

PUB 6064

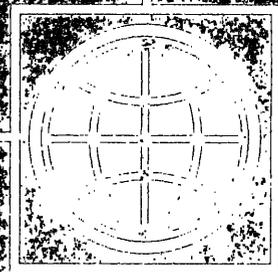
A WORLD BANK COUNTRY STUDY

PUB-6064

# China

## Growth and Development in Gansu Province

SEPTEMBER 1988



Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure

# DISTRIBUTORS OF WORLD BANK PUBLICATIONS

## ARGENTINA

Carlos Hirsch, SRL  
Galena Guemes  
Florida 165, 4th Floor-Ofc. 453/465  
1333 Buenos Aires

## AUSTRALIA, PAPUA NEW GUINEA, FIJI, SOLOMON ISLANDS, VANUATU, AND WESTERN SAMOA

Info-Line  
Overseas Document Delivery  
Box 506, GPO  
Sydney, NSW 2001

## AUSTRIA

Gerold and Co.  
A-1011 Wien  
Graben 31

## BAHRAIN

MEMRB Information Services  
P.O. Box 2750  
Manama Town 317

## BANGLADESH

Micro Industries Development Assistance  
Society (MIDAS)  
G.P.O. Box 800  
Dhaka

## BELGIUM

Publications des Nations Unies  
Av. du Roi 202  
1060 Brussels

## BRAZIL

Publicacoes Tecnicas Internacionais Ltda.  
Rua Peixoto Gomide, 209  
01409 Sao Paulo, SP

## CANADA

Le Diffuseur  
C.P. 85, 1501 Ampere Street  
Boucherville, Quebec  
J4B 5E6

## CHINA

China Financial & Economic Publishing House  
8, Da Fo Si Dong Jie  
Beijing

## COLOMBIA

Enlace Ltda.  
Carrera 6 No. 51-21  
Bogota D.E.  
Apartado Aereo 4430  
Cali, Valle

## COSTA RICA

Libreria Trejos  
Calle 11-13  
Av. Fernandez Guell  
San Jose

## COTE D'IVOIRE

Centre d'Edition et de Diffusion Africaines  
(CEDA)  
04 B.P. 541  
Abidjan 04 Plateau

## CYPRUS

MEMRB Information Services  
P.O. Box 2098  
Nicosia

## DENMARK

Samfundslitteratur  
Rosenoerms Alle 11  
DK-1970 Frederiksberg C.

## DOMINICAN REPUBLIC

Editora Taller, C. por A.  
Restauracion  
Apdo postal 2190  
Santo Domingo

## EGYPT, ARAB REPUBLIC OF

Al Ahram  
Al Galaa Street  
Cairo

The Middle East Observer  
8 Chawarbi Street  
Cairo

## FINLAND

Akateeminen Kirjakauppa  
P.O. Box 128  
SF-00101  
Helsinki 10

## FRANCE

World Bank Publications  
66, avenue d'Iena  
75116 Paris

## GERMANY, FEDERAL REPUBLIC OF

UNO-Verlag  
Poppelsdorfer Allee 55  
D-5300 Bonn 1

## GREECE

KEME  
24, Ippodamou Street  
Athens-11635

## GUATEMALA

Librerias Piedra Santa  
Centro Cultural Piedra Santa  
11 calle 6-50 zona 1  
Guatemala City

## HONG KONG, MACAO

Asia 2000 Ltd.  
6 Fl., 146 Prince Edward Road, W,  
Kowloon  
Hong Kong

## HUNGARY

Kultura  
P.O. Box 139  
1389 Budapest 62

## INDIA

Allied Publishers Private Ltd.  
751 Mount Road  
Madras - 600 002

### Branch offices:

15 J.N. Heredia Marg  
Ballard Estate  
Bombay - 400 038

13/14 Asaf Ali Road  
New Delhi - 110 002

17 Chittaranjan Avenue  
Calcutta - 700 072

Jayadeva Hostel Building  
5th Main Road Gandhinagar  
Bangalore - 560 009

3-5-1129 Kachiguda Cross Road  
Hyderabad - 500 027

Prarthana Flats, 2nd Floor  
Near Thakore Baug, Navrangpura  
Ahmedabad - 380009

Patalia House  
16-A Ashok Marg  
Lucknow - 226 001

## INDONESIA

Pt. Indira Limited  
Jl. Sam Ratulangi 37  
Jakarta Pusat  
P.O. Box 181

## IRELAND

TDC Publishers  
12 North Frederick Street  
Dublin 1

## ISRAEL

The Jerusalem Post  
The Jerusalem Post Building  
P.O. Box 81  
Romema Jerusalem 91000

## ITALY

Licosa Commissionaria Sansoni SPA  
Via Lamarmora 45  
Casella Postale 552  
50121 Florence

## JAPAN

Eastern Book Service  
37-3, Hongo 3-Chome, Bunkyo-ku 113  
Tokyo

## JORDAN

Jordan Center for Marketing Research  
P.O. Box 3143  
Jabal Amman

## KENYA

Africa Book Service (E.A.) Ltd.  
P.O. Box 45245  
Nairobi

## KOREA, REPUBLIC OF

Pan Korea Book Corporation  
P.O. Box 101, Kwangwhamun  
Seoul

## KUWAIT

MEMRB  
P.O. Box 5465

## MALAYSIA

University of Malaya Cooperative Bookshop,  
Limited  
P.O. Box 1127, Jalan Pantai Baru  
Kuala Lumpur

## MEXICO

INFOTEC  
Apartado Postal 22-860  
Col. PE/A Pobre  
14060 Tlalpan, Mexico D.F.

## MOROCCO

Societe d'Etudes Marketing Marocaine  
2 Rue Moliere, Bd. d'Anfa  
Casablanca

## NETHERLANDS

InOr-Publikaties b.v.  
P.O. Box 14  
7240 BA Lochem

## NEW ZEALAND

Hills Library and Information Service  
Private Bag  
New Market  
Auckland

## NIGERIA

University Press Limited  
Three Crowns Building Jericho  
Private Mail Bag 5095  
Ibadan

## NORWAY

Narvesen Information Center  
Bertrand Narvesens vei 2  
P.O. Box 6125  
N-0602 Oslo 6

## OMAN

MEMRB Information Services  
P.O. Box 1613, Seeb Airport  
Muscat

## PAKISTAN

Mirza Book Agency  
65, Shahrah-e-Quaid-e-Azam  
P.O. Box No. 729  
Lahore 3

## PERU

Editorial Desarrollo SA  
Apartado 3824  
Lima

## PHILIPPINE

National Book Store  
701 Rizal Avenue  
Metro Manila

## POLAND

ORPAN  
Palac Kultury i Nauki  
00-001 Warszawa

## PORTUGAL

Livraria Portugal  
Rua Do Carmo 70-74  
1200 Lisbon

## SAUDI ARABIA, QATAR

Jarir Book Store  
P.O. Box 3196  
Riyadh 11471

## SINGAPORE, TAIWAN, BURMA,

## BRUNEI

Information Publications  
Private, Ltd.  
02-06 1st Fl., Pei-Fu Industrial  
Bldg., 24 New Industrial Road  
Singapore

## SOUTH AFRICA

Oxford University Press Southern Africa  
P.O. Box 1141  
Cape Town 8000

## SPAIN

Mundi-Prensa Libros, S.A.  
Castello 37  
28001 Madrid

## SRI LANKA AND THE MALDIVES

Lake House Bookshop  
P.O. Box 244  
100, Sir Chittampalam A. Gardiner Mawatha  
Colombo 2

## SWEDEN

ABCE Fritzes Kungl. Hovbokhandel  
Regeringsgatan 12, Box 16356  
S-103 27 Stockholm

## SWITZERLAND

Librairie Payot  
6, rue Grenus  
Case postal 381  
CH 1211 Geneva 11

## TANZANIA

Oxford University Press  
P.O. Box 5299  
Dar es Salaam

## THAILAND

Central Department Store  
306 Silom Road  
Bangkok

## TRINIDAD & TOBAGO, ANTIGUA,

BARBUDA, BARBADOS, DOMINICA,  
GRENADA, GUYANA, JAMAICA,  
MONTserrat, ST. KITTS AND  
NEVIS, ST. LUCIA, ST. VINCENT &  
GRENADINES

Systematics Studies Unit  
55 Eastern Main Road  
Curepe  
Trinidad, West Indies

## TURKEY

Haset Kitapevi, A.S.  
Davutpasa Caddesi  
Sergekale Sokak 115  
Topkapi  
Istanbul

## UGANDA

Uganda Bookshop  
P.O. Box 7145  
Kampala

## UNITED ARAB EMIRATES

MEMRB Gulf Co.  
P.O. Box 6097  
Sharjah

## UNITED KINGDOM

Microinfo Ltd.  
P.O. Box 3  
Alton, Hampshire GU34 2PG  
England

## URUGUAY

Instituto Nacional del Libro  
San Jose 1116  
Montevideo

## VENEZUELA

Libreria del Este  
Apto. 60.337  
Caracas 1060-A

## YUGOSLAVIA

Jugoslovenska Knjiga  
YU-11000 Belgrade Trg Republike

## ZIMBABWE

Longman Zimbabwe  
P.O. Box 5T 125, Southerton  
Harare

Prices and credit terms vary from country to country. Consult your local distributor before placing an order.

**A WORLD BANK COUNTRY STUDY**

**China**  
**Growth and Development**  
**in Gansu Province**

**The World Bank**  
**Washington, D.C., U.S.A.**

Copyright © 1988  
The World Bank  
1818 H Street, N.W.  
Washington, D.C. 20433, U.S.A.

All rights reserved  
Manufactured in the United States of America  
First printing September 1988

World Bank Country Studies are reports originally prepared for internal use as part of the continuing analysis by the Bank of the economic and related conditions of its developing member countries and of its dialogues with the governments. Some of the reports are published informally with the least possible delay for the use of governments and the academic, business and financial, and development communities. Thus, the typescript has not been prepared in accordance with the procedures appropriate to formal printed texts, and the World Bank accepts no responsibility for errors.

Any maps that accompany the text have been prepared solely for the convenience of readers. The designations and presentation of material in them do not imply the expression of any opinion whatsoever on the part of the World Bank, its affiliates, or its Board or member countries concerning the legal status of any country, territory, city, or area or of the authorities thereof or concerning the delimitation of its boundaries or its national affiliation.

The material in this publication is copyrighted. Requests for permission to reproduce portions of it should be sent to Director, Publications Department at the address shown in the copyright notice above. The World Bank encourages dissemination of its work and will normally give permission promptly and, when the reproduction is for noncommercial purposes, without asking a fee. Permission to photocopy portions for classroom use is not required, though notification of such use having been made will be appreciated.

The complete backlist of publications from the World Bank is shown in the annual *Index of Publications*, which contains an alphabetical title list and indexes of subjects, authors, and countries and regions; it is of value principally to libraries and institutional purchasers. The latest edition of each of these is available free of charge from the Publications Sales Unit, Department F, The World Bank, 1818 H Street, N.W., Washington, D.C. 20433, U.S.A., or from Publications, The World Bank, 66 avenue d'Iéna, 75116 Paris, France.

#### Library of Congress Cataloging-in-Publication Data

China : growth and development in Gansu Province.

p. cm. -- (A World Bank country study)

ISBN 0-8213-1122-0

1. Kansu Province (China)--Economic conditions. 2. Education--China--Kansu Province. 3. Manpower policy--China--Kansu Province.

I. International Bank for Reconstruction and Development.

II. Series.

HC428.K3C45 1988

338.951'45--dc 19

88-27714

CIP

## Preface

As preliminary background for World Bank assistance to the province of Gansu, it was agreed in February 1985 that the Bank would undertake a review of development issues and options in the key sectors of agriculture, industry and human development. To this end, three missions visited Gansu in April/May, May/June and October/November 1985. Each mission traveled extensively in Gansu and saw agricultural projects, industrial enterprises, schools and health facilities. The missions also had numerous discussions and received helpful suggestions and much valuable information from government officials at central, provincial, prefectural and county levels. The support and contribution of all these people made possible the preparation of this report.

The first mission covered issues in education and health. It was led by G.B. Baldwin and included I. Porter (senior economist), R. Drysdale (senior education economist), B. Searle (general educator), N. Prescott (health economist), S. Scheyer (public health specialist), J.C. Wang (consultant on education management), and W. P. Chang (consultant on public health). The second mission studied agricultural development. It was led by D.C. Pickering and included T. J. Goering (senior agricultural economist), J.B. Doolette (agriculturalist), R. Ng (agricultural institutions specialist), A. Piazza (agricultural economics consultant), C. Pereira (consultant on land management) and P. Shallow (consultant on irrigation). The third mission conducted further work in agriculture and human development and covered issues in industry and public finance. It was led by I. Porter and included R. Drysdale, J.B. Doolette, A. Piazza, G. Pohl (senior economist), J. Brown (agroindustries adviser), J. Chanmugam (senior industrial engineer), W. Byrd (economist), A. Kumar (economist) and U. Sae-Hau (research assistant).

The following also contributed to the study: K. Hill (consultant on demography), Cai Jinyong (researcher), T. Bassler (editor), M. Cassidy (secretary).

The report includes three annexes (agriculture, industry and education) as well as a main report which summarizes the findings on specific sectors and highlights some of the development options facing Gansu. The report is selective in its coverage of sectors and topics and a number of issues of potentially major importance to Gansu (e.g., interprovincial transport) have not been addressed. The report should therefore be viewed primarily as input into the central and provincial government's thinking about future policies and programs for Gansu. Drafts of the main report and the annexes were discussed with the central and provincial governments in April/May 1986 and have been revised to take account of their comments.

CURRENCY EQUIVALENTS

The Chinese currency is called Renminbi (RMB).  
It is denominated in Yuan (Y). Each Yuan is  
1 Yuan = 10 jiao = 100 fen

Calendar 1985

US\$1.00 = Y 2.94

Y 1.00 = US\$0.34

October 1986

US\$1.00 = Y 3.69

Y 1.00 = US\$0.27

FISCAL YEAR

January 1 - December 31

WEIGHTS AND MEASURES

Metric System

TRANSLITERATION

The Pinyin system is used in this report.

ABBREVIATIONS

ABC	-	Agricultural Bank of China
GDP	-	Gross Domestic Product
GITC	-	Gansu Investment and Trust Corporation
GVAO	-	Gross Value of Agricultural Output
GVIAO	-	Gross Value of Industrial and Agricultural Output
GVIO	-	Gross Value of Industrial Output
ICBC	-	Industrial and Commercial Bank of China
ICOR	-	Incremental Capital Output Ratio
ICT	-	Industrial and Commercial Tax
MOPH	-	Ministry of Public Health
NMP	-	Net Material Output
NVAO	-	Net Value of Agricultural Output
PCBC	-	People's Construction Bank of China

Table of Contents

	<u>Page No.</u>
<u>SUMMARY</u> .....	ix
I. <u>PROVINCIAL SETTING</u> .....	1
A. Growth and Development.....	2
Employment, Productivity and Incomes.....	2
Agricultural Resources and Production.....	3
Mineral Resources and Industrial Concentration.....	6
Social Service Development and Financing.....	9
Public Expenditures and Finance.....	14
B. Regional Development Strategy in International Perspective.....	16
International Experience.....	16
Issues and Options for Gansu.....	17
II. <u>PROSPECTS FOR AGRICULTURE</u> .....	22
A. Loess Hills Rehabilitation.....	22
Carrying Capacities.....	22
Rehabilitation Programs and Farming Systems.....	23
Economic Returns.....	25
Implementation Schedule.....	26
B. Irrigation Development.....	27
Development Program.....	27
Farming Systems.....	28
Economic Returns.....	29
C. Resettlement.....	30
D. Agricultural Management.....	31
E. Investment Costs and Financing Arrangements.....	34
III. <u>INDUSTRIAL POTENTIAL</u> .....	36
A. Rural Industries and Services.....	36
Gansu in National and International Perspective.....	36
Composition of Rural Industries and Services.....	37
B. Urban Industry.....	40
Heavy Industry.....	40
Light Industry.....	41

C.	Industrial Organization and Management.....	42
	Ownership and Control.....	42
	Prices and Wages.....	44
	Technology Transfer and Development.....	46
	Role of Financial Institutions.....	47
	Role of Industrial Bureaus.....	48
D.	Investment Costs and Financing.....	49
IV.	<u>HUMAN DEVELOPMENT</u> .....	51
A.	Education.....	51
	Basic Education.....	51
	Upper Secondary Education.....	53
B.	Health.....	55
	Child Development.....	56
	Chronic Diseases.....	57
C.	Organization and Management of Social Services.....	58
	Role of the Government.....	58
	Decentralization.....	59
	Accountability.....	59
D.	Alternative Financing Arrangements for Social Services.....	60
V.	<u>MANAGEMENT AND FINANCE</u> .....	64
A.	Scope and Allocation of Government Responsibilities.....	64
B.	Revenue Raising.....	66
	Forms of Taxation.....	66
	User Charges.....	67
C.	Revenue Sharing.....	68
	Forms of Transfer.....	69
	Institutional Arrangements.....	70
D.	Other Resource Flows.....	71

TABLES IN TEXT

1.1	Employment and Productivity, 1982.....	2
1.2	Income Disparities and Poverty, 1982.....	3
1.3	Rural Per Capita Incomes, 1978-84.....	4
1.4	Agricultural Resources, Output and Incomes, 1983.....	5
1.5	Fixed Assets, Employment and Output of State Industry, 1982.....	8
1.6	Industrial Concentration, 1983.....	9
1.7	Social Indicators.....	10
1.8	Resources of the Rural Collective Sector, 1983.....	11
1.9	Public Expenditures, 1980-84.....	14
1.10	Balancing of Public Expenditures and Revenues, 1980-84.....	15
1.11	Interprefectural Variations in Public Expenditures and Revenues Per Capita, 1983.....	16

1.12	Provincial and National Targets for GDP Growth, 1984-2000.....	18
1.13	Natural Population Growth, 1984-2000.....	18
1.14	Output, Investment and Employment Growth Under Alternative Scenarios, 1984-2000.....	19
2.1	Population Growth in Dingxi Under Alternative Scenarios, 1982-2000.....	22
2.2	Distribution of Land and Population in the Dingxi Region by Zone, 1983.....	23
2.3	Carrying Capacities in the Dingxi Region by Zone.....	24
2.4	Estimated Economic Returns to Selected Loess Hill Rehabilitation Measures.....	25
2.5	Irrigation Development in Gansu, 1950-95.....	27
2.6	Ongoing and Proposed Irrigation Projects.....	28
2.7	Estimated Economic Returns to Yindaruqin and Jingtai Phase II Under Alternative Assumptions.....	29
2.8	Projected Agriculture Investment Under Alternative Scenarios, 1984-2000.....	34
2.9	Projected Public Expenditures on Agriculture Under Alternative Scenarios, 1984-2000.....	35
3.1	Employment in Rural Nonagricultural Activities in Selected Economies.....	36
3.2	Composition of Industrial Township and Village Enterprise Employment and Output.....	39
3.3	Composition of Rural Nonagricultural Employment.....	39
3.4	Gross Industrial Output by Ownership, 1979-83.....	43
3.5	Urban Wages and Rural Incomes, 1978-84.....	45
3.6	Wages by Type of Enterprise, 1983.....	45
3.7	Industrial Output and Investment Growth Under Alternative Scenarios, 1984-2000.....	49
4.1	End-of-Year Dropouts in Primary Grades.....	52
4.2	Financial Resource Requirements for Basic Education Under Alternative Scenarios, 1983-2000.....	53
4.3	Structure of Primary and Secondary Education Expenditures, 1983-2000.....	55
4.4	Projected Hospital Bed and Financial Resource Requirements Under Alternative Scenarios, 1983-2000.....	58
4.5	Education Expenditures by Source of Finance, 1983-2000.....	62
4.6	Health Expenditures by Source of Finance, 1983-2000.....	62
5.1	Growth in Provincial Budget Expenditures Under Alternative Scenarios, 1984-2000.....	64

FIGURES IN TEXT

1.1	A. Total Grain Production, 1952-83.....	7
	B. Per Capita Grain Production, 1952-83.....	7
1.2	Urban-Rural and Public School Versus Village School Differentials in Per Student Recurrent Expenditure on Primary Education, 1984.....	12
1.3	Urban-Rural Differentials in Per Capita Recurrent Expenditures on Health, 1983.....	13
2.1	Organizational Structure of the Gansu Provincial People's Government and the Agricultural and Two-Xi Commissions.....	33

APPENDICES

A.	Conversion of Macroeconomic Statistics.....	74
B.	Estimates of Rural Per Capita Income.....	88
C.	The Provincial Budget: Structure and Flows.....	91
D.	Macroeconomic and Fiscal Projections: Method of Estimation...	102
E.	Notes on Projections of Urban/Rural Population and Employment, 1980-2000.....	124

ANNEXES

A.	An Agricultural Development Program for Dingxi and Hexi .....	133
B.	Industrial Development Issues in Gansu .....	205
C.	Basic and Vocational Education .....	347

MAP

## SUMMARY

1. This report summarizes the findings of three World Bank missions that visited Gansu in 1985 to review policies and programs in agriculture, industry and human development. A major objective of the report is to highlight some of the issues in these sectors that will need to be considered by the central and provincial governments in developing an overall strategy for income growth and poverty reduction in the province. The report has also formed the basis for discussions with the central and provincial governments about the potential role of the World Bank in supporting programs and projects in Gansu.

### Economic Background

2. Past policies and investments have led to the emergence of two very distinct and almost entirely unrelated economies in Gansu. The vast majority of the 20 million people in the province are part of the rural economy, which is based largely on agriculture. The productivity of Gansu's agricultural labor force is extremely low, and the development of rural nonagricultural activities has been slow, resulting in average rural per capita incomes that are lower than in any other province in China and an incidence of poverty that is much above the national average (41% in 1982 compared with the national average of 13%). The remainder of the population is part of the urban economy and most are engaged directly or indirectly in the capital-intensive heavy industry sector that has been built up over the past 30 years. Urban wages reflect national guidelines for wages of state enterprise staff and workers. Average urban per capita incomes are slightly higher than the national average for urban areas and about four times higher than average rural per capita incomes in Gansu. The urban and rural economies in Gansu exist side by side but have few forward or backward production linkages, and mobility of labor between the two economies is still quite restricted.

3. Gansu's poor agricultural resource endowment in terms of soils, rainfall and topography causes great difficulties in crop and livestock production. Rainfall is low, erratic and concentrated in only three to four months in the summer. Over the past 30 years, irrigation (based mainly on snow runoff from surrounding mountains) has been expanded from 10% to 25% of cultivated area, but even in irrigated areas, crop growth is restricted to the summer months because of the long cold period. In rainfed areas, agricultural activities have caused progressive removal of vegetation, leading to massive erosion of the predominantly loess soils and a significant reduction in agricultural productivity. At the same time, the population has been increasing by about 2% p.a. As a result, per capita grain production in the early 1980s was no better than in the early 1950s and had actually declined relative to the 1970s.

4. Agricultural resources, output and incomes vary widely among different regions within Gansu and particularly between the Hexi region in the northwest and the Dingxi region in the central and eastern part of the province (see Map). Almost 80% of the cultivated land in Hexi is irrigated, and yields, per capita output and incomes are all much above provincial

averages. In Dingxi, only 13% of the cultivated land is irrigated and grain yields are less than a third of those obtained in Hexi. Over the past 30 years, grain production in Dingxi has increased more slowly than in the province as a whole, while population has increased more rapidly. As a result, even in the relatively good years of 1983 and 1984, grain production per capita averaged only 256 kg (compared with a national average of 460 kg), and many households had to rely on relief grain from the state to meet minimum food consumption requirements. Within Dingxi, drinking water for humans and livestock is also scarce and has to be hauled by truck to large numbers of the rural population during several months each year. In addition, more than 50% of rural households in the Dingxi region are short of fuel for cooking, heating, lighting and other uses during at least four to six months of the year. About 35% of rural household fuel supply in the region consists of grass and grass roots (sod) dug up from the surrounding hillsides, thereby accelerating soil erosion and environmental degradation in the region.

5. Although Gansu faces a very difficult agricultural environment, the province is rich in mineral resources. Over the past 30 years, the government has invested large amounts in the development of a heavy industry sector based on exploitation of petroleum, mineral and hydro resources. Consequently, the ratio of state industrial fixed assets to total population is now much higher in Gansu than in China as a whole. However, the employment generation and capital and labor productivity of Gansu's industrial sector have been poor relative to industry in the rest of the country. In addition, investment in industry has been heavily concentrated in the capital city of Lanzhou and has generated few linkages to other sectors and other parts of the province. Only in 1984 and 1985 did rural areas of Gansu begin to experience a rapid growth in industry and service development.

6. The government's grain, water and fuel relief programs, in conjunction with regular public health campaigns, have enabled Gansu to achieve life expectancy levels and infant mortality rates that are now quite close to national averages. In other respects, however, the level of social services remains low. Nutrition levels, for example, are lower, and the incidence of infectious diseases in Gansu is higher, particularly in mountainous areas, than in the country as a whole. Gansu is also far behind the rest of the country in basic, though not higher, education. The condition of school facilities in rural areas is poor, and the quality of instruction is inadequate due to the low qualifications of the teachers. Of every ten children of primary school age in Gansu, only about eight begin school, four continue to attend to the fifth grade, and two successfully continue to secondary school.

7. The differences between social services in urban and rural areas stem from the fact that responsibility for social services is divided among the government, state enterprise, and collective sectors. The amount of resources available for social services varies widely from one sector to another. In urban areas, schools and health facilities are managed and financed either by the government or by state enterprises and are probably as well off as urban facilities in other parts of China. Schools and health facilities in rural areas, on the other hand, are primarily the responsibility of the collective sector and individual households. Rural facilities in Gansu are much worse off than those in most of the rest of the country because of

the very low level of rural per capita incomes in the province and the small amount of resources available to townships and villages from rural nonagricultural enterprises. The government provides special subsidies to rural doctors and teachers, which help to reduce but fall far short of eliminating the major inequities in social service expenditures between urban and rural areas.

8. Revenue-sharing systems at provincial, prefectural and county levels have made it possible for the government to allocate additional fiscal resources to poorer provinces and localities. As a result, government expenditures per capita on social services and other items are higher in Gansu than in some richer provinces such as Jiangsu. Total government expenditures have also been increasing more rapidly in Gansu than in the country as a whole in recent years due primarily to rapid growth in special-item subsidies from the central government, including a special "Two-Xis" fund for development of the Dingxi and Hexi regions.

#### Alternate Strategies and Policies

9. Gansu, like the rest of China, has set itself the task of quadrupling the gross value of industrial and agricultural output (GVIAO) between 1980 and 2000. In terms of total GDP, a growth rate of about 6.6% p.a. is needed to achieve such growth. If industry in Gansu grows at a projected national rate of 7.2% and infrastructure and services grow at a projected national rate of 7.5%, agriculture will need to grow at 3.9% compared with a national growth rate of 4.9% p.a., because of agriculture's low share in Gansu provincial GDP relative to national GDP. Experience from other countries suggests that it will be difficult for poorer regions to keep up with the national average growth rate at China's current stage of development, but the central government is strongly committed to providing Gansu with the financial and other resources to achieve the target growth rates. However, Gansu's experience over the past 30 years has shown that high investment rates do not necessarily result in much reduction in poverty. It is therefore important that the central and provincial governments pay particular attention to the pattern as well as the pace of economic growth.

10. Gansu could continue to emphasize development of mineral-based heavy industry and large-scale irrigation. As long as adequate investment funds are available from the central government, both the industrial and agricultural target growth rates could probably be attained. However, such a strategy would do little to generate nonagricultural employment and if accompanied by continued restrictions on labor mobility, would almost certainly result in a significant increase in the agricultural labor force between now and the year 2000. This would put even greater pressure on the province's fragile natural resource base. Even with major investments in irrigation, the population remaining in rainfed agriculture would remain above the carrying capacity of the land. Yields and output per worker in these rainfed areas would probably stagnate or grow very slowly, and the Government would have to continue its grain, water and fuel relief programs to meet basic needs.

11. An alternative strategy could be based on the recognition that mineral resources are not the only advantage Gansu has over the rest of China, nor always the most important. The province also has a large rural labor

force whose opportunity cost is low because of the difficult agroclimatic conditions and is likely to remain low for some time, whatever the government's overall policy on migration. A concerted effort to develop labor-intensive industries and services, relying on relatively low costs of labor, could enable Gansu to achieve the same overall growth rate as a strategy focused on capital-intensive heavy industries. Moreover, developing light and rural industries would almost certainly require lower overall investment and would bring a broader distribution of the benefits of growth.

12. In the past, China's economic system would have made it very difficult for Gansu to implement such an alternative development strategy. But economic reform has greatly increased the scope for movement of goods, capital and, to a lesser extent, people between regions and sectors, and Gansu's pattern of development is already beginning to change. In recent years there has been a significant shift away from heavy and towards light and rural industries. Incomes have also been increasing more rapidly in rural than in urban areas. Economic reform is not without potential costs to the province in the form of increased competition for inefficient local industries and potential outflows of skilled labor and capital. It is also not yet clear how far reform will proceed in terms of labor and capital mobility. But there is no doubt that economic reforms provide Gansu with new opportunities for development of labor-intensive activities. To take advantage of these opportunities, the province will need to further restructure its investment program, and it will be necessary to increase labor mobility and permit greater flexibility in the wage system.

13. Economic reform will mean that Gansu is likely to be affected in many of the same ways that poor regions in other countries have been affected during the low- to middle-income transition. But compared with poor regions in other developing countries, Gansu has a major advantage in its relatively slow rate of natural population growth. Indeed, the school-age population in Gansu is already declining, the number of new entrants into the labor force is beginning to decline and the working-age population is expected to grow at only 1.1% p.a. in the 1990s compared with 3.2% in the 1980s. If some outmigration from the province is also allowed, Gansu will have the opportunity to make major structural changes in employment in a relatively short time. This, in turn, would greatly facilitate the task of reducing poverty and raising rural incomes in Gansu, which is a key objective of the central as well as the provincial governments.

#### Prospects for Agriculture

14. Any strategy for poverty reduction in Gansu must address the plight of people in the Dingxi region, almost all of whom work in agriculture, putting tremendous pressure on the available land. Research and experiments undertaken in Dingxi suggest that there are new farming practices and rehabilitation measures that could reduce soil erosion and improve productivity. Measures would need to be developed for each watershed and would involve intensifying crop production on flat land in valley bottoms or on wide bench terraces on milder slopes, as well as returning steep slopes and hilltops to controlled production of tree crops and fodder. Economic returns to rehabilitation are likely to be good, primarily because of the low economic cost of

labor. Rehabilitation would also result in decreased siltation in the Yellow River watershed.

15. Land rehabilitation for the Dingxi region is an enormous task. The government will need to continue its research on rehabilitation methods and will also need to be involved in preparing land use plans, assessing the population's needs, setting goals and translating land use plans into detailed action programs. Farmers will be responsible for implementing most of the land development, but the government will need to ensure that there are adequate incentives for farmers to undertake rehabilitation. Technical assistance and necessary support services will also be needed.

16. Successful implementation of rehabilitation also requires resettlement to reduce the population to the carrying capacity of the land. This need is well-recognized by the provincial government and is a major justification for the province's ambitious program for irrigation development, which is expected to increase the proportion of cultivated area under irrigation from the current 25% to nearly 35% by the late 1990s. It is apparent, however, that new irrigation projects are steadily becoming more complex to prepare and implement. Economic returns to two of the major ongoing projects, Yindaruqin and Jingtai Phase II, are unlikely to be above 13%, and some of the proposed new high-lift pump projects are likely to have returns considerably below 10%, whereas the opportunity cost of capital is probably between 10 and 15%. It is probably in the province's economic interest to complete ongoing projects, but construction should be expedited and completed before any work on new projects is begun. At the same time, investment in new high-lift pump projects, where there are no appreciable sunk costs, should not be made unless there are no better alternatives for agricultural labor absorption. Instead, attention should be focused on providing a guaranteed supply of water to areas already under irrigation and improving the quality of system maintenance.

17. More attention also needs to be paid to helping farmers optimize agricultural production on newly irrigated land. This will involve increasing the number and quality of agricultural personnel at the system level. There will also need to be efforts to enhance adaptive research, improve seed production and distribution, develop and test alternative production practices, and communicate researchers' findings to farmers. As a result of rural reforms, farmers are now able to diversify out of wheat when market and technical conditions are favorable, but they are not yet receiving appropriate advice on how to do so.

18. Because of the very low returns to some of the proposed new irrigation projects, the government (in particular the Two-Xis Commission) needs to consider alternative ways of reducing the agricultural population in areas such as Dingxi and increasing agricultural productivity and per capita incomes. Formal resettlement programs for irrigated areas will certainly be one means for reducing agricultural population in rainfed areas and will need to be carefully and adequately designed by the government. The central and provincial governments will also need to research and analyze potential for employment in nonagricultural activities and the costs and benefits of migration to other provinces of China.

## Potential for Industry and Services Development

19. Throughout China, rural nonagricultural activities are being emphasized as a source of employment and income growth. Coastal provinces have been able to respond most quickly to new policies for rural areas, partly because their proximity to cities and markets permits easy transport and marketing of inputs and goods and because their relatively high level of agricultural development and incomes has generated greater demands for agricultural processing and other manufactured goods and services. Over the past two years, however, rural nonagricultural activities have also been increasing rapidly in Gansu, and there appears to be considerable potential for further expansion.

20. Prospects for rural industrial development lie not only in agro-processing (which in Gansu as in other provinces accounts for only a small proportion of the rural industrial sector) but also in the many other types of rural industry that are now in existence or have potential for development. Rapid expansion in small-scale coal mining, for example, is both feasible and important for future agricultural and industrial growth. There is potential in industries that produce bulky or heavy products that are costly to transport (such as building materials). Much more attention also needs to be paid to "footloose" industries, such as machinery parts and textiles, which depend primarily on cheaper labor and are still very underdeveloped in Gansu. The recent reforms permitting rural residents to engage in transport and sale of goods between rural and urban areas and across county and provincial lines make it likely that rural services (which account for one third to three quarters of rural nonagricultural employment in other countries) will be a rapidly growing source of employment. Indeed, development of rural industries and services are likely to be tightly linked.

21. Further development of urban industry will and should be a major feature of economic growth in Gansu. It will be essential, however, that the importance of mineral and hydro resources is not overemphasized and that the overall performance of urban industry is improved by more rigorous economic analysis of project proposals and plans. Improved analysis would reveal that the economic costs of certain resources in Gansu are still very different from their financial costs. For example, the economic cost of hydroelectric power in Gansu appears to be at least 5 and possibly as much as 7 fen/kWh, much higher than the financial cost and not much lower than the economic cost of thermal power generation in a coastal location, which is around 7-8 fen/kWh. In contrast, the economic cost of unskilled labor in rural Gansu is much below both the financial and economic costs in most other parts of China. More consideration of these differences in policymaking and programs development could help stimulate growth of labor-intensive light industries.

22. Economic reform is gradually reducing the government's direct control of industrial growth. Township and village enterprises and small urban collectives have gained the greatest independence: they have full responsibility for profits and losses and are required to pay taxes. Large collectives and state enterprises are "owned" and administered by different levels of government (central, provincial, prefectural and county), but they too are now less subject to direct government control because of the gradual

replacement of unified allocation by market allocation for more and more materials and the increasing importance of "above-quota" production, supplies, sales and prices. The government will retain a major indirect role in industrial development through provision of supporting infrastructure and services and through development of appropriate incentives.

23. To invest and produce efficiently as they become more independent and profit-oriented, enterprises will need to be able to obtain inputs and market outputs at rational prices. The central government recognizes these needs and has begun efforts to give market forces a greater role. It is not as well-recognized, however, that the present wage practices and restrictions on labor mobility pose serious obstacles to efficient investment and production decisionmaking and could seriously limit the pace and pattern of industrial development in poorer provinces like Gansu. Despite the relatively low economic cost of unskilled labor in Gansu, industrial wages in both urban and rural enterprises in Gansu are 10-20% above those prevailing in the more advanced coastal provinces. Collective enterprises are free to set wages as they see fit and over time it can be expected that the average level of wages paid by these enterprises will be lower in Gansu than on the coast. But in order for state and large urban collective enterprises in Gansu to pay lower wages than similar enterprises on the coast, the current practice of national uniform wages would need to be modified. One possibility would be to allow the general level of unskilled wages to increase more slowly in Gansu than elsewhere. Another possibility would be to offer lower wages to new entrants into the labor force. To the extent that some labor-intensive industries and services are most efficiently located in urban areas, the government will also need to relax some of the restrictions on rural-urban migration.

24. The central and provincial governments also need to review the possibility of further increasing wage differentials between skilled and unskilled jobs, because experienced and trained technical personnel are in short supply in Gansu. Higher wage differentials would also make it easier for Gansu to attract experienced technical personnel from other provinces and thereby gain access to improved technologies. Township and village enterprises in Gansu have already begun to hire retired workers and specialists from more advanced areas, but more such arrangements need to be made in state and large collective enterprises. Foreign technology imports also need to be increased selectively by allowing enterprises in Gansu to have direct contact with foreign buyers and suppliers and to engage in joint ventures for production or export marketing.

25. Economic reform in industry implies new roles and responsibilities for both banks and industrial bureaus. With more competition in the industrial sector, from within and outside the province, enterprises will face the risk of bankruptcy, and banks will have to carefully evaluate proposed loans and ensure that nonperforming loans are kept within prudent limits. The Agricultural Bank of China (ABC) is faced with the most immediate challenge, because township and village enterprises are now fully responsible for their own profits and losses, and ABC is their principal bank. The reform process of separating state enterprises from industrial bureaus could create a similar situation for the Industrial and Commercial Bank, the People's Construction Bank and other financial intermediaries.

26. To carry out their new responsibilities, the specialized banks need to develop skills in project analysis, portfolio management and other techniques of managing banks as enterprises. Meanwhile, the industrial bureaus need to move from a controlling to a supportive role with respect to industrial enterprises by assisting with technology and product upgrading, worker training and marketing and by monitoring overall trends in the industrial sector and planning for future changes. This shift from a controlling to a supportive role has progressed furthest in the Bureau of Rural Industries; similar changes are now required in other industrial bureaus.

#### Human Development

27. Rapid development of labor-intensive industries and services will help greatly to reduce the absolute numbers of people in rainfed agriculture, especially in Dingxi, but there also needs to be greater mobility of labor to small towns and larger urban areas. In addition, the central government should carefully review the costs and benefits of permitting some migration of unskilled labor from Gansu to other parts of China. Of course, increased mobility of people between sectors and rural and urban areas, and across counties and provinces is not without problems. There may be fiscal, social and political costs of rapid rural-urban migration which could retard improvement of urban living standards by holding down urban wages and adding to pressure on government services. The exodus of bright young people from rural areas could also hold back agricultural progress. On balance, however, the experience of other countries suggests that, by enabling labor to be used where it is most productive, migration aids both growth and poverty reduction.

28. Increased labor mobility and rapid change in the structure of employment in Gansu will depend greatly on improvements in basic education. Strengthening the educational system will involve ensuring access to six years of primary schooling for rural as well as urban children, improving the quality of buildings, and increasing the quantity of teaching materials, especially in rural areas. Most important of all, however, is the need to improve the qualifications of teachers, especially village or minban teachers, where deficiencies in training are most apparent. Although the institutional and financial arrangements for such improvements will be complex, the task will be eased by the decline in the school-age population that will occur between now and the year 2000.

29. Gansu will also need to make changes in the structure and content of upper secondary education. The experience of other countries suggests that it is best to proceed gradually--evaluating the achievements of each phase before moving ahead--and try to maintain quality and relevance of technical and vocational education while minimizing its costs. The province should reconsider its emphasis on three-year vocational programs at the secondary level, bearing in mind that only 10% of the youth in Gansu enroll in upper secondary education and much of the future demand is likely to be for semiskilled workers and operatives. For such positions, a solid basic education combined with short-term exposure to job-related skills, either prior to job entry or as part of employment, is sufficient and much less expensive.

30. In health, Gansu faces the difficult task of maintaining and improving upon achievements already made. Experience from other countries suggests that the province's health achievements are the result of social policies and programs far broader than health services per se, and that a continuation of grain relief programs, improvements in rural water and fuel supplies, and maintenance of public health campaigns will all be important. Child survival and development can also be enhanced by improvements in maternal health and education, the guarantee of complete immunization for all children 0-5 years of age, and the development of a system for monitoring child health. Effective implementation of such measures will require emphasis on preventive as opposed to curative activities by village doctors as well as by the maternal and child health and the anti-epidemic organizations. There will also need to be greater attention to preventive aspects of chronic disease management and careful analysis of future staffing and equipping of hospitals and health centers.

31. In recent years the role of the government in provision of social services has been expanding. About half of all rural primary school teachers are now government employees, as are about 70% of personnel in township health centers. However, in view of the very limited resources available to rural areas of Gansu, a further shift of management and financing responsibilities from collectives and individuals to the government seems warranted. Both the quantity and the quality of rural primary education could be enhanced by the elimination of school fees and charges and by increased support and accelerated transfer of minban teachers to the government payroll. The health status of the rural population could also be enhanced by transferring more personnel, including qualified village doctors, to the government payroll, by eliminating charges for preventive services such as immunizations and by exercising caution in increasing charges for rural curative services, in view of the fact that the present charges already constrain the access of rural families to available services.

#### Management and Finance

32. The proposed changes in management and financing responsibilities for health and education would obviously result in an increase in state budget expenditures on social services. But the capacity of the government to accept such increased responsibilities must be viewed in the context of the scope and allocation of provincial government responsibilities and the commitment of the central government to help poorer provinces such as Gansu. In the coming years, the government's direct involvement in financing agricultural and industrial activities can be expected to decline as economic reform proceeds and alternative channels of finance become more developed. Thus, provincial budget expenditures on capital construction can be expected to grow at a slower rate than total GDP. As a result, even if the provincial government expands its responsibilities for rural social services and recurrent expenditures increase more rapidly than GDP, the growth rate of total public expenditures may still be quite close to total GDP growth.

33. As part of the overall process of economic reform, some major changes in tax instruments and rates can be expected. There may also be scope for introducing user charges for urban services such as housing while user

charges for rural social services are reduced or eliminated. But regardless of changes in the tax system and in the system of user charges, Gansu is likely to remain in a situation where provincial budget expenditures greatly exceed provincial budget revenues. There will continue to be need for revenue transfers from the central to the Gansu provincial government and within Gansu from higher to lower levels of government. Funds like the "Two-Xis" special subsidy will also continue to be necessary. In order to improve the efficiency in use of such transfers, it will be important to consolidate institutional responsibilities for determining the level and the use of such transfers at both central and provincial government levels. More formal procedures and timetables will also need to be established for determining the level and composition of transfers between different levels of government and for assessing the appropriate balance between fixed and special subsidies.

34. Economic reform also means that the institutional arrangements for determining the level and composition of fiscal transfers to Gansu need to take account of the magnitude and direction of other types of resource flow. For example, more and more financial resources are flowing through the banking rather than the fiscal system and need to be taken into account in any strategy for ensuring that adequate financial resources are available to Gansu. There are increasing possibilities for movement of people between provinces which may mean that Gansu could benefit more from policies and programs to facilitate outmigration of unskilled labor than from larger inflows of investment finance. Finally, the increased possibilities for interprovincial trade in goods and services will have significant implications for location of economic activities and hence for capital and labor requirements.

35. Many of these more general aspects of economic reform are beyond the scope of this report but will clearly have major implications for poor provinces such as Gansu and require further consideration. In the meantime, however, the analysis of development issues in Gansu suggests that there are a number of measures that the central and provincial governments could take to help improve efficiency and reduce poverty. The province should move ahead as quickly as possible with loess hills rehabilitation but should look carefully at the economics of new irrigation projects. Instead there should be more emphasis on the development of labor-intensive nonagricultural activities as a means of reducing the size of the labor force remaining in rainfed agriculture. This will require a further shift in financial resources away from heavy industry and towards light and rural industries and services, development of supporting infrastructure and increased technical assistance from industrial bureaus. Programs to improve social services, especially basic education, will also be important. In addition, the central government will need to consider reducing restrictions on labor mobility and permitting more flexible wage practices while continuing to allocate substantial financial resources to the province. In many of these areas changes are already underway. But without a combination of such measures by the central and provincial governments, it will be difficult for Gansu to take advantage of economic reform, increase economic efficiency, and simultaneously reduce rural poverty.

## I. PROVINCIAL SETTING

1.01 Gansu province is situated in the semiarid northwest region of China. It has a population of 20 million and is the poorest province in the country in terms of rural per capita income (Y 221 in 1984 compared with a national average of Y 356). Much of the province is affected by major erosion problems as well as by a short growing season and low and erratic rainfall (generally below 400 mm per year). Development of economic irrigation systems is constrained by difficult topographical conditions. Gansu has significant mineral resources, and during the 1950s and 1960s a major effort was made to develop a heavy industrial base in the province. But the industrial sector as a whole appears to be very inefficient and is not well-linked with other parts of the provincial economy. In some areas of the province, primary school enrollment is as low as 50%, partly because parents cannot afford to pay the fees and other charges. The central government has established a special development program for parts of Gansu and will be allocating about Y 160 million per year to the program for the next ten years. But many questions remain as to how these resources and indeed the provincial government's own funds can be used to achieve the greatest economic and social benefit.

1.02 The World Bank's first and second economic missions (November 1980 and April 1984) visited Gansu and collected a substantial amount of background information. During the past year, further study missions have carried out more detailed review of sectors within the provincial economy and have discussed future policies and programs in human resource development, agriculture and industry with provincial officials. The objective of this report (which includes a main overview report as well as three annexes) is to summarize the findings of these missions and highlight some of the issues and options that are likely to confront the province in the coming years. The report has also formed the basis for discussions with the central and provincial governments about the potential role of the World Bank in supporting development programs and projects in Gansu.

1.03 The report begins by summarizing the key features of the Gansu economy and the development issues and options facing the province. It then reviews policies and programs for increasing agricultural productivity and incomes, focusing particularly on the Dingxi and Hexi regions. This is followed by a discussion of the potential for industrial development and employment generation and the policies necessary to realize that potential. Issues of human development have been reviewed, including the critical importance of improving social services such as basic and vocational education and rural health. The report concludes by briefly outlining some of the major issues of public sector management and finance that are likely to emerge. The report focusses primarily on policies and programs that are the responsibility of the provincial government. In addition, the report discusses several aspects of national economic reform that will have significant implications for Gansu.

A. Growth and Development

Employment, Productivity and Incomes

1.04 The vast majority of the labor force in Gansu continues to work in agriculture (see Table 1.1) in spite of major investment and rapid development in heavy industry over the past 30 years. The share of the labor force in agriculture is still substantially above the national average and very similar to the average for other low-income countries. The percentage of the labor force employed in industry remains well below the national average though still above the average for other low-income countries. The proportion engaged in infrastructure and services is relatively low by Chinese as well as by international standards.

Table 1.1: EMPLOYMENT AND PRODUCTIVITY, 1982 /a

	Labor force (%)			GDP/worker (Y)		
	Gansu	Jiangsu	China	Gansu	Jiangsu	China
Agriculture	75.8	63.5	69.3	319	628	540
Industry	10.1	21.6	14.5	4,393	2,289	3,003
Other	14.1	14.9	16.2	1,923	668	1,538
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>931</u>	<u>1,200</u>	<u>1,058</u>

/a To illustrate how Gansu compares with China's more developed coastal provinces, Jiangsu is used as a comparator in this and subsequent tables.

Source: Appendix A.

1.05 The productivity of the agricultural labor force in Gansu is extremely low as a result of very difficult natural resource conditions and relatively high population densities. Agricultural GDP per worker in 1982 was much below the national average and only one third of Gansu's total GDP per worker. In contrast, GDP per worker in industry is higher than the national average and is also about 14 times that in agriculture, compared with a factor of six for China, four for India, and a typical figure of 2.5 for other low-income countries. Such a huge labor productivity differential between agriculture and industry may be without parallel in the rest of the world and reflects the high capital intensity of industry--predominantly heavy industry --in Gansu.

1.06 Urban wages and incomes in the province are not related to labor productivity in either the industrial or agricultural sectors but instead reflect national level guidelines for wages of state enterprise staff and workers. Average per capita income in Gansu's urban areas is slightly higher

than the national average for urban areas (see Table 1.2). Incomes in rural areas of Gansu, on the other hand, are closely related to labor productivity. The very low level of labor productivity in agriculture combined with the still limited development of rural nonagricultural activities accounts for an average rural per capita income that is lower than in any other province of China and an incidence of poverty that is much above the national average. It should be noted that the income and expenditure survey on which these figures are based appears to favor parts of Gansu that are better off; the real level of rural incomes in the province may therefore be even lower.<sup>1/</sup>

Table 1.2: INCOME DISPARITIES AND POVERTY, 1982

	<u>Average per capita income (Y)</u>			<u>Incidence of poverty (%) /a</u>		
	<u>Gansu</u>	<u>Jiangsu</u>	<u>China</u>	<u>Gansu</u>	<u>Jiangsu</u>	<u>China</u>
Urban	648	593	574	2	0	1
Rural	174	309	269	41	3	13
<u>Total</u>	<u>245</u>	<u>354</u>	<u>333</u>	<u>35</u>	<u>3</u>	<u>11</u>

/a Defined as percentage of population with per capita income below Y 167 in urban areas and Y 140 in rural areas.

Source: China's Economic Structure in International Perspective, Annex 5 to World Bank Country Study, (World Bank, 1985).

1.07 In recent years, rural per capita incomes in Gansu have increased quite significantly as a result of increased agricultural production and a rapid growth in rural nonagricultural activities, and the gap between urban and rural per capita incomes appears to have narrowed somewhat. However, rural per capita incomes in Gansu have not been growing as fast as in the rest of China (see Table 1.3), and some parts of the province have seen little or no improvements in living standards in recent years.

#### Agricultural Resources and Production

1.08 Gansu's poor natural resource endowment causes great difficulties in crop and livestock production. Rainfall is low, erratic and concentrated in only three to four months in the summer. Over the past 30 years, irrigation (based mainly on snow runoff from surrounding mountains) has been expanded from 10% to almost 25% of cultivated area (see Table 1.4), but even in irrigated areas the long cold period restricts crop growth to the summer months. In

1/ Appendix B provides analysis of alternative estimates of rural per capita incomes in the province.

Table 1.3: RURAL PER CAPITA INCOMES, 1978-84

	Growth rate 1978-84 (% p.a.)		% of national average	
	Current prices	Constant prices	1978	1984
Gansu	14.4	11.2	73	62
Jiangsu	19.7	16.5	113	126
China	17.6	14.4	100	100

Source: State Statistical Bureau, Statistical Yearbook of China, 1984, Hong Kong: Economic Information and Agency, 1984; data provided by the Gansu Statistical Bureau.

rainfed areas, agriculture has caused progressive removal of vegetation, leading to massive erosion of the predominantly loess soils and a reduction in agricultural productivity. At the same time, the population has been increasing by about 2% p.a. As a result, per capita grain production in the early 1980s was no better than in the early 1950s and had declined relative to the average for the 1970s. In recent years, favorable weather and the introduction of the production responsibility system have helped to stimulate more rapid agricultural growth. The gross value of agricultural output (GVAO) for example, has increased by nearly 11% p.a. between 1981 and 1985. Nonetheless, cultivated area per capita in Gansu is only about the same as the national average and the extent of irrigation and yield levels are much less (see Table 1.4).

1.09 There are substantial differences in agricultural resources and output among different regions within Gansu, particularly Hexi, Dingxi and southern Gansu. Hexi comprises 17 counties in the northwest of the province <sup>2/</sup> (see Map and Table 1.4). Mean annual rainfall in Hexi ranges from 50 mm to 200 mm, significantly less than in the rest of the province, making crop agriculture virtually impossible without irrigation. Consequently, the region has always been sparsely populated and development of agriculture and employment have been closely linked to the development of irrigation. Almost 80% of the cultivated land in Hexi is now irrigated, and yields, per capita output and incomes in the region are all much higher than provincial averages.

<sup>2/</sup> Hexi includes the counties in Jiuquan and Zhangye prefectures and counties in Wuwei prefecture except Jingtai and Gulang which are included in Dingxi.

Table 1.4: AGRICULTURAL RESOURCES, OUTPUT AND INCOMES, 1983

	Gansu				Jiangsu	China
	Total	Hexi	Dingxi	Other	Total	Total
<b>Population</b>						
Total (millions)	19.9	3.0	5.7	11.2	61.4	1,025.0
Agricultural (%)	85.7	94.1	84.9	81.6	84.7	82.4
<b>Land</b>						
Cultivated land per capita (ha) <u>/a</u>	0.2	0.2	0.3	0.2	0.16	0.17
Irrigated (% of cultivated)	23.1	79.3	13.2	13.8	40.9	31.0
<b>Output</b>						
Grain yield (kg/ha)	1,900	4,380	1,300	1,720	4,715	3,396
Grain output per capita (kg) <u>/a</u>	313	615	256	261	588	460
GVAO per capita (Y)	161	300	113	146	416	282
<b>Incomes</b>						
Average rural per capita income (Y)	108/b	241	74	86	357	310
Range of income (Y) <u>/c</u>	34-478	86-478	40-116	34-251	n.a.	213-563

/a Refers to agricultural population only.

/b This compares with a figure of Y 213 from the household income and expenditure survey for the same year; see Appendix B for further analysis of this issue.

/c For Gansu the range refers to differences in average incomes between counties; for China the range refers to differences in average incomes between provinces.

Source: Statistical Yearbook of China, 1984, op. cit.; Agricultural Yearbook of China, 1984, Agricultural Publishing House, Beijing; Gansu Statistical Bureau.

1.10 The Dingxi region comprises 18 dry counties in six prefectures in central and eastern Gansu <sup>3/</sup> and accounts for nearly 30% of the provincial population. The region is part of the great Loess Plateau which covers more than 630,000 km<sup>2</sup> and extends into northern Shaanxi, southern Ningxia and the western part of Shanxi province. Mean annual rainfall in the region ranges from 200 to 400 mm which makes rainfed agriculture feasible but at very low and erratic yields. Cultivated area per capita is a little higher in Dingxi than in Hexi, but only 13% of the land is irrigated and grain yields are less

<sup>3/</sup> The counties are: Yongdeng, Gaolan and Yuzhong in Lanzhou municipality; Dingxi, Huining, Jingyuan, Tongwei, Longxi and Lintao in Dingxi prefecture; Zhuanglang and Jingning in Pingliang prefecture; Huachi and Huanxian in Qingyang prefecture; Qinan in Tianshui prefecture; Yongjing and Dongxiang in Linxia prefecture; and Jingtai and Gulang in Wuwei prefecture.

than a third of those obtained in Hexi. Over the past 40 years, grain production in Dingxi has increased more slowly than in Gansu as a whole and much more slowly than the national average (see Figure 1.1). Even in the relatively good years of 1983 and 1984 annual grain production per capita averaged only 256 kg and many households had to rely on relief grain from the state to meet minimum food consumption requirements. Indeed, a large part of the 600,000 tons of grain imported into the province annually between 1979 and 1983 was distributed as relief grain to rural households. About 80% of this relief grain was provided to households in Dingxi. Scarcities also extend to drinking water which must be trucked to sizable numbers of the rural population for people and livestock during several months each year. In addition, more than 50% of rural households in Dingxi lack fuel for cooking, heating, lighting and other uses during at least 4 to 6 months of the year. Moreover, about 35% of rural household fuel supply in the region consists of grass and grass roots (sod) which is dug up from surrounding hillsides, thereby contributing to soil erosion and environmental degradation in the region.<sup>4/</sup>

1.11 Average incomes in southern Gansu are only a little higher than in the Dingxi region, but the range of incomes and resource conditions is much greater. Most of Gansu's minority nationalities live in the mountainous southwest of the province (Gannan and Linxia prefectures), and many are nomadic herdsman. In some of the more remote counties, average income per capita is as low as Y 30-40, most children do not attend primary school, and health conditions and life expectancy are much below provincial averages. In other parts of southern Gansu, however, incomes are significantly above those prevailing in Dingxi, primarily because of higher rainfall (400-600 mm per year) conditions which allow more productive rainfed agriculture.

#### Mineral Resources and Industrial Concentration

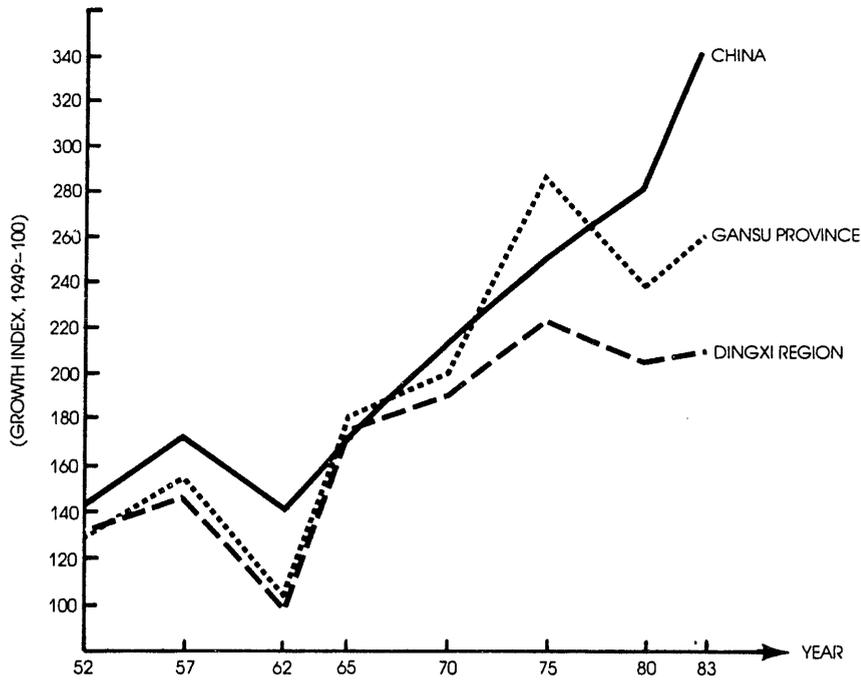
1.12 Relative to most other parts of China, Gansu faces a very difficult agricultural environment but is rich in mineral resources--including nonferrous metals, petroleum, and coal--and hydropower. Over the past 30 years the government has invested greatly in the development of heavy industry based on these resources. As a result, the extent of state industrial fixed assets in relation to population is now much higher in Gansu than in the country as a whole (see Table 1.5). Even in light industry, which until recently has been given little emphasis in Gansu, the level of fixed assets per capita is very close to the national average. However, the performance of the industrial sector in terms of employment generation and capital and labor productivity has been very poor relative to industry in the rest of the country.

---

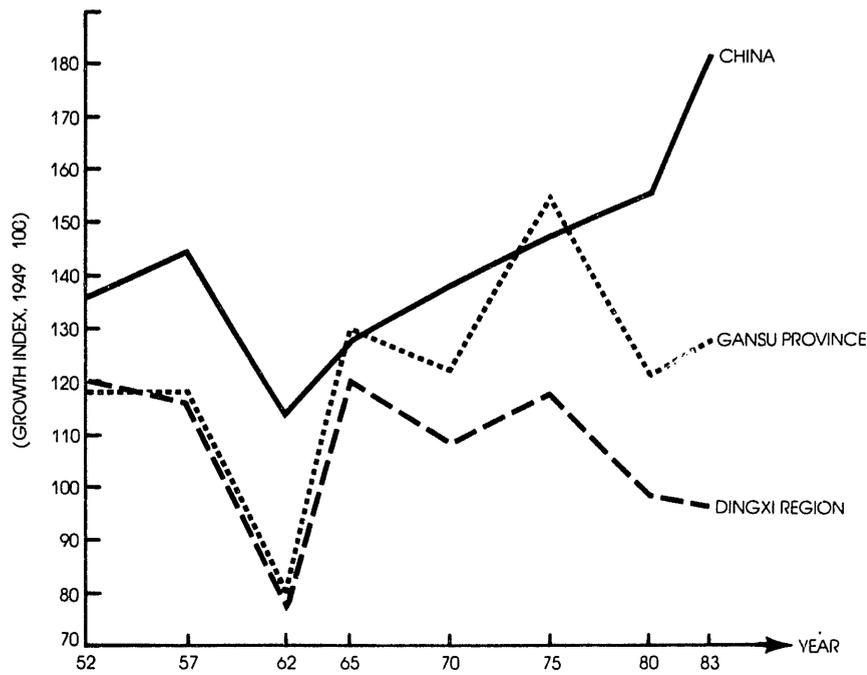
<sup>4/</sup> Nearly 90% of the region face erosion problems. The Loess Plateau as a whole, including those parts in neighboring provinces, now sheds an estimated 1.6 billion tons of silt annually into the Yellow River.

Figure 1.1

A. Total Grain Production, 1952-1983



B. Per Capita Grain Production, 1952-1983



Source: Estimates provided by the Two-Xi Commission

World Bank - 30413

**Table 1.5: FIXED ASSETS, EMPLOYMENT AND OUTPUT OF STATE INDUSTRY, 1982**

		Gansu	Jiangsu	China
Fixed assets per capita (Y)	Total	758	305	431
	Heavy	688	239	356
	Light	70	66	75
Employment per Y million in fixed assets	Total	45	109	80
	Heavy	40	85	67
	Light	96	174	142
GVIO per employee (Y)	Total	10,362	15,122	11,484
	Heavy	10,455	21,629	10,205
	Light	9,985	10,496	14,378

Source: Annex B, Appendix 5.

1.13 It is also apparent that investment in industry has been heavily concentrated in the capital city of Lanzhou and has generated relatively few linkages to other sectors and other parts of the province. In 1983 Lanzhou accounted for 51% of provincial industrial output (including output of village-level industrial enterprises) whereas Nanjing, the capital of Jiangsu province, accounted for less than 15% of provincial industrial output (see Table 1.6). As a result, industrial output per capita in Lanzhou was very close to that of Nanjing, but industrial output per capita outside the provincial capital of Gansu was only about one quarter of that in the rest of Jiangsu. While the heavy industry strategy of the past three decades has helped to raise Lanzhou to the level of richer coastal cities, it has failed to do so for the rest of the province, where over 90% of the population live. In 1984 and 1985 Gansu began to experience a rapid growth in rural industrial and service development but this comes from a very small base and still leaves Lanzhou as an industrial enclave within a poor and predominantly agricultural province.

Table 1.6: INDUSTRIAL CONCENTRATION, 1983  
(% of gross industrial output value) /a

	Gansu	Jiangsu	China
Capital city	50.7	15.0	3.7
Other urban	46.3	56.5	84.7
Township	1.8	17.7	6.4
Village	1.2	10.8	4.2
Other	-	-	1.0
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

/a Including village industrial enterprises.

Source: Annex B.

#### Social Service Development and Financing

1.14 The Government's grain, water and fuel relief programs (see para. 1.10) have been and are still critical to ensuring that a minimum level of basic needs are met in rural areas of Gansu. When combined with regular patriotic (public) health campaigns and other health measures, these programs have helped Gansu to achieve life expectancy levels and infant mortality rates that are now quite close to national averages (see Table 1.7). These aggregate figures do, however, hide substantial intraprovincial differences, especially between urban and rural areas. It is also apparent that Gansu is far behind the rest of the country in terms of basic, though not higher, education. The condition of school facilities in rural areas is poor, and the quality of instruction is low due to the low qualifications of the teachers. Of every ten children of primary school age in Gansu, only about eight begin school, four continue to attend to the fifth grade, and two successfully continue to secondary school.

Table 1.7: SOCIAL INDICATORS

	Gansu	Jiangsu	China
<u>Health</u>			
Life expectancy at birth, 1981	61	n.a.	67
Infant mortality rate, 1981	43	n.a.	41
Stunted children 6-8 years (rural), 1980 (%)	29	12	n.a.
<u>Education</u>			
Adult literacy rate, 1983/84	46	75	76
Completion rate for primary school, 1983/84	34	94	65
Secondary enrollment ratio, 1983/84	20	36	35
Higher education enrollment ratio, 1983/84	4	2	5

Source: China: The Health Sector, World Bank, 1983; Annex C; data provided by the Gansu Bureau of Health.

1.15 Large differences in the level of social services between urban and rural areas of Gansu stem from the fact that responsibility for providing such services is divided among the government, the state enterprise and the rural collective sectors.<sup>5/</sup> The amount of resources available for social services varies widely from one sector to another. In primary education, for example, there are five categories of schools with varying degrees of support from government, state enterprises and collectives. In urban areas, primary schools are managed and financed either by the government or by state enterprises. In rural areas, a few central schools are financed publicly but most are financed largely by local sources. Most of the teachers in rural primary schools are locally hired minban teachers who serve on terms agreed with the village or township that hired them as opposed to gongban teachers who are government employees. Minban teachers are generally less qualified than gongban teachers and are remunerated at somewhere between 25% and 50% the level of the gongban teachers.<sup>6/</sup> Expenditures on equipment and materials for education is also lower in rural than in urban areas. Taken together these factors result in large inequalities in recurrent expenditures between rural and urban areas. Overall it appears that recurrent expenditure per student varies from Y 100 in an urban state-run primary school to Y 41.5 per student

<sup>5/</sup> In this and other parts of the report the term "rural collective sector" is used to refer to institutions that were formerly part of the commune sector and are now undergoing major change as a result of economic and institutional reforms.

<sup>6/</sup> Minban teachers' pay includes both a public subsidy paid out of the state budget and local support, either in cash or grain.

in an average rural public primary school and to Y 33.0 in a village primary school (see Figure 1.2).

1.16 A similar situation of divided responsibilities and large urban-rural differentials in expenditures prevails in the health sector. In urban areas, hospitals are managed and financed either by state enterprises or by the health bureau. Direct payments by individuals in urban areas for health services are covered either by the government or by state enterprises through insurance schemes. In rural areas, on the other hand, facilities and personnel may receive some public subsidies but are expected to rely mainly on collective or individual finance. The result again is very large differentials in expenditures between urban and rural areas (see Figure 1.3).

1.17 Although all provinces in China face a situation of divided responsibilities, inequalities in social service expenditures are much greater in Gansu than in most other provinces because the differences in resources available to the government, the state enterprise and the collective sectors are much greater. Schools and health facilities managed by state enterprises in Gansu are generally as well off as similar facilities in other provinces because state enterprises are able to allocate substantial resources for the welfare of their workers and their workers' families. Most public expenditures on social services are allocated to government-run facilities in urban areas. These too are probably as well off as urban schools and health facilities in other parts of China. In contrast, collective facilities in rural areas which have to rely primarily on collective or individual finance are much worse off because of the very low level of rural per capita incomes and the limited resources available to townships and villages from rural nonagricultural enterprises (see Table 1.8). The government provides special subsidies to doctors and teachers in rural areas, and even higher subsidies to those working in minority areas. Such measures help to reduce but fall far short of eliminating the major inequities between urban and rural areas.

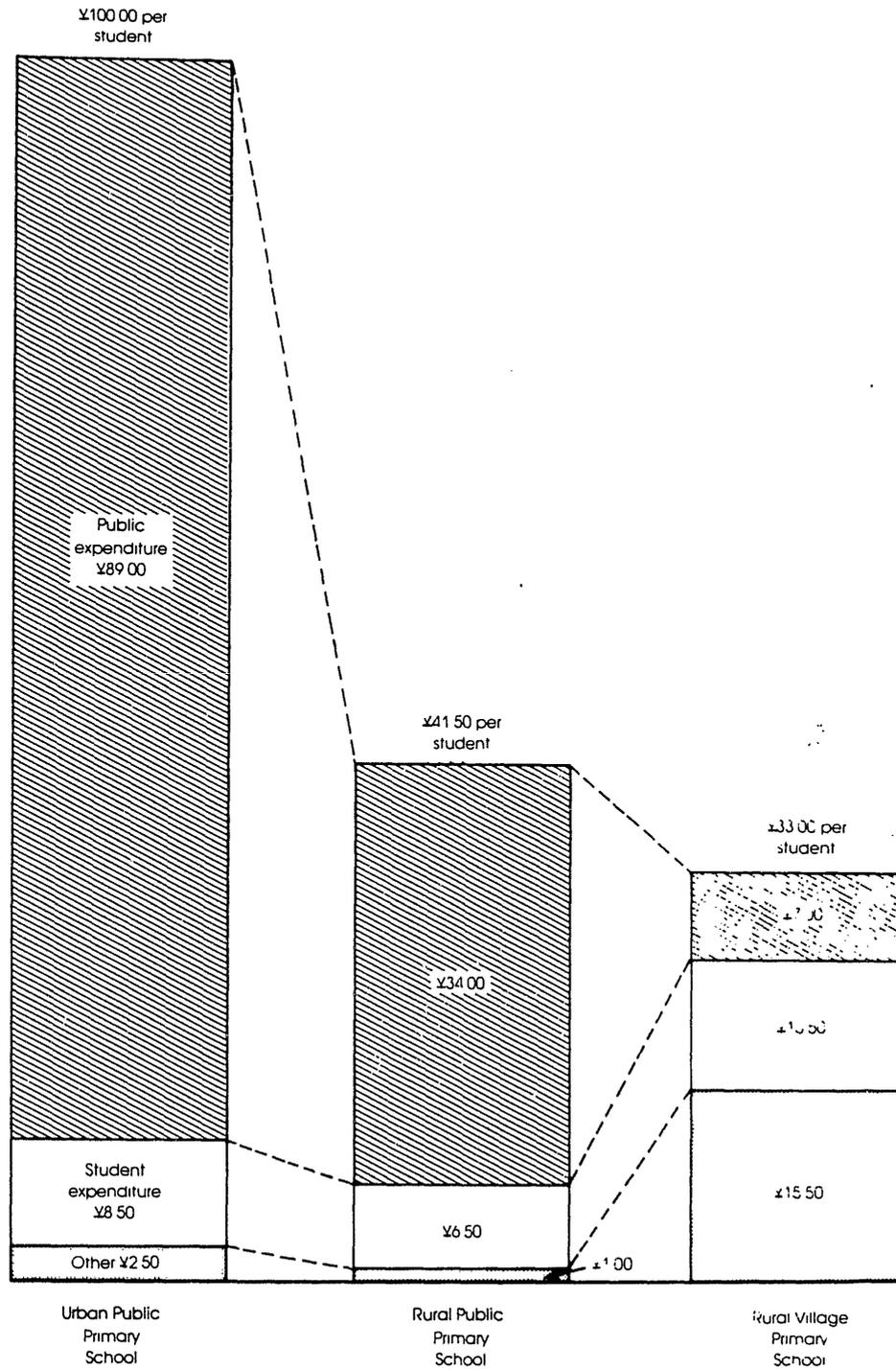
Table 1.8: RESOURCES OF THE RURAL COLLECTIVE SECTOR, /a 1983  
(Yuan per capita)

	Gansu	Jiangsu	China
Net profits	3.4	34.1	15.0
Welfare expenditures	0.3	2.8	1.5

/a Data covers resources of rural collective enterprises only; however, other resources are likely to be very small.

Source: Statistical Yearbook of China, 1984, op. cit.

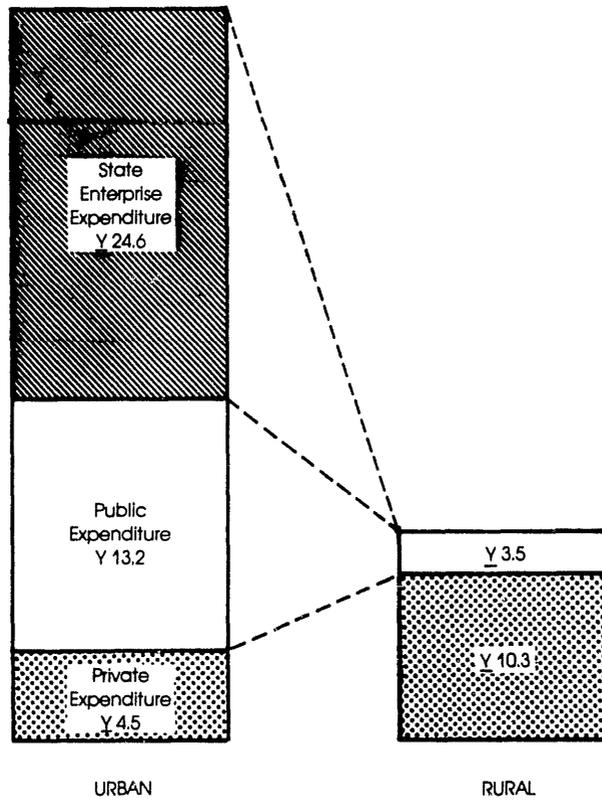
Urban-Rural and Public School Versus Village School Differentials in Per Student Recurrent Expenditure on Primary Education 1984<sup>1</sup>



<sup>1</sup> Estimates of average recurrent expenditure are based on school accounts of income (that exclude fees & charges to students) & expenditure plus estimated average expenditure by each student on texts & educational materials

Source: Mission estimates based on school expenditure surveys in Lanzhou & four counties

### Urban-Rural Differentials in Per Capita Recurrent Expenditures on Health, 1983



Source: Mission estimates based on data provided by the Gansu Bureau of Health.

Public Expenditures and Finance

1.18 Although the public finance system has yet to rectify urban-rural inequalities in expenditures on social and other services in Gansu, public expenditures have been increasing rapidly in recent years, and faster than the national average (see Table 1.9). Public expenditures per capita on culture, education and health are now slightly higher in Gansu than in some of the richer provinces such as Jiangsu. Differentials in per capita expenditures for other items, including capital construction, appear to be somewhat greater with the result that total public expenditures per capita are significantly higher in Gansu than in Jiangsu. The differences would, however, have to be much higher in order to equalize the availability of services between the two provinces.

Table 1.9: PUBLIC EXPENDITURES, 1980-84

	<u>Growth rate, 1980-84</u>			<u>Expenditures per capita, 1983 (Y)</u>		
	<u>Gansu</u>	<u>Jiangsu</u>	<u>China</u>	<u>Gansu</u>	<u>Jiangsu</u>	<u>China/a</u>
<u>Total</u>	<u>11.5</u>	<u>n.a.</u>	<u>7.0</u>	<u>92.6</u>	<u>69.7</u>	<u>139.7</u>
<u>Capital construction and modernization</u>	<u>11.4</u>	<u>n.a.</u>	<u>6.3</u>	<u>17.7</u>	<u>11.3</u>	<u>41.6</u>
<u>Aid to agriculture</u>	<u>3.0</u>	<u>n.a.</u>	<u>10.9</u>	<u>10.0</u>	<u>3.3</u>	<u>8.5</u>
<u>Culture, education and health</u>	<u>16.5</u>	<u>n.a.</u>	<u>13.9</u>	<u>18.7</u>	<u>17.3</u>	<u>21.9</u>
<u>Other</u>	<u>8.3</u>	<u>n.a.</u>	<u>7.3</u>	<u>46.2</u>	<u>37.8</u>	<u>67.7</u>

/a It should be noted that the totals for China include direct expenditures by the central government as well as the aggregate expenditures of all the provinces.

Source: Appendix C, Table 5; and IMF data.

1.19 The rapid growth in public expenditures in Gansu has been made possible not by a rapid growth in provincial revenues but rather by a substantial net increase in transfers from the central government (see Table 1.10). Annual provincial revenues have in fact shown a declining trend over the period 1980-84, due primarily to the transfer of a large number of enterprises from provincial to central control and the consequent loss in enterprise revenue which more than offset increased revenues from industrial and commercial taxes.<sup>7/</sup> Meanwhile, net transfers from the central government have increased rapidly due primarily to a rapid growth in special item subsidies including

7/ For further discussion of the composition of public expenditures and revenue, see Appendix C.

the "Two-Xis" fund, which began in 1983 and under which the province receives about Y 160 million annually for development of the Dingxi and Hexi regions. The rapid growth in special subsidies (which now account for 12.5% of total public expenditures in the province) has helped to expand aggregate expenditures. But greater subsidies have also meant greater complexity in decision-making about expenditures. Many different institutions at central and provincial levels are now involved in negotiating and bargaining over resources, thus complicating the task of arriving at an optimal composition of total public expenditures and reducing somewhat the province's flexibility and autonomy in fiscal planning and allocation.

Table 1.10: BALANCING OF PUBLIC EXPENDITURES AND REVENUES, /a 1980-84  
(Y million)

	1980	1981	1982	1983	1984
Total expenditures	1,517	1,447	1,664	1,841	2,345
Total revenues /b	1,780	1,626	1,633	1,380	1,553
Enterprises	639	483	353	139	217
Taxes and other	1,141	1,143	1,280	1,241	1,316
Deficit /c	-264	-179	32	463	792
Fixed subsidies	-	-	-	199	195
Special subsidies /d	156	200	276	500	491
Other balancing items	108	-21	-244	-236	106

/a Defined on an IMF basis.

/b Revenues raised within Gansu, not including transfers from higher levels.

/c Total expenditures less revenues raised in Gansu.

/d Includes the "Two-Xis" fund at Y 160 million in 1983 and Y 171 million in 1984.

Source: Appendix C.

1.20 Revenue-sharing systems within Gansu operate at the prefectural and county levels and are beginning to operate at the township level, as townships are gradually incorporated as the lowest layer of the public finance system. An analysis of revenue sharing at the prefecture level shows clearly that it has helped to ensure that public expenditures on culture, education and health are distributed more equitably than total expenditures and that total expenditures are distributed more equitably than total revenues (see Table 1.11). This is also happening at the county and township levels, although data at these levels are more scarce. However, at the prefecture, county and township levels--as at the provincial level--it appears that the increasingly dominant role played by special subsidies may be complicating the task of efficient fiscal planning.

Table 1.11: INTERPREFECTURAL VARIATIONS IN PUBLIC EXPENDITURES AND REVENUES PER CAPITA, 1983

	Inequality index (I) /a	Range (Y per capita)	Average (Y per capita)
<u>Expenditures</u>			
Total	0.18	33.3 - 118.0	78.1
Culture, education and health	0.14	11.1 - 31.1	18.7
<u>Revenues</u>			
Total	0.49	11.9 - 178.9	54.8

/a Varies from 0 if the distribution is perfectly equal to 1 if the distribution is perfectly unequal.

Source: Appendix C, Table 6.

### B. Regional Development Strategy in International Perspective

#### International Experience

1.21 Economic reform is likely to mean that Gansu will be subject to many of the same forces that have affected poor regions in other countries during the low- to middle-income transition. Unfortunately, it is not easy to draw firm conclusions from international experience concerning either trends in regional inequalities or the major forces likely to shape those trends. The analysis of regional inequities in other countries suggests a pattern of change which could be seen as reassuring for development of Gansu in the long run: regional inequalities usually increase in the early stages of transition to a middle-income country, stabilize after a time and eventually decrease.<sup>8/</sup> However, there is strong evidence that inequality among regions increases in the early stages of industrialization; the evidence is less strong that inequality then narrows later on. Evidence about the timing of the change from increasing to decreasing regional inequality is also not very encouraging despite the introduction of special regional development programs and other measures to stimulate growth in poorer localities. In France, regional inequality increased throughout the 19th century and until the first world war. In the United States, regional inequality increased until 1880 before regional rates of growth began to converge. In Brazil, regional inequalities increased moderately during 1920-40, rose more rapidly in the 1950s, and since then have been either stable or increasing more slowly.

<sup>8/</sup> See Alternative International Economic Strategies and their Relevance for China, World Bank Staff Working Paper No. 759, 1986.

1.22 As countries undergo the low- to middle-income transition, factors such as decline in the relative importance of agriculture, growth of services in poor regions and migration of labor from poor to richer regions should help to reduce regional inequalities. But other forces tend to counteract the positive "trickle-down" and "spread" effects of economic growth. Centers of growth in higher-income regions can actually destroy traditional lines of production in poorer regions by providing new products which are lower in cost or preferable in quality and by offering higher-paying industrial employment which attracts skilled workers away from poorer areas.

1.23 In developing appropriate strategies and policies for regional development, the central as well as the Gansu provincial government will need to take account of these different forces and their potential effects on regional inequalities. Experience in other countries also suggests that poverty alleviation aspects of a regional development strategy need to be clearly specified. In many countries, spatial income equalization has come to be regarded as the major objective of regional policy, and measures have been introduced to maximize output and growth in the poorer regions. However, even in cases where such measures have succeeded in increasing average incomes, they have not always helped to reduce poverty and on occasion have even been counterproductive to eliminating poverty.

#### Issues and Options for Gansu

1.24 Gansu, like the rest of China, has set itself the target of quadrupling the gross value of industrial and agricultural output (GVIAO) by the year 2000, which would require a growth rate of about 6.6% p.a. in GDP (see Table 1.12). If industry in Gansu grows at the projected national rate of 7.2% p.a. and if infrastructure and services increase at the projected national rate of 7.5% p.a., agriculture would need to grow at 3.9% p.a. compared with the national growth rate of 4.9% p.a. because of the low share of agriculture in Gansu provincial GDP relative to national GDP.<sup>9/</sup> Although experience from other countries suggests that it will be difficult for poorer regions to keep up with the national average growth at this stage in China's development, the central government is strongly committed to providing Gansu with the financial and other resources necessary to achieve the target growth rates. Achieving these aggregate targets will also mean a rapid growth in average per capita incomes in the province because of the relatively slow natural growth rate of the population anticipated for the coming years (see Table 1.13).

---

<sup>9/</sup> See Appendix D for a more detailed outline of these projections.

Table 1.12: PROVINCIAL AND NATIONAL TARGETS FOR GDP GROWTH, /a 1984-2000

	<u>% growth rate, 1984-2000</u>		<u>% shares, 1984</u>		<u>% shares, 2000</u>	
	Gansu	China	Gansu	China	Gansu	China
Agriculture	3.9	4.9	26	36	17	28
Industry	7.2	7.2	43	40	48	44
Other	7.5	7.5	31	24	35	28
<u>Total</u>	<u>6.6</u>	<u>6.6</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

/a National targets are from the QUADRUPLE scenario; provincial targets are from Scenario A.

Source: Appendix D, Tables 1-4.

Table 1.13: NATURAL POPULATION GROWTH, 1984-2000 /a

Age group	<u>Absolute size (million)</u>			<u>Growth rate (% p.a.)</u>	
	1984	1990	2000	1984-90	1990-2000
0-4 years	1.9	1.8	1.8	-0.9	-
5-9 years	1.9	1.8	1.8	-0.9	-
10-14 years	2.5	1.8	1.8	-5.3	-
15-19 years	2.8	2.3	1.8	-3.2	-2.4
20-64 years	10.4	12.9	15.1	3.7	1.6
65 +	1.0	1.3	1.6	1.1	0.9
Total population	20.5	21.9	23.9	1.1	0.9

/a Projections assume no interprovincial migration.

Source: Appendix E, Table 1.

1.25 The experience of the past 20 years shows, however, that rapid growth of provincial GDP does not necessarily result in much poverty reduction in Gansu and that both the central and provincial governments need to be concerned about the pattern as well as the rate of economic growth. To illustrate how different development strategies could affect Gansu, two alternative scenarios have been developed for Gansu which closely follow the QUADRUPLE and BALANCE scenarios, in the World Bank's recent economic report

(see Table 1.14 and Appendices D and E).<sup>10/</sup> Under Scenario A, which is similar to the QUADRUPLE scenario, the province endeavors to achieve its growth targets by following a development strategy quite similar to its past strategy. Emphasis continues to be placed on development of capital-intensive heavy industries and large-scale irrigation projects. Development of rural nonagricultural activities is also encouraged but migration both to urban areas and outside of the province is restricted. The rapid growth in investment, which is necessary for the achievement of the overall growth targets, is made possible by substantial fiscal support from the central government. But the employment generation effects of the overall strategy are relatively limited and the agricultural labor force continues to increase. Those who benefit from the development of irrigation experience significant improvements in income, but in rainfed areas the population remains above the carrying capacity of the land and therefore yields and output per worker stagnate or grow very slowly.

Table 1.14: OUTPUT, INVESTMENT AND EMPLOYMENT GROWTH UNDER  
ALTERNATIVE SCENARIOS, 1984-2000  
(% p.a.)

		Scenario A	Scenario B
<u>GDP</u>	Total	6.6	6.6
	Agriculture	3.9	3.9
	Industry	7.2	6.2
	Other	7.5	8.8
<u>Investment</u>	Total	7.6	6.8
	Agriculture	3.5	2.3
	Industry	7.0	4.1
	Other	9.0	9.8
<u>Employment</u>	Total	2.0	1.2
	Urban	1.3	3.0
	Rural nonagricultural	11.0	12.0
	Agricultural	1.1	-1.1

Sources: Appendix D, Tables 1-8 and Appendix E, Table 7.

<sup>10/</sup> The QUADRUPLE and BALANCE scenarios represent alternative development patterns to achieving the same aggregate GDP growth. The BALANCE scenario involves greater emphasis on services and more efficient resource use.

1.26 Under Scenario B, which is similar to the BALANCE scenario in the World Bank's recent economic report, much more emphasis is placed on development of labor-intensive agricultural, industrial and service activities in recognition of the fact that Gansu has a large rural labor force whose opportunity cost is low. Some migration of the labor force from rural to urban areas and to other provinces is also allowed. The resulting improvement in efficiency from this pattern of development relative to Scenario B means that the province is able to achieve the same overall growth rate as in Scenario A but with a lower growth rate of investment. In addition, the absolute size of the agricultural labor force declines significantly, making possible a more rapid increase in agricultural incomes and a broader distribution of the benefits of growth.

1.27 In the past, China's economic system would have made it very difficult for Gansu to implement the type of strategy outlined in Scenario B. But economic reform has greatly increased the scope for movement of goods, capital and, to a lesser extent, people between regions and sectors, and Gansu's pattern of development is already beginning to change. In recent years there has been a significant shift away from heavy industry and towards light and rural industries. Incomes have also been increasing more rapidly in rural than in urban areas. These trends now need to be reinforced and an overall strategy developed for efficient output growth and poverty reduction.

1.28 In agriculture, the introduction of the production responsibility system and other reforms have already done much to improve incentives and stimulate production and income growth. Nevertheless, the government's grain, water and fuel relief programs will remain important elements of a poverty reduction strategy in Gansu for many years to come. In addition, the government will need to consider carefully what investments in land rehabilitation, irrigation, transport, marketing and other supporting infrastructure are economically and socially justifiable in Gansu. Research in Gansu and elsewhere in China already appears to have resulted in development of an economically viable strategy for controlling erosion in Dingxi.<sup>11/</sup> The program consists of land rehabilitation measures linked with new farming practices that will improve the productivity of land and labor while greatly reducing soil erosion. The strategy is predicated, however, on significant reduction of population pressure through resettlement. The government is presuming that much of this resettlement will be to new irrigation schemes and a large number of irrigation projects are underway or planned. However, their costs are substantial and require careful economic and social analysis, taking into account the expected rate of growth in nonagricultural employment and the residual labor force and population that will be active in agriculture in the 1990s and beyond.

1.29 The size of the residual agricultural labor force will be crucially affected by the government's strategy for industrial and service sector

---

11/ The strategy appears to be economically viable even before taking into account downstream benefits in terms of reduced siltation of the Yellow River watershed.

development. A continuation of the past pattern of heavy industry development, based on Gansu's mineral potential, may enable Gansu to achieve its growth targets but at a high investment cost and with limited employment generation. On the other hand, a strategy which emphasizes the further development of labor-intensive light and rural industries and services would be based on Gansu's other comparative advantage--an abundance of human resources whose economic cost is much lower than in most of the rest of China, in part because of difficult agroclimatic conditions and restraints on migration. Effective implementation of such a labor-intensive industrial and service development strategy would, however, require some increase in labor mobility, changes in wage policies, shifts in the allocation of investment resources and further development of infrastructure.

1.30 The rate of structural change in employment will depend not only on the rate of growth of labor-intensive nonagricultural activities but also on the extent of interprovincial migration. Increased mobility of people, whether between rural and urban areas or across provinces, is not, of course, without problems. There may be concerns about the fiscal, social and political costs of rapid rural-urban migration, which by holding down urban wages and adding to pressure on government services, retards improvement in urban living standards. The exodus of bright young people from rural areas could also hold back agricultural progress. On balance, however, the experience of other countries suggests that by enabling labor to be used where it is most productive, migration aids growth and poverty reduction.

1.31 International experience also suggests that poor health and lack of education are likely to hold back structural changes in employment and aggravate the exclusion of the poor from development. It is important, therefore, to develop strategies for maintaining and improving health and nutrition in rural households. It is also critical to poverty reduction and long-term development of the province that an immediate start be made on improving the quantity and quality of basic education. Experience in other developing countries has shown that basic education can help to enhance agricultural productivity by enabling farmers to more readily adopt improved technology. Basic education is also a precondition for many jobs in manufacturing and modern services.

1.32 In the coming years the government will need to decide not only what types of programs and policies to introduce in different sectors but also how such programs should be managed and financed. As in other provinces, the relationships between the state enterprise sector and the government, and between the rural collective sector and the government are still evolving. There are also questions about relationships between different levels of government and concerns as to how townships should gradually be integrated as the lowest level of government. Finally, of course, there are major issues of how programs should be financed and how to develop a fiscal system that will equitably and efficiently raise and allocate resources among sectors and regions. Clearly, Gansu province and many lower-level units of government within the province will remain revenue-deficient. Thus there is a need to explore how to efficiently transfer revenues from higher to lower levels of government while adhering to the broad principles of horizontal equity and allowing each level of government the revenue and transfers necessary for its expenditure requirements.

## II. PROSPECTS FOR AGRICULTURE

### A. Loess Hills Rehabilitation

#### Carrying Capacities

2.01 Any strategy for poverty reduction in Gansu must address the plight of the Dingxi region, which accounts for 30% of the province's population and an even larger proportion of the rural poor. Almost the entire Dingxi population is currently involved in agriculture, putting tremendous pressure on the available land and causing massive soil erosion. Moreover, unless there are major efforts to move people out of the region and to develop rural nonagricultural employment opportunities, the agricultural population could be slightly larger in 2000 than in 1984 (see differences between Scenarios A and B in Table 2.1).

Table 2.1: POPULATION GROWTH IN DINGXI UNDER ALTERNATIVE SCENARIOS, 1982-2000 (Million)

	1982	1984	1990 /a		2000 /a	
			Scenario A	Scenario B	Scenario A	Scenario B
Total population	5.68	5.79	6.35	6.02	6.94	6.02
Urban	0.32	0.35	0.36	0.40	0.39	0.54
Rural total	5.36	5.45	5.99	5.62	6.54	5.48
Nonagricultural	n.a.	0.42	0.47	0.70	1.31	1.65
Agricultural	n.a.	5.03	5.52	4.92	5.23	3.83

/a Based on province-wide growth rates in Appendix E.

Source: Appendix E.

2.02 In an effort to raise agricultural productivity and reduce environmental degradation in the region, the provincial government has increased research on erosion control and appropriate agricultural production systems via an experimental land rehabilitation program on a number of micro watersheds. The government has also conducted an extensive survey of land use and distribution of the population throughout the region. On the basis of this survey, researchers have divided the region into various zones and made a preliminary assessment of land rehabilitation requirements (see Table 2.2). The need for rehabilitation is particularly great in Zones I and II which together account for about 70% of the cultivated land and 60% of the population.

**Table 2.2: DISTRIBUTION OF LAND AND POPULATION IN THE DINGXI REGION BY ZONE, 1983 /a**  
(%)

	Zone I	Zone II	Zone III	Irrigated zone	Total
Gross area	31.4	43.0	8.9	16.7	100.0
Cultivated area	21.2	50.2	9.9	18.7	100.0
Agricultural population	18.2	45.2	9.8	26.8	100.0
Agricultural households	17.1	45.6	10.0	27.3	100.0

/a Zones are defined in terms of temperature and precipitation; most parts of Zone I have less than 350 mm of rainfall per year; most parts of Zone II receive between 350 and 500 mm of rainfall; and most parts of Zone III receive between 450 and 550 mm of rainfall.

Source: Annex A, Table 1.4.

2.03 Research and experimentation is still at a relatively early stage. Experience so far suggests that there are new farming practices and rehabilitation measures that can both reduce soil erosion and improve productivity. In many cases, however, the measures would involve substantial changes in the ratios of annual crops to fodder and fuelwood and a large reduction in the agricultural population in order to bring the population down to the carrying capacity of the land. For example, given the normal distribution of land deemed suitable for crops, fodder and fuelwood, a typical farm family in Zone I is likely to require a total area of 14 ha in order to meet basic food and other subsistence requirements, whereas at present there are only 8 ha of land per family in this zone. Similarly, a typical farm family in Zone II, which has greater agricultural potential, is likely to require about 7 ha compared with the existing situation of 4 ha. Even assuming the conversion of some currently barren land to forest and pasture, the number of agricultural households in Zones I and II would still need to be reduced by about 140,000 (equivalent to about 760,000 people) (see Table 2.3). If less land can be reclaimed for forest and pasture, the required population reduction would be even larger.

#### Rehabilitation Programs and Farming Systems

2.04 Although individual rehabilitation plans will need to be developed for each watershed, taking into account the land use capability and the population's needs and goals, there is likely to be a general thrust to the overall rehabilitation strategy. Crop production will be intensified on flat land in valley bottoms or on wide bench terraces built on the milder slopes, while the steep slopes and hilltops will be returned to the controlled production of tree crops and fodder. In general, land with slope above 25° will be planted to forest or productive ground cover. Further work is required to determine what types of trees and grasses are most suitable for different conditions and

how they should be established. Land sloping between 15° and 25° will be converted into wide (7m) bench terraces and used for annual cropping. In cases where bench terraces already exist but are forward sloping, they will need to be converted to a negative slope, using a simple animal-drawn plow. Land with less than a 15° slope will continue to be used for crop production without terracing. Additional flat land for annual cropping will be created by building soil dams to stop or retard the movement of erosion debris through existing gullies. In many areas, the rehabilitation measures will also include dry wells and storage ponds to catch runoff water which can be used for domestic and livestock purposes as well as for watering trees during their establishment period.

Table 2.3: CARRYING CAPACITIES IN THE DINGXI REGION BY ZONE

		Zone I	Zone II	Other zones	Total
Land availability <u>/a</u> ( '000 ha)	Current	1,279	1,973	1,166	4,418
	Potential	1,931	2,420	1,592	5,943
Carrying capacity <u>/b</u> ( '000 households)	Current	91	282	370/ <u>c</u>	743
	Potential	138	345	370/ <u>c</u>	853
Current number of households		170	452	370	992

/a Includes land under pasture and treecrops as well as cultivated land. It should be noted that there appears to be considerable underestimation of the existing area under agriculture; the difference between current and potential land availability may therefore be somewhat less than the official figures indicate.

/b Based on 14 ha per household in Zone I and 7 ha in Zone II.

/c Carrying capacity of households in other zones could increase if new irrigation schemes are developed.

Source: Annex A, Table 3.5.

2.05 Rational land use planning and erosion control should not be the only measures to raise agricultural productivity in Dingxi. More attention needs to be paid to improved cropping systems, including the rotation of wheat with other crops, and to developing more productive and hardier varieties. Water use efficiency also needs to be improved, and fertilizer strategies (adapted to rainfall conditions) need to be developed for each crop. In addition, livestock should be more fully integrated into the production system. Pasture and fodder are key elements in soil and water conservation and land rehabilitation and will also have the potential to feed ruminants, preferably sheep, and nonruminant traction animals.

2.06 The pace at which integrated livestock production systems can be introduced will be determined by the extent of the need for households to use

fodder for fuel. Relocation of some of the population will be critical in reducing rural energy demand in Dingxi, but it will not be enough. There is an urgent need to identify and introduce species of fuelwood that mature more quickly and have higher yields than the species now common in Dingxi. The proportion of fuel use accounted for by coal also needs to be increased by expanding local production and making coal available to rural households in exchange for land rehabilitation or other work. There is also potential for high economic returns to improvements in efficiency of household fuel use. Among the possibilities are the introduction of more efficient stoves, including solar cookers, and improvements in the traditional kang, a bed-like structure with fire underneath to create a heated sleeping or sitting area.

Economic Returns

2.07 The economic returns to loess hills rehabilitation will vary from area to area depending on the measures that are introduced and the land slope and other factors within each zone. Preliminary analysis of several rehabilitation measures appropriate to Zone II conditions suggests that overall returns are likely to be good (see Table 2.4).

Table 2.4: ESTIMATED ECONOMIC RETURNS TO SELECTED LOESS HILL REHABILITATION MEASURES (%) /a

	<u>Gentle slope</u>		<u>Steep slope</u>		<u>Soil dams</u>	
	<u>Crops</u>	<u>Trees</u>	<u>Fuelwood</u>	<u>Trees</u>	<u>Small</u>	<u>Large</u>
<u>Base Case /b</u>	27	26	40	19	13	13
<u>Alternative Assumptions</u>						
Economic cost of labor Y 1.0	17	24	20	18	7	10

/a Economic returns have been estimated using a methodology similar to that employed in project appraisal work by the World Bank and the Agricultural Bank of China.

/b For all measures except scrub fuelwood the "without project situation" assumes some cultivation. Scrub fuelwood is assumed to be on previously barren land; net benefits are negative if fuelwood is produced on previously cultivated hillsides.

Source: Annex A, Table 3.9.

2.08 The above figures take no account of the positive downstream effects of loess hills rehabilitation in terms of decreased siltation in the Yellow River watershed; nonetheless the figures show positive net benefits to all of the proposed rehabilitation measures. Terracing gently sloped land for crop and tree production has a high rate of return of about 26-27%. Terracing steeper slopes for tree crop production appears to be somewhat less remunerative. Production of scrub fuelwood on previously barren land, on the other

hand, has a very high rate of return and represents a major development opportunity, because overgrazing and the removal of sod over many years has resulted in large tracts of barren land in the Dingxi region. Because of their large investment costs and delayed benefits, soil dams are the least attractive of the rehabilitation measures examined. However, soil dams play a key role in soil conservation and so are associated with large but unquantified downstream benefits. Furthermore, the rate of return is higher for soil dams constructed in areas where little or no sloped land is lost to production.

2.09 Most of the proposed rehabilitation measures are labor-intensive, and thus the economic returns are very sensitive to assumptions about the economic cost of labor (see Table 2.4). At present, there is a substantial amount of surplus labor in rural areas of Dingxi. The economic cost of labor in these areas is estimated at Y 0.6 per work day (see Annex A, para. 3.52), much below the prevailing daily wage level of about Y 1-2. However, as the provincial economy continues to develop and more labor moves into nonagricultural activities, this differential between economic and financial prices is likely to narrow, with obvious consequences for the returns to the rehabilitation program. When downstream benefits are taken into consideration, the program is likely to remain economically justifiable, but additional incentives may need to be given to farmers to undertake and maintain the various land development measures (see para. 2.25).

#### Implementation Schedule

2.10 Development of a comprehensive action plan for the rehabilitation of the entire Dingxi region is an urgent but also enormous task. Survey work has been completed in almost 600 watersheds, and detailed proposals have been prepared for watersheds in two river basins. However, these river basins cover only 250,000 ha, whereas the potential area to be rehabilitated amounts to about 3 million ha in Zones I and II.<sup>12/</sup>

2.11 In developing an action plan for the Dingxi region, it will be important to bear in mind that much of the research was initiated only quite recently (the Dingxi Loess Plateau Comprehensive Control Experimental Station was established in 1982) and that much further research and experimentation will be necessary. On the other hand, the needs are urgent--the population is extremely poor and the natural resource base is being progressively eroded. During the next few years, it may well be appropriate to concentrate on a relatively limited program of rehabilitation in the two river basins for which detailed proposals have already been prepared. On the basis of the experience gained in these areas, it will then be necessary to develop and refine techniques and plan for a much larger rehabilitation program in the 1990s.

---

<sup>12/</sup> This figure of 3 million includes all of the potentially suitable land in Zone II but only a portion of the potentially suitable land in Zone I.

## B. Irrigation Development

### Development Program

2.12 Provincial planners expect that new irrigation development, in both Dingxi and Hexi, will play a critical role in labor absorption and agricultural growth, as it has done over the past thirty years (see Table 2.5). However, only two thirds of the 900,000 ha of already irrigated land receives a fully guaranteed supply of water, and there are many opportunities for improving water efficiency in existing schemes. It is also apparent that new irrigation projects have become more complex to prepare and implement. With the exception of a few small experimental areas of sprinkler irrigation, all irrigation projects in Gansu still employ gravity systems for distributing water within the service area. Most large projects also employ gravity diversion systems for conveying water from the source to the service area. But many of the small-scale irrigation schemes (those with command areas of less than 3,300 ha) and in recent years some of the larger schemes have been forced by difficult topographical conditions to employ high-lift pump systems. During the 1970s, for example, three large irrigation schemes were completed with lifts of 445, 511 and 534 meters and a total command area of 35,300 ha.

Table 2.5: IRRIGATION DEVELOPMENT IN GANSU, 1950-95  
(Million ha)

Year	Total cultivated area	Total irrigated area	Share of total (%)
1950	3.45	0.34	9.9
1960	3.76	0.50	13.3
1970	3.59	0.68	18.9
1980	3.55	0.86	24.3
1984	3.53	0.89	25.3
1995 Target	3.50	1.15	32.9

Source: Annex A, Table 4.1.

2.13 In planning irrigation development, therefore, the government needs to emphasize the rehabilitation or improvement of existing schemes as well as development of new, more complex and more costly gravity diversion and high-lift pump projects (see Table 2.6). The government will also need to look more carefully at the timing of development initiatives. In recent years there has been a tendency to launch a large number of projects without full assurance of financial resources. Such circumstances have resulted in unnecessary delay and extended construction schedules which have affected the benefits of the program.

Table 2.6: ONGOING AND PROPOSED IRRIGATION PROJECTS

	Name of scheme	Type of scheme	Area irrigated (ha)	Investment cost (Y per ha)
<u>Ongoing</u>	Jingtai Phase II	High lift (460 m)	32,800	9,700
	Yindaruqin	Gravity diversion	57,300	9,800
<u>Proposed</u>	Linding	High lift (460 m)	22,000	n.a.
	Yinli	Gravity diversion	50,000	n.a.
	Changma	Gravity diversion	43,000	n.a.

Source: Annex A, paras. 4.07-4.12; Appendix D, Table 3.

### Farming Systems

2.14 The very long period of low temperatures in Gansu seriously constrains the development of intensive farming systems in irrigated areas, but there are opportunities for improving existing systems and thereby improving the returns to irrigation. At present, farming practices vary little. There is little or no double cropping and everywhere wheat occupies 70-80% of the irrigated cropping area. Oil seed crops (principally linseed) and summer cereals (mainly millet) occupy 5-10% of the area and the remaining 10% is made up of a variety of crops--sugarbeets and melons in Hexi, and potatoes, broad beans, medicinal crops, melons, vegetables, some fruit trees and roses for oil in Dingxi.

2.15 In considering the prospects for more intensive farming systems, greater attention should be paid to developing systems that take advantage of the characteristics of different areas. For example, double cropping is possible in some parts of the province and, indeed, is already being introduced. Thus, in some of the irrigated areas in Dingxi, farmers are now growing a vegetable crop immediately following wheat--potatoes at lower elevations (1,600 m) and cabbage or garlic at higher elevations. Above 2,000 m no follow-on crop appears feasible because of the shortness of the growing season. In some of the irrigated areas in Hexi, a short-season summer fodder crop is being planted immediately after the wheat is harvested. In some areas it may also be possible to introduce crops that would precede summer cereals.

2.16 Although wheat is likely to remain the dominant crop in irrigated areas, more research is needed on production and market prospects for other field crops and how these crops might be incorporated into farming systems in different areas. For example, there appears to be considerable potential for developing the livestock industry by expanding the area of forage crops, including beets for animals. Such an expansion in animal feed production would help to enhance the efficiency of animal traction, permit an expansion in pig, poultry, sheep and goat production, and reduce grazing pressures in rainfed areas. Market study and technology research on alternatives to field

crops is also needed. Alternative crops such as melons, medicinal crops, roses for oil and strawberries have already demonstrated high net benefits but are constrained by market demand. Others, including vegetables and other fruits (apples, pears, peaches), may be of more widespread significance. In addition, the role of forestry in irrigated farming systems should not be ignored. The planting of poplars on irrigation ditches is already an established practice in many areas of Gansu and demand for wood products is likely to remain strong.

Economic Returns

2.17 In order to accurately assess the economic returns to irrigation projects, the designs and costs of each irrigation system will need to be analyzed along with the costs and benefits of alternative farming systems. The importance of this analysis and its potential significance for the size and composition of the investment program in Gansu are evident from the estimated returns to the Yindaruqin and Jingtai Phase II projects under alternative assumptions (see Table 2.7). Because of data and other limitations, the results should be seen as no more than illustrative of some of the key factors and issues that will help determine the economic costs and benefits and hence the overall viability of different types of projects.

Table 2.7: ESTIMATED ECONOMIC RETURNS TO YINDARUQIN AND JINGTAI PHASE II UNDER ALTERNATIVE ASSUMPTIONS (%)

	Yindaruqin	Jingtai
<u>Base Case</u>	12.2	12.8
<u>Alternative Cost Assumptions</u>		
Economic cost of labor		
Y 1.2 per workday	11.4	11.0
Economic cost of energy		
Y 0.04 per kWh	-	14.5
Y 0.06 per kWh	-	11.1
Inclusion of sunk costs	11.5	9.4

Source: Annex A, Table 4.5.

2.18 On the costs side it is apparent that the returns to both Yindaruqin and Jingtai are sensitive to the economic cost of labor, which in the base case is assumed to be Y 0.6 per workday (see para. 2.09). Returns to Jingtai, which requires lift pumping, are even more sensitive to assumptions about the economic cost of power. The current financial price of electricity in Jingtai Phase I is 1 fen/kWh, but average annual long-run marginal costs of electric power are estimated to be a minimum of 5 fen/kWh (see para. 3.11).

2.19 Economic returns will also be significantly affected by whether projects are new or ongoing. The estimated returns to both Yindaruqin and Jingtai are also higher because they are ongoing projects and sunk costs are not taken into account.<sup>13/</sup> Costs incurred in the past cannot generally be retrieved; they are therefore not opportunity costs and are excluded from the analysis. However, in evaluating past investment decisions and as a guide to decisions about new projects of a similar type, such costs should be taken into account and the estimated rates of return reduced accordingly.

2.20 On the benefits side also, estimated returns to Yindaruqin and Jingtai vary according to assumptions about farming systems, yields and prices. There is a need for much more analysis of the effects of such alternatives. In the base case, farming activities are constrained to include wheat, tree crops, millet and linseed (72, 10, 9 and 9%, respectively, of the irrigated area), and expected yields at full development are assumed to reach 4.5 tons/ha for wheat and millet and 2.25 tons/ha for linseed. Alternative crops and/or the inclusion of livestock production could increase the returns to both projects. However, in neither case are returns likely to rise much above 13%, whereas the opportunity cost of capital in China probably lies somewhere between 10 and 15%.

2.21 To the extent that more detailed analysis confirms the above analysis of irrigation costs and benefits in Gansu, a number of important conclusions can be drawn. First, it is probably in the province's economic interest to complete ongoing projects such as Yindaruqin and Jingtai Phase II, but construction should be expedited and completed before any work on new projects is begun. Second, investments in new lift irrigation projects such as Linding, where there are no appreciable sunk costs and where the lifts required are at least as great as Jingtai Phase II, are unlikely to be economic. Third, considerably more attention needs to be paid to increasing the benefits of existing, ongoing and proposed projects by optimizing agricultural production on irrigated land.

### C. Resettlement

2.22 Provincial planners regard new irrigation development in Gansu as critical to the generation of employment opportunities and hence to the alleviation of the population pressure on Dingxi's fragile resource base. Tentative plans have already been drawn up for the resettlement of about 600,000 people or 125,000 households, which is a little less than the difference between the existing population and the potential carrying capacity of the land (see Table 2.3). Almost all of the proposed resettlement is directly connected with irrigation development. An estimated 400,000 people are expected to resettle in newly developed irrigation schemes in Dingxi itself. The other 200,000 are expected to resettle in Hexi where irrigation development is

---

<sup>13/</sup> This is very significant for Jingtai Phase II but less so for Yindaruqin, because, although the project is ongoing, few resources have so far been committed.

more advanced and there are a variety of other opportunities. About 52,000 settlers have already relocated; an additional 28,000 are expected to be relocated by the end of 1986. In the event that the future irrigation development program progresses more slowly than expected or is reduced in scope, both the schedule and the absolute level of labor absorption in irrigation schemes would be affected. The appropriate schedule and absolute level of labor absorption also need to take account of both the incremental population growth that can be expected between now and the year 2000 and the potential for employment growth in nonagricultural activities (see Chapter 3).

2.23 Whatever the results of such analysis, some formal resettlement programs for irrigated areas are likely to be required. These programs will need to be carefully and adequately designed. The schedule of resettlement will need to be well-coordinated with the implementation of land rehabilitation measures in Dingxi and with the development of irrigated cropland in Dingxi and Hexi. In addition, greater emphasis will need to be placed on training settlers in irrigated farming techniques, because loess hills farmers have had no previous experience with irrigated farming.

#### D. Agricultural Management

2.24 As a result of the introduction of the production responsibility system and the abolition of compulsory state procurement of agricultural products, individual farmers will play a critical role in the implementation of agricultural development programs in Dingxi and Hexi. In addition, however, the government will have a key role to play in providing appropriate price and other incentives to farmers and developing the necessary supporting infrastructure and services.

2.25 In the case of the loess hills rehabilitation program, for example, different levels and agencies of the government will need to collaborate effectively on the design of programs for different watersheds. This will involve preparing land use plans (based on soil, slope and topographic mapping plus current data on land use, population, livestock numbers and so on), assessing the population's needs, setting goals and translating land use plans into detailed action programs. Individual farmers will be responsible for the implementation of most of the land development measures. The government will be responsible for providing technical assistance and necessary services and for ensuring that there are incentives for farmers to undertake the land development measures. In fact, the government has already decided that individual farmers will be provided with provisional land use rights for as much of the steep hillsides as they believe they can revegetate. They will also be allotted lower land of milder slope suitable for annual cropping and will be required to comply with restrictions on the grazing of their animals, mainly sheep. The government will pay minimal grants to assist farmers in land development (see para. 2.30). But the more important incentive will be that upon satisfactory completion of the terracing work, supervised by local technical staff, farmers will receive a certificate of tenure which can be

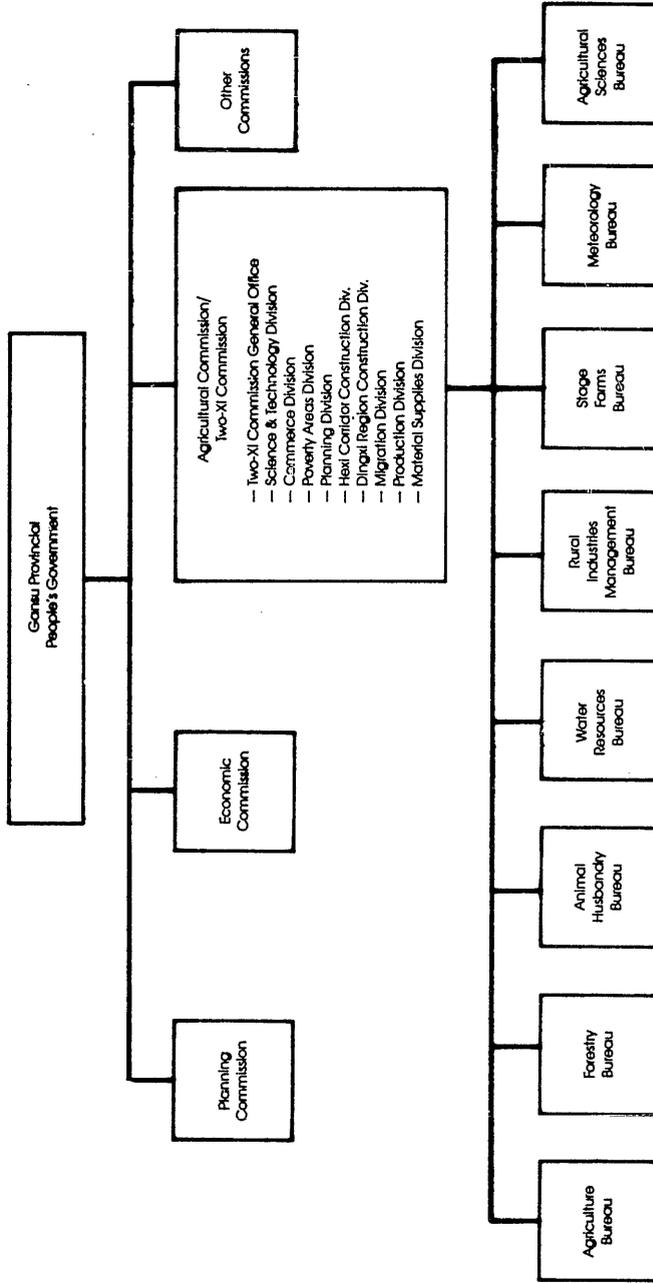
inherited by their children and grandchildren. Early experience with these arrangements suggests that they do provide farmers with adequate incentives.

2.26 Through the water resources burcaus at different levels, the provincial government will also retain a major role in irrigation development and management, although some changes are underway, stimulated in part by the introduction of the production responsibility system. The Design Institute of the Provincial Water Resources Bureau will remain responsible for preparing feasibility studies of new irrigation projects, but outside consultants may be used to review the feasibility studies. Construction of new irrigation systems will also be under the supervision of the water resources bureaus at different levels, but much of the work itself will be contracted out to construction companies, from both inside and outside the province. Operation and maintenance of schemes will generally be the responsibility of prefectural and county bureaus, again with technical guidance from the provincial bureau. Local townships will be responsible for quaternary canals and field channels. At present, the quality of system maintenance leaves something to be desired, due partly to shortages of funds but also to the lack of clear institutional responsibilities following the introduction of the production responsibility system. It also appears that much more attention needs to be paid to helping farmers optimize agricultural production on newly irrigated land. This will involve increasing the number and quality of agricultural personnel at the system level. There will also need to be efforts to enhance adaptive research, improve seed production and distribution, develop and test alternative production practices, and communicate researchers' findings to farmers. As a result of rural reforms, farmers are now able to diversify out of wheat when market and technical conditions are favorable, but they are not yet receiving appropriate advice as to how best to do this.

2.27 As already noted, resettlement of people out of rainfed areas in Dingxi will be a critical element in the loess hills rehabilitation program. Resettlement can take place in several different ways with varying implications for the role of the government. The government's role will be greatest in the settlement of newly irrigated areas and will involve both planning and implementation activities. The absorptive capacity of individual irrigation tracts will need to be assessed and migrants selected on the basis of appropriate criteria. Migrants will have to be organized to work with the local population in such tasks as land leveling and construction of on-farm irrigation works. In addition, county and township officials will need to assist migrants by providing housing as well as establishing schools, health facilities and other services.

2.28 In an effort to better coordinate these various development programs for Dingxi and Hexi, the government established in 1980 a "Two-Xis" Commission (see Figure 2.1). The commission includes a number of specialized divisions for planning, construction, resettlement, and so on and is represented at the provincial, prefectural, and county levels. Since its inception, the commission has assumed a great deal of responsibility in coordinating and supervising the work of different bureaus concerned with rural development and in integrating their activities into a strategy for rural development in Dingxi and Hexi. But the division of responsibilities between the commission and the technical bureaus still needs to be clarified. The commission also appears to

Organizational Structure of the Gansu Provincial People's Government and the Agricultural and Two-Xi's Commissions



Source: Two-Xi's Commission

require further strengthening, especially in economic evaluation and project planning.

E. Investment Costs and Financing Arrangements

2.29 During the remainder of the 1980s and 1990s, a fundamental shift in the structure of agricultural investment is likely to occur, but the extent of the shift will depend in part on the balance between different elements of the program for development of Hexi and Dingxi. Irrigation currently accounts for over half of total agricultural investment and will probably still account for close to half of the total program in 1990. During the 1990s, however, both the level and share of irrigation investment are likely to decrease and will do so very rapidly if stricter economic criteria are used to assess the program and if projects such as Linding are ruled out (see para. 2.21 and Scenario B in Table 2.8). On the other hand, investment in loess hills rehabilitation is expected to increase greatly during the 1990s and under Scenario B could account for about one third of total provincial investment in agriculture by the year 2000. Such a scenario would only be feasible, however, if there is a very rapid development of rural nonagricultural activities and, hence, a significant reduction in the agricultural population.

Table 2.8: PROJECTED AGRICULTURE INVESTMENT UNDER ALTERNATIVE SCENARIOS, 1984-2000  
(Y million at constant prices)

	1984	2000	
		Scenario A	Scenario B
<u>Fixed Investment</u>			
Loess hills rehabilitation	5	88	146
Irrigation development	140	180	51
Formal resettlement	5	5	2
Other investment	100	161	161
Subtotal	<u>250</u>	<u>434</u>	<u>360</u>
Working capital total	25	43	36
<u>Total Investment</u>	<u>275</u>	<u>477</u>	<u>396</u>

Source: Appendix D, Tables 11-13.

2.30 Financing arrangements for the different types of agricultural investment are likely to vary. Most of the land rehabilitation work can and will be undertaken by farmers themselves and will be financed mainly by own-labor contributions. The government does, however, make grants to farmers to assist them in land improvement; these grants provide an important financial incentive and are likely to continue. The grants range from Y 5 to 20 per mu, depending on the nature of the work to be undertaken, and are equivalent to

about one third of the daily wage rate of Y 1. The share of budget financing in irrigation is likely to remain much higher than the share for land rehabilitation. Farmer contributions to on-farm development in irrigation are roughly 75%, but farmer contributions to irrigation investment as a whole are usually no more than about 25%.

2.31 Because the share of investment financed through the budget will be much lower for loess hill rehabilitation than for irrigation development, budgetary expenditures on agricultural investment can be expected to increase much more slowly than total agricultural investment and could even decline with a sufficient reduction in the irrigation program relative to its present level (see Table 2.9). On the other hand, meeting the urgent need for strengthening of lower-level agricultural personnel to assist in land rehabilitation and in optimizing production on rainfed and irrigated land may well require a rapid expansion in recurrent budgetary expenditures on agriculture.

Table 2.9: PROJECTED PUBLIC EXPENDITURES ON AGRICULTURE  
 UNDER ALTERNATIVE SCENARIOS, 1984-2000  
 (Y million at constant prices)

	1984	2000	
		Scenario A	Scenario B
Loess hills rehabilitation	2	18	29
Irrigation development	105	135	38
Formal resettlement	5	5	2
Other investment	60	96	96
<u>Total Investment</u>	<u>172</u>	<u>255</u>	<u>165</u>
Total recurrent <u>/a</u>	144	264	264
<u>Total Expenditures</u>	<u>316</u>	<u>519</u>	<u>429</u>

/a Assumed to grow at the same rate as agricultural output; i.e., 3.9% p.a.

Source: Appendix D, Tables 3 and 7.

### III. INDUSTRIAL POTENTIAL

#### A. Rural Industries and Services

##### Gansu in National and International Perspective

3.01 Throughout China there is now much emphasis on rural nonagricultural activities as a major source of future employment and income growth. Both of the development strategies outlined in Chapter I of this report assume rapid growth in rural nonagricultural employment and an increasing share of nonagricultural employment in total rural employment. The projected growth rates and shares of rural nonagricultural employment are in line with the experience of other parts of China and other countries, taking into account that Gansu is moving from a very low base (see Table 3.1). But the projected trends are by no means a certainty, and provincial planners need to look carefully at the policy and institutional environment that would facilitate development of productive nonagricultural jobs in Gansu.

Table 3.1: EMPLOYMENT IN RURAL NONAGRICULTURAL ACTIVITIES  
IN SELECTED ECONOMIES

Economy	Share of total rural employment /a	
	Period	% share
Gansu	1982	5
Jiangsu	1982	25
China	1982	12
India	1966	24
Republic of Korea	1970	25
Malaysia (western)	1970	37
Philippines	1970	40

/a In the case of China may include township centers which have not been reclassified as urban areas.

Source: Annex B, Table 2.2.

3.02 Over the past ten years, rural nonagricultural activities have developed much more rapidly in the more advanced coastal provinces of China than in interior provinces such as Gansu. In Jiangsu, for example, employment in township and village enterprises (which account for about three quarters of rural nonagricultural employment) increased by 9% p.a. during 1979-82 and output grew by 22% p.a. In Gansu, township and village enterprise employment actually declined by 3% during this period and output increased by only 1-2% p.a. Only in 1983 did growth rates of employment and output accelerate

(mostly due to a sharp increase in construction activities) and only in 1984 and 1985 did growth in Gansu reach the high levels that have prevailed in coastal provinces during the past five to ten years. This uneven performance may be explained in part by different rates of implementation of rural reforms, but it also seems clear that coastal provinces like Jiangsu were in a much better position to respond favorably to the new policy environment. Because of their physical proximity to major cities and markets, coastal provinces had fewer transport and marketing constraints, and their relatively high level of agricultural development and incomes provided greater opportunity for agricultural processing and greater local demand for manufactured goods and services.

3.03 International experience suggests strongly that the extent of rural involvement in nonagricultural activities is determined by a combination of "push" and "pull" factors.<sup>14/</sup> The most important push factor is the limited capacity of agriculture to absorb labor with a given amount of land. The pull factors are related to the availability of attractive nonagricultural job opportunities. Agricultural growth and rising farm incomes themselves create a favorable demand environment for the development of rural nonagricultural activities because of the forward and backward linkages between agriculture and nonagriculture, on the one hand, and because rising farm household incomes are likely to generate considerable demand for nonagricultural goods and services in rural areas, on the other hand. But other factors such as the presence of mineral resources, proximity to urban areas, the availability of labor and/or land at relatively low cost, the state of road and other infrastructure development, and levels of education can also be important in explaining rural involvement in nonagricultural activities.

#### Composition of Rural Industries and Services

3.04 Rural nonagricultural development depends in part on the ability of rural areas to attract manufacturing industries. Two of the most important factors influencing the location of manufacturing industries are transport costs and technology. Weight-reducing, resource-based production processes (for example, agricultural processing and metallurgy) are usually dispersed throughout the economy and clustered around the resource bases. Industries that produce bulky or heavy products that are costly to transport are also distributed in a decentralized manner. But, because of scale economies, not all of these industries are necessarily suitable for small- and medium-sized enterprises. On the other hand, manufacturing industries that produce standardized products using relatively simple technology are generally "footloose" and tend to gravitate toward rural locations where land and labor may be cheaper.

3.05 Although the level of agricultural development and the degree of commercialization are much lower in Gansu than in coastal provinces, there has been a considerable expansion in agricultural processing industries in recent

---

<sup>14/</sup> See The Asian Experience in Rural Nonagricultural Development and Its Relevance for China, World Bank Staff Working Paper No. 757.

years, which is expected to continue. The growth of marketable surpluses of wheat in certain parts of the province, particularly Hexi, will stimulate the development of flour milling. A rapid expansion in rapeseed, linseed and other vegetable oil processing for human consumption and uses such as paints and varnishes can also be expected. There also appears to be considerable potential for the expansion of fruit and vegetable processing in Gansu, not only for the provincial market but also for shipment to other provinces, particularly in the case of the temperate fruits for which Gansu is famous, and for export in the case of dehydrated vegetable ingredients. In the case of oil processing and fruit and vegetable processing, however, economies of scale and market organization are likely to become more important and thus need to be taken into consideration. The potential for rapid expansion in animal feed production also appears to be large, based on the expected expansion of livestock production. Moreover, unlike many other activities, feed milling (including cereal grinding and feed mixing) are economically viable on a small scale. A rational livestock feed industry in Gansu is therefore likely to include centralized producers of specialized ingredients, an efficient trade and handling network for the by-products of larger related industries, and a large number of grinding and mixing operations typically located in areas of livestock population.

3.06 Rural industrial development in Gansu will depend not only on growth of agroprocessing industries, which account for only a small proportion of the rural industrial sector, but also on prospects for other types of rural industry. The rural energy sector can be expected to grow rapidly. Although Gansu is well-endowed with coal resources, rural energy demand outstrips current supplies, and a rapid expansion in small-scale coal mining will be critical in future agricultural as well as industrial growth (see para. 2.06). Industries that produce bulky or heavy products, such as building materials, currently dominate the rural industry sector in Gansu (see Table 3.2) and appear to have good potential for future growth. In addition, much more attention needs to be paid to footloose industries in, for example, machinery parts and textiles, which are still very underdeveloped in Gansu.

3.07 The construction sector accounts for a very large share of rural nonagricultural employment in Gansu (see Table 3.3). However, this is due not to a large rural construction sector but rather to the underdevelopment of manufacturing and services. In other countries, services generally account for one third to three quarters of rural nonagricultural employment. Following recent rural reforms in China which permit rural residents to engage in transport and sale of goods between towns and the countryside and across county and provincial lines, rural services also have the potential to be a rapidly growing source of employment opportunities in Gansu. Indeed, development of rural industries and services are likely to be tightly linked.

**Table 3.2: COMPOSITION OF INDUSTRIAL TOWNSHIP AND VILLAGE ENTERPRISE EMPLOYMENT AND OUTPUT**  
(% of total)

	<u>Gansu, 1984</u>		<u>Jiangsu, 1982</u>	<u>China, 1982</u>
	Employment	Output	Output	Output
Metallurgy	3	4	3	2
Power	1	1	-	1
Coal	13	12	-	5
Petroleum	-	-	-	-
Chemicals	6	12	10	8
Machinery	11	14	27	25
Building materials	47	44	19	21
Wood products	2	2	1	3
Food	6	6	3	8
Textiles, leather	3	3	26	17
Paper	1	2	3	4
Other	7	-	8	6
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

Source: Annex B, Table 2.5; Gansu Township and Village Enterprise Bureau.

**Table 3.3: COMPOSITION OF RURAL NONAGRICULTURAL EMPLOYMENT**

	<u>Township and village enterprise employment, 1983</u>			<u>Total rural nonagricultural employment</u>	
	Gansu	Jiangsu	China	China 1982	Asian developing countries 1970
Agriculture	7	2	10	-	-
Industry	45	80	67	45	15-39
Transport	4	3	3	5	5-10
Construction	41	13	15	9	4-14
Other	3	2	5	41	37-76
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
% of rural labor force	3	19	9	12	20-40

Source: Annex B.

## B. Urban Industry

3.08 Gansu's development efforts continue to emphasize the importance of the province's mineral resource base and, consequently, the importance of heavy industry development. Capital-intensive heavy industry plants still account for 90% of the capital invested in large-scale or "urban" industry and three quarters of gross industrial output and employment. Gansu's petroleum, mineral, hydro and other resources are not, however, the province's only advantage over the rest of China, nor always the most important. The province does have a large rural labor force whose opportunity cost is low because of difficult agroclimatic conditions and because large scale outmigration is still quite restricted. Offsetting these advantages are some natural disadvantages such as Gansu's remote location, involving high transport costs and lack of direct access to major urban markets in China and abroad. All of these advantages and disadvantages need to be taken into account in assessing the future growth and composition of urban industry in Gansu.

### Heavy Industry

3.09 Over the past 20 years, Gansu has built up a very large heavy industry sector based on exploitation of petroleum, mineral and hydro resources, and further development of this sector will and should be a major feature of industrial growth. The Yumen oilfield located in the Jiuquan area was the largest producer of crude oil in the country until the 1960s and provided the basis for development of a large refinery and petrochemical and petroleum equipment manufacturing plants in the province. The availability of iron ore and coal in the province has led to the construction of a ferrous metal industry which produces pig iron, steel, steel alloys and ferro-silicon. Similarly, rich and abundant copper, nickel, lead and zinc deposits have been the basis for a substantial nonferrous metal industry. More recently, the availability of large amounts of hydroelectric power has led to electricity-intensive activities such as aluminum smelting.

3.10 It is essential, however, that the importance of the mineral resources and heavy industry not be overemphasized and that the overall performance of the heavy industry sector be improved by more rigorous economic analysis of project proposals and plans. Engineering feasibility is critical but should not be the only consideration. Economic factors such as optimal size and location, appropriate processes and marketing arrangements are equally important.

3.11 More rigorous economic analysis should involve careful assessment of the economic costs as well as benefits of exploiting Gansu's mineral and other resources. The importance of economic analysis for urban industry planning in Gansu can be illustrated by a review of the costs of electric power generation in the province. It is widely believed in Gansu (and elsewhere in China) that the cost of hydroelectric power generation in Gansu is as low as 1-2 fen/kWh and hence that the province should move ahead quickly with the development of electricity-intensive heavy industry projects such as aluminum smelters. However, an economic analysis of one of the best available hydropower sites in Gansu (Daxia), using standard World Bank methods of project appraisal, shows that the economic cost of hydroelectric power generation is considerably

higher, in the range of 5-7 fen/kWh.<sup>15/</sup> There is very little difference between this cost and the cost of thermal power generation in a coastal location, which is around 7-8 fen/kWh using the same methods of calculation. Thus, electric power generation in Gansu appears to be only 1-2 fen/kWh (13-30%) cheaper than elsewhere in China. This small cost advantage should be verified through further project analysis before decisions are made on the feasibility of energy-intensive projects such as an aluminum smelter or a high-lift irrigation scheme (see paras. 2.18-2.21).

3.12 In considering the future development of heavy industry in Gansu, there should be greater consideration of the low economic cost of labor in the province (see para. 2.09). This will involve looking much more closely at production techniques for different types of industrial activity. For example, the nonferrous metals industry is oriented almost exclusively towards large-scale, capital-intensive operations, in part because of price distortions which make raw material processing (such as smelting) very profitable but keep mining unprofitable; it is possible that on careful economic assessment of alternatives, small-scale nonferrous metal mining might be more attractive than large-scale mining on account of significantly lower investment requirements and higher employment generation. In addition, a more careful review is needed of the potential for increasing the indirect employment effects of heavy industry development through greater forward linkages to other industries and enterprises in the province. In the past, forming these linkages has been difficult because of the dominance of centrally owned enterprises which purchased inputs and sold outputs through central allocation channels and thus had no incentive to develop subcontracting arrangements or cross-linkages with other enterprises in the province. However, this is likely to change gradually as a result of reforms in state industry and commerce.

#### Light Industry

3.13 More recognition of the low economic cost of labor in Gansu could also lead to the rapid development of light industries, which hitherto have been somewhat neglected in the province. The gross output value of light industry in Gansu is less than a quarter of total industrial output, compared with a national average of about one half. The existing light industrial enterprises are relatively small in scope and size, are largely based on agricultural inputs with minimal utilization of intermediate manufactured inputs, and are using rather outdated technologies to produce goods, often of poor quality. There are very few interlinkages between the heavy and light industry subsectors in Gansu. Very few basic metals and petrochemicals produced in the province are being used by light industry enterprises which in turn supply only very few inputs to heavy industry.

3.14 The food industry in Gansu presently consists of processed grains, processed fruits and vegetables, and beverages. Production is principally for

---

<sup>15/</sup> See Annex B, Appendix 3 for a detailed discussion of hydroelectricity costs.

local consumption and is undertaken in small units. Rising per capita incomes will generate demands for an increased level and quality of production, suggesting that there should be considerable potential for development of economically sized facilities in appropriate locations. Prospects are especially good for modernizing and expanding commercial canning, bottling and preservation of fruits and vegetables for the growing urban population in Gansu and in other provinces. But there is a need to improve quality and hygiene. The livestock sector, particularly meat and leather industries, also has considerable potential not only to meet the needs of the province but also for export. Developing the livestock sector will require attention to improved livestock husbandry practices and modern agroprocessing facilities, including slaughterhouses, rendering facilities, cold storage and leather processing plants.

3.15 The textile industry in Gansu is limited mainly to woolen mills, which process the wool produced in the province. Much of the growth in wool processing has taken place in a piecemeal manner with little regard for economies of scale and specialization of operations and, with the phasing out of the material allocation system, competition with producers of better quality textiles in other provinces is growing. Efforts are thus required to upgrade quality and improve efficiency. There is no reason why Gansu could not also be a leading producer of synthetic fibers, although much more attention needs to be paid to improving the quality of local synthetic fiber production, possibly through technical assistance from experienced fiber producers in more established textile centers. In addition, Gansu should at least investigate the possibilities for further development of cotton textiles and garments. The province is unlikely ever to be a major cotton producer, but it does have the important advantage of low economic costs of labor. The recent change from plan to market allocation of cotton and other agricultural raw materials opens up the possibility for Gansu to obtain cotton from elsewhere in China.

3.16 Production of consumer durables and all kinds of machinery and hardware parts are also potentially important light industries. Examples are manufacture of cast-iron products, hardware for the construction and household sectors, tools and forged products, electrical fittings and appliances, industrial hardware of brass, bronze and aluminum, and downstream processing of plastics, synthetic rubber and fine chemicals. Traditionally, these are classified as heavy industry in Gansu, but they share many of the characteristics of light industry manufacturing, including labor intensity (and low capital requirements). For many of these industries, a reasonably skilled labor force at moderate wages is the most important ingredient for success.

### C. Industrial Organization and Management

#### Ownership and Control

3.17 Reforms of industrial organization and management have not proceeded as far or as fast as agricultural reforms. But peasants are now permitted, either individually or jointly, to engage in industrial, handicraft, commercial, food and beverage, service, repair, transport and house renovation enterprises and to transport and sell goods between towns and the countryside and across county and provincial lines. Township and village enterprises and

small urban collectives also have independence, with full responsibility for profits and losses as well as for paying taxes. In recent years, such enterprises and collectives have been the most rapidly growing segment of industry in Gansu, yet they accounted for less than 5% of gross output in 1983 compared with 24% in Jiangsu (see Table 3.4). Large collectives are administered by provincial, prefectural (municipal) or county (district) industrial bureaus depending on size and sectoral characteristics. The industrial bureaus are also in charge of state enterprises. In practice there is very little difference between larger collectives and state enterprises. State enterprises are also "owned" and administered by different levels of government (center, province, prefecture, and county) and can be transferred from one level to another. In 1984, for example, 94 state enterprises in Gansu (all heavy industry), accounting for 48% of total gross industrial output, were owned by the central government, compared with 84 central state enterprises accounting for 23% of GVIO in 1982. At one time "ownership" in the state sector was defined by the claim on remitted profits: a centrally owned enterprise remitted its profits directly to the central budget, a provincial state enterprise to the provincial budget, and so on. Ownership is now defined by the level to which income and adjustment taxes are remitted (see para. 5.08).

3.18 Ownership thus defined does not, however, necessarily translate into control. In some cases, enterprises may belong to one level of government but are in fact controlled by another level of government. Until 1984, for example, the (central) textile ministry maintained unified allocation of cotton for the whole country and, as a result, was much more in control of provincial or local textile enterprises than the local governments and bureaus to which these enterprises officially reported. It is also apparent that the replacement of unified allocation by market allocation for more and more materials, the increasing importance of "above-quota" production, supplies, sales and prices, the shift to bank finance of investments, and other aspects of economic reform are gradually reducing the bureaus' direct control of most state and large collective enterprises. There is still, however, an important indirect role for the government and for industrial bureaus in developing appropriate incentives and providing the necessary technical assistance and support services for all types of industrial enterprises.

Table 3.4: GROSS INDUSTRIAL OUTPUT BY OWNERSHIP, 1979-83

	Real growth, 1979-83 (% p.a.)			Share in GVIO, 1983 (%)		
	Gansu	Jiangsu	China	Gansu	Jiangsu	China
State enterprises	1.4	8.7	6.1	93	55	74
Large urban collectives	4.4	12.0	10.8	4	19	14
Township and village enterprises	3.8	21.9	16.0	3	24	11
Other	-	74.8	44.9	-	2	1
<u>Total</u>	<u>1.6</u>	<u>12.4</u>	<u>7.9</u>	<u>100</u>	<u>100</u>	<u>100</u>

Source: Appendix B, page 10.

## Prices and Wages

3.19 In order to ensure that enterprises will make efficient investment and production decisions as they become more independent and profit-oriented, it is essential that enterprises are faced with rational prices for their inputs and outputs. As long as energy prices are low, enterprises will be encouraged to invest in overly energy-intensive activities, and as long as price distortions make mining unprofitable relative to smelting, small- and medium-scale mining will be discouraged. These issues are recognized by the central government and efforts are underway to give market supply and demand forces a greater role. It may not, however, be as widely recognized that restrictions on labor mobility and the maintenance of present wage practices are also potentially serious obstacles to efficient investment and production decisionmaking and could seriously limit the pace and pattern of industrial development in poorer provinces such as Gansu.

3.20 The difficult agroclimatic conditions, low agricultural productivity, and restrictions on large-scale outmigration cause the opportunity cost of unskilled labor in Gansu to be much lower than in most other parts of China. At present, however, this is not reflected in the actual wages paid to industrial workers in the province. Quite the contrary, wages in Gansu are 10-20% above those prevailing in the more advanced coastal provinces (see Table 3.5).<sup>16/</sup> Moreover, this is true not only for workers in state enterprises who are paid wages according to a unified nationwide scale, but also for workers in urban collectives and rural township and village enterprises (see Table 3.6). If maintained, such wage practices are likely to limit industrial development to those activities where the province has a distinct natural resource advantage (such as nonferrous metal mining and processing) or is protected by transport costs or other barriers to competition from more efficient producers elsewhere. Continuing current wage practices will hamper development of the many footloose industries and will reduce industrial production and employment growth. Those lucky enough to find employment in the modern sector will be well off, but a higher proportion of the labor force will have to remain in agricultural employment, subsisting at a fraction of urban incomes.

---

<sup>16/</sup> This appears to result from differences in the composition of the urban labor force; there may also be some special incentives provided to urban workers in remote provinces such as Gansu.

Table 3.5: URBAN WAGES AND RURAL INCOMES, 1978-84  
(Yuan)

	Gansu			China		
	1978	1981	1984	1978	1981	1984
Urban wages (Y/year)						
All sectors	..	945	1,200	614	779	974
Industry	760	985	1,358	..	800	988
Rural income per worker (Y/year)	..	317	442	267	620	711
Urban wage as % rural income per worker						
All sectors	..	298	271	230	130	137
Industry	..	311	307	..	134	139

Source: Annex B, Table 1.8.

Table 3.6: WAGES BY TYPE OF ENTERPRISE, 1983

	Gansu	Jiangsu	China	Gansu	Jiangsu	China
	-----	(Y/year)	-----	-(% of state enterprise)-		
State enterprises	973	768	865	100	100	100
Urban collectives	702	643	698	72	84	81
Rural collectives	641	525	544	66	68	63

Source: Annex B, Table 1.9.

3.21 If significant numbers of industrial jobs are to be efficiently created in Gansu, wages for unskilled labor will need to be lower in Gansu than in more advanced areas of China. This should pose the least problem for collective enterprises in rural areas, which are free to set wages as they see fit. However, as long as state enterprises pay far higher wages, there may be a tendency to keep the wage gap between state and collective enterprises within "acceptable" limits by paying wages that are well above the going wage for other types of rural activity such as construction (which currently pays only about Y 1 per day). More importantly, many footloose industries require scales of operation that are beyond the present financial resources of townships and village enterprises but can only be competitive with others in more advanced areas if they have a labor cost advantage. Thus, the central and

provincial governments will need to find ways of slowing the growth of wages in state and large urban collective enterprises and modifying the current practice of uniform national wages. There are many ways in which such modifications could be made. One possibility would be to allow the general level of wages of unskilled labor to increase more slowly in Gansu than elsewhere. Another possibility would be to offer lower wages to new entrants into the labor force.

3.22 It may be to Gansu's economic advantage to allow some further increase in wage differentials between skilled and unskilled jobs. Experienced and technically trained personnel are in short supply in Gansu and often have greater mobility between jobs in different enterprises within the province and even outside the province. Higher wage differentials would also make it easier for Gansu to attract experienced technical personnel from outside the province. Already, collective enterprises have more flexibility than state enterprises and are paying relatively high wages to skilled workers brought in from other parts of China. State enterprises need more of this kind of flexibility.

#### Technology Transfer and Development

3.23 Learning managerial and technical skills from enterprises in more advanced provinces such as Jiangsu will be vital to Gansu's future industrial development. Township and village enterprises have already begun to hire retired workers and technical specialists from more advanced areas to help them improve existing production processes and quality and introduce new products and processes. But these arrangements, which range from advisory visits of a few weeks to managing enterprises for one or more years, need to be encouraged and expanded, particularly in state and large collective enterprises. Another means of technology transfer that could be used more extensively is to arrange for skilled workers, technicians and middle-level managers from Gansu to visit or work for a period in more advanced enterprises in the coastal provinces. In many cases, it will be desirable to have an even more permanent link with technically advanced enterprises elsewhere in China. This could take many forms--from paying for specific technical assistance, to licensing arrangements for proprietary technology and permanent joint ventures in production, sales and marketing.

3.24 Transfer of domestic technology is likely to remain most important in Gansu, given the relative backwardness of industry in the province, but foreign technology imports should also be increased, in a selective manner. In a number of areas, Gansu has a unique advantage over most other areas of China in developing production for exports. Examples include a number of agroindustries, such as temperate climate fruits and vegetables, leather and woolen textiles, nonferrous metal industries, and even footloose industries that depend primarily on low wages. If these industries are to develop, enterprises in Gansu must be permitted to have direct contact with foreign buyers and suppliers, and allowed to engage in joint ventures for production or export marketing.

## Role of Financial Institutions

3.25 The specialized banks and other new financial institutions will be taking on a much more prominent and autonomous role than in the past in industrial investment. At present, however, the specialized banks are more akin to accounting departments of the government rather than to financial intermediaries that mobilize and efficiently allocate surplus resources. The challenge is to turn banks into enterprises rather than government departments. In addition to facilitating an expansion in the level of industrial investment, banks will have to share and help manage the risks of enterprises. With more competition in the industrial sector, both from within and outside the province, enterprises will face growing risk of bankruptcy, and banks will have to carefully evaluate and manage their portfolios to keep nonperforming loans within prudent limits.

3.26 The Agricultural Bank of China (ABC) is faced with the most immediate challenge, because the growth in rural industries and services will require a very rapid expansion in credit on appropriate terms and because township and village enterprises are now fully responsible for profits and losses, and ABC is their principal bank. Experience in other countries has shown that provision of subsidized credit is not an efficient means of stimulating rural industrial development and in fact often leads to overinvestment and diversion of funds to purposes other than those intended. The maturity of loans is important, however, and ABC should give serious consideration to easing the cash flow problems of township and village enterprises by extending maturities from the standard 3 years to 5-10 years. The new environment in rural areas also calls for a reevaluation by ABC of the system, skills and allocation of responsibility for the granting of credit. In particular, ABC staff will need much more training in improved methods of project or credit analysis.

3.27 Other specialized banks and financial institutions such as the Industrial and Commercial Bank of China (ICBC), the People's Construction Bank of China (PCBC), and the Gansu Investment and Trust Corporation (GITC) have so far been much less affected by the issue of nonperforming loans (or enterprise failure). But the process of separating state enterprises from their industrial bureaus and increasing their autonomy could lead to some cases of enterprise failure. The provincial government will need to ease the transition to a more indirectly managed economy by helping these institutions build up the necessary skills in project analysis, portfolio management and other techniques of managing banks as enterprises. ICBC, PCBC and GITC will also have an important role to play in mobilizing state enterprise deposits and channeling them into the most efficient investments. However, to enable specialized banks to carry out this role efficiently, the central government will need to consider raising interest rates on enterprise deposits.

3.28 While banks are the most important institutions for providing horizontal flows of finance to the highest value uses, leveraging of enterprise resources by bank loans alone will, in many cases, not pool enough capital to finance projects whose minimum economic scales are large. This is particularly true for rural enterprises. An alternative to setting up state enterprises in rural areas would be to have several townships (and other investors)

join in setting up a joint venture enterprise. GITC, as well as the specialized banks, could play an important role in arranging and participating in such ventures.

### Role of Industrial Bureaus

3.29 In the past, the role of industrial bureaus was to allocate the resources and control the activities of enterprises under their jurisdiction. In the more liberal and competitive environment that is emerging, control over investment resources will gradually shift to the enterprises themselves and to the specialized banks and other financial institutions. The bureaus will nevertheless need to support enterprises in technology and product upgrading, worker training, marketing and maintenance of hygiene and safety standards, as well as monitor trends in the industrial sector and plan for future changes. In order to succeed in this supportive role, industrial bureaus at different levels will need to change the size, technical composition and work assignments of their staff.

3.30 The change from a controlling to a supportive role has progressed furthest in the Bureau of Rural Industries, which is represented at the prefecture and county as well as at the provincial level. Previously, the bureau was responsible for registering new enterprises, aggregating applications for credit and raw material supplies from registered enterprises, and monitoring the physical and financial performance of rural industries. In recent years, the Bureau has expanded its technical assistance and training functions and now provides short-term courses in management and technical subjects, arranges for experts from other provinces to visit Gansu and is endeavoring to expand its marketing assistance to individual enterprises. While there remains a shortage of staff with formal training, the bureau does appear to have frequent and helpful contact with client enterprises.

3.31 In other industrial bureaus, changes have not yet progressed very far, due primarily to the fact that the policies for state enterprises and large urban collectives have not yet changed as much as those for township and village enterprises. However, there will be and probably already is considerably more room for a new and supportive role by other industrial bureaus. For example, the recent abolishment of unified plan allocation for many agricultural raw materials (such as cotton, wool and hides) has given light industrial enterprises considerably more freedom to expand production, to specialize and to enter new markets. However, because the commercial and service sector is still very underdeveloped, enterprises have difficulty in learning about new market opportunities, arranging for sales outside the province and finding material suppliers and technical assistance. The Bureau of Light Industry could play a much larger role in assisting enterprises in these areas, if the institution was strengthened through a process similar to what has taken place in the Bureau of Rural Industries. In view of the many opportunities for cooperation between rural industries and state enterprises, the bureaus could also play a much larger role in promoting cooperation in, for example, subcontracting.

D. Investment Costs and Financing

3.32 In view of the potential for rural and urban industrial development in Gansu and the commitment of the central as well as the provincial governments to rapid development of the province, there is every reason to believe that industrial growth in Gansu will at least match the 6-7% p.a. range discussed in Chapter 1. The pattern and composition of such industrial growth will, however, have major implications for investment requirements as well as for employment generation. A continued emphasis on large, capital-intensive heavy industries will make it very difficult to reduce the already high incremental capital output ratios, and total industrial investment would probably need to increase at about the same rate as industrial output (see Scenario A in Table 3.7). Such a strategy is also likely to involve relatively moderate industrial employment growth concentrated mostly in urban areas. On the other hand, an industrial strategy with greater emphasis on development of light and rural industries would involve major shifts in the allocation of investment but would be much less costly in terms of the total investment required to achieve a particular rate of output growth (see Scenario B in Table 3.7). Moreover, since investment costs per job in rural industries are particularly low--about one tenth of the average cost in state enterprises--the employment-generation effects would be much greater and much more widespread.

Table 3.7: INDUSTRIAL OUTPUT AND INVESTMENT GROWTH UNDER ALTERNATIVE SCENARIOS, 1984-2000  
(% p.a.)

	Scenario A	Scenario B
<u>Output Total</u>	<u>7.2</u>	<u>6.2</u>
<u>Fixed Investment Total</u>	<u>7.0</u>	<u>4.1</u>
State enterprises	6.0	2.4
Heavy	5.8	1.3
Light	7.1	6.6
Urban collectives total	15.3	18.1
Rural collectives total	15.4	16.2

Source: Appendix D, Tables 1, 5, 14 and 15.

3.34 Whatever overall strategy Gansu chooses to adopt, there will be major shifts in the pattern of industrial investment financing. At present, between a quarter and a third of total industrial fixed investment is financed through the provincial or central government budgets.<sup>17/</sup> The remainder is financed partly through self-raised funds and partly through bank loans. As a

<sup>17/</sup> See Appendix D, Table 15.

result of the ongoing process of state enterprise reform, however, it can be expected that central and provincial budget financing of industrial investment will be gradually phased out in favor of bank loans. It should also be noted that both scenarios in Table 3.7 involve a rapid increase in industrial investment in rural areas, and additional sources of finance would need to be identified. Until 1984, total investment of township and village enterprises was only about Y 10-20 million per year. In 1985, however, it appears to have increased sharply to Y 60-80 million with most of the additional finance coming from the Agricultural Bank of China.

#### IV. HUMAN DEVELOPMENT

##### A. Education

###### Basic Education

4.01 International experience strongly suggests that adjustment to new occupations and new economic opportunities as may be presented by mobility out of the province, from the countryside to towns and cities, and from agricultural to nonagricultural employment would all be greatly facilitated by a good basic education.<sup>18/</sup> Basic education is also likely to be of great benefit to those remaining in agriculture, by helping to speed the adoption of improved agricultural technology and increase farm productivity. In addition, experience from other countries suggests that basic education--especially of women--can have social benefits, including a reduction in fertility, improvements in child nutrition and family health, and increased participation of children in school. The World Bank has concluded from a review of 20 developing countries, including eight in Asia, that the economic returns to investment in education are high when compared with other sectors; that returns to investment in primary education are generally higher than those in other levels of schooling when the average level of education among a population is low; and that the lower the level of a country's development, the higher the returns to any level of education.

4.02 In Gansu, this means that high priority should be given to improving the quantity and quality of basic education (defined as six years of primary plus three years of lower secondary). One immediate task will be to assure access to six years of primary schooling for all children, but particularly for girls who have been underrepresented in school. At present, there are six grades in some of the primary schools in urban areas of Gansu but in none of the primary schools in rural areas. Moreover, 41% of primary schools (all of them rural) have fewer than five grades, typically two or three. In theory, such village schools are meant to facilitate school attendance for young children who, when they are somewhat older, can be expected to walk to five-year primary schools farther away. But in practice, many children finish three grades in a village school and do not transfer, with the result that the dropout pattern at the end of the third grade is strikingly different for Gansu than for China as a whole (see Table 4.1).

---

<sup>18/</sup> See Annex C for a more detailed review of international experience.

**Table 4.1: END-OF-YEAR DROPOUTS IN PRIMARY GRADES  
(%)**

Grade	Gansu, 1980/81-1984/85		China, 1979/80-1983/84	
	Mean	Range	Mean	Range
1	21.1	18-23	18.2	17-19
2	11.0	5-13	7.2	6-8
3	18.4	11-26	5.8	5-6
4	15.9	13-23	11.5	10-12
5	n.a.	n.a.	n.a.	n.a.

Source: Annex C.

4.03 Assuring access to six years of primary schooling and eventually to nine years of basic education will not be enough to reduce dropout rates and increase completion rates. It will also be essential to raise the quality of basic education, especially in rural areas. School facilities and instructional materials need to be improved. Many rural schools are inadequate for instructional purposes and, in some cases, are so dilapidated as to be unusable due to the low quality of original construction and the lack of regular maintenance. Equipment, teaching materials, and furniture are also in short supply. Again, the poorest conditions are in rural areas.

4.04 Most serious of all is the issue of low qualifications of the teachers in Gansu. Only two thirds of primary school teachers in Gansu meet the minimum educational requirement of full upper secondary schooling, and only one quarter of lower secondary school teachers in the province have completed the required minimum two years of postsecondary schooling. The deficiency in training of primary school teachers is especially apparent among village or minban teachers and, consequently, most of them are ineligible to become gongban teachers. The development of short-term inservice training programs for teachers who have no formal qualifications, as well as for those who received their education many years ago, is therefore an urgent priority. There is also a need to establish a regular program of short-term refresher training for all teachers so that they can continue to bring new information and new pedagogical advances into all the provincial classrooms. Refresher programs are at least as important as programs to upgrade institutions for preservice training of teachers and, indeed, in order to improve the overall efficiency of resource use, it may well be appropriate to begin consolidating preservice and inservice teacher training institutions.

4.05 Although Gansu faces great challenges in improving the quantity and quality of basic education, its task will be eased by the changing age structure of the population. Between 1983 and 1990, the primary school-age population will decline by 20% and lower secondary by 26%. From 1990-2000, the primary school-age population will remain approximately constant and the lower secondary school-age group will decline by an additional 8%. This decrease in

school-age population will dramatically affect requirements for facilities and teachers and, in fact, in the absence of programs to improve the quality and efficiency of the system, financial requirements for basic education would actually fall between now and 1990 (see Scenario A in Table 4.2). Even assuming rapid implementation of programs to improve teaching facilities and teachers' skills, total financial requirements are unlikely to increase by more than 4-5% per year in real terms between 1983 and 2000.

**Table 4.2: FINANCIAL RESOURCE REQUIREMENTS  
FOR BASIC EDUCATION UNDER ALTERNATIVE SCENARIOS, 1983-2000 /a**  
(Y million at 1983 prices)

	1983	1990		2000	
		Scenario A	Scenario B	Scenario A	Scenario B
<u>Primary</u>					
Capital	43	28	39	28	39
Recurrent	126	114	182	190	313
Subtotal	<u>169</u>	<u>142</u>	<u>221</u>	<u>218</u>	<u>352</u>
<u>Lower Secondary</u>					
Capital	11	6	14	6	15
Recurrent	55	31	80	52	141
Subtotal	<u>66</u>	<u>37</u>	<u>94</u>	<u>58</u>	<u>156</u>
<u>Total</u>	<u>235</u>	<u>179</u>	<u>315</u>	<u>276</u>	<u>508</u>

/a Scenario A assumes the system continues to operate at current levels of internal efficiency as determined by current repetition and dropout rates, and there are no changes in management and in resource inputs (other than teacher salaries). Scenario B assumes a large increase in resource inputs and more students staying longer in school.

Source: Annex C, Tables F.7 and F.8.

#### Upper Secondary Education

4.06 The combination of rapid economic growth and past neglect of technical and vocational education has meant that Gansu, like other provinces in China, is now faced with excess demand in both urban and rural areas for skilled and technical staff and workers. At the same time, about 220,000 students leave the school system each year without job-related skills. In recognition of these conditions, the provincial government is considering moving ahead rapidly with programs of technical and vocational education and, in particular, raising to 50% the proportion of upper secondary school students receiving some form of vocational education. The experience of other coun-

tries in implementing technical and vocational education programs has, however, been mixed. On the one hand, a graduate of a technical/vocational program is generally better prepared for immediate job requirements and possesses a stronger academic background than a person who enters the work force without secondary education. On the other hand, there are several potential shortcomings in the technical and vocational systems: schools cannot easily duplicate actual working conditions for students; school equipment is often inappropriate (either outdated or in some cases too sophisticated); teachers may themselves lack practical trade experience; and the syllabus may fall behind changing skill requirements. It is also apparent that technical and vocational education are much more expensive than regular secondary education, which, with its emphasis on basic academic and intellectual development, is itself a foundation for successful performance in employment.

4.07 In the case of Gansu, there is no doubt that some changes in the structure and content of upper secondary education are desirable. But the mixed experience of other countries strongly suggests that there is an advantage to proceeding gradually and aiming to maintain the quality and ensure the relevance of technical and vocational education while minimizing its costs. The province's current emphasis on vocational programs of three years or longer at the secondary level should be further reviewed, bearing in mind that only 10% of the youth enroll in upper secondary education and that much of the current demand is for semiskilled workers. For such positions, whether they be in rural industries, in urban or rural services, or in agriculture, a complete secondary education is not required. Rather a solid basic education combined with a relatively short-term exposure to selected job-related skills either prior to job entry or as part of employment is sufficient and much less expensive. In Japan and in some western European countries, successful vocational education programs have been based on very close linkages between the industries or sectors for which students are being prepared and the schools and training institutions. In many cases, their programs are short-term, six months or one year, rather than a full three-year cycle. Another cost-saving innovation that Gansu should consider involves developing centralized physical facilities for training that can be shared by a relatively large number of students enrolled in different schools.

4.08 The importance of looking carefully at the costs as well as the design of technical and vocational education programs is demonstrated by the projected structure of total education expenditures (see Table 4.3). If the province moves ahead with official plans to develop vocational and upper secondary education, enrollment in upper secondary schooling would increase from the current 10% to 30% by 1990 and would be 60% by 2000. The share of vocational students in total upper secondary enrollment would increase from the current 20% to 50% by 1990 and would remain at that level throughout the decade. Expenditures on upper secondary education as a whole would increase more rapidly than basic education expenditures, and expenditures on technical and vocational education would increase more rapidly than expenditures on general upper secondary education. By 2000, expenditures on technical and vocational education could account for 23% of total primary and secondary education expenditures compared with 4% in 1983. In view of this potentially major shift in the composition of education expenditures, it is even more important that the efficacy of proposed technical and vocational education programs be carefully reviewed.

Table 4.3: STRUCTURE OF PRIMARY AND SECONDARY EDUCATION  
EXPENDITURES, 1983-2000  
(Y million at 1983 prices)

	1983 Actual	1990 Projected /a	2000 Projected /a
<u>Basic Education</u>			
Total	235	315	508
<u>Upper Secondary</u>			
General	19	12	77
Vocational	10	82	177
<u>Total</u>	<u>29</u>	<u>114</u>	<u>254</u>
<u>Total Primary and Secondary</u>	<u>264</u>	<u>429</u>	<u>762</u>

/a Projections based on Scenario B.

Source: Annex C, Tables F.7 and F.8.

#### B. Health

4.09 Having achieved a remarkable increase in life expectancy, Gansu, like the rest of China, is now faced with the growing problem of managing chronic disease. This problem will become more acute in the years ahead as a larger percentage of the population moves into the older age group and the service demand for chronic diseases increases. At the same time, Gansu must also manage the relatively high risk that still remains for infectious diseases and other health problems common in developing economies.

4.10 Experience from other countries strongly suggests that improvements in the health status of the Gansu population are the result of social policies and programs that are far broader than health services per se (whether curative or preventive) and that efforts to preserve and improve on those programs at a time of major institutional change will be very important. Due to seasonal, climatic or other factors, many villages in Gansu will be unable to maintain food self-sufficiency on a continuous basis and will benefit greatly from continued grain relief programs. Improvements in the quality and quantity of rural water supplies will be another urgent priority. At present, almost all of the rural population use surface water or shallow well water. About a third use water which is unsafe, thereby contributing to the high prevalence of intestinal infections and digestive diseases. The continuation of patriotic health campaigns and other programs to keep villages clean will also be of major importance for the overall health status of the population.

## Child Development

4.11 The survival and development of children must be one of Gansu's top health priorities, especially in view of the one-child family policy. In recent years, maternal and infant mortality rates have declined significantly, and there have been major improvements in child nutrition. Despite these improvements, many children continue to show moderate levels of malnutrition, and the prevalence of rickets, anemia and other potentially preventable dietary or nutrition-related problems is quite high. The high incidence of infectious disease relative to the rest of China also affects children under five more seriously than the rest of the population.

4.12 Child development is closely linked with improvements in maternal health and education. In order to reduce maternal mortality, systems for early identification of high-risk pregnancies need to be developed and rural maternal delivery facilities need to be expanded at the township level and below. Experience from other countries also suggests that maternal literacy is strongly correlated with the survival and general health status of children (see para. 4.01) and that an educated mother is much better able to protect her child from the multiple health risks present in most low-income villages.

4.13 The incidence of communicable diseases could be further reduced by the guarantee of complete immunization for all children up to 5 years of age. This will require establishment of a complete cold chain linking provincial depots to village-level distribution, which will help ensure that vaccine potency is preserved and that immunization sessions can be held more frequently. To ensure full coverage of eligible children, a monitoring system needs to be developed. Such a monitoring system could also be extended to cover children's height and weight measurements and signs of diseases such as rickets.

4.14 The successful introduction of such child development programs will require some important changes in the structure and roles of the existing maternal and child health and antiepidemic organizations. Maternal and child health stations will need to deemphasize their role in providing curative services and concentrate on their responsibility for prenatal, perinatal and postnatal care, scientific delivery services, surveillance of infants and children and provision of family planning services. In order to better carry out such responsibilities, the stations will require equipment as well as additional staff, supported by more intensive inservice training. Staff of the county epidemic prevention stations will also need additional training, more transport vehicles and other equipment in order to better fulfill their responsibilities for disease surveillance and control, immunization, monitoring of environmental health and health education.

4.15 Perhaps most critical, however, is the need to arrange for guidance on child development and preventive medicine at the village level. In the past, the village doctor played a major role in organizing patriotic health campaigns and advising parents about child development. But in recent years, many of these doctors have become more like village pharmacists, deriving their income from the prescription and sale of traditional and modern medicines. If village doctors are to resume their role in preventive activities,

then training programs need to be reoriented to emphasize the preventive rather than the curative aspects of health care. Financial or other incentives will also need to be provided to village doctors in order to ensure that they undertake the necessary preventive work (see para. 4.29.)

### Chronic Diseases

4.16 In the coming years, Gansu, like other parts of China, will face the difficult task of developing cost-effective programs for diagnosing, monitoring and treating chronic problems. The technology available to manage such problems has advanced so rapidly that there is almost no limit to what could be provided on a per capita basis. But hard choices will have to be made, given the limited resources available for health care.

4.17 It will be important that the preventive aspects of chronic diseases receive greater attention. The prevalence of rheumatic heart disease, for example, could be sharply reduced if streptococcal diseases in children were recognized early and treated with penicillin. Similarly, excess salt consumption leads to preventable heart disease and stroke, and high cigarette consumption leads to increasing lung cancer and chronic respiratory diseases. It also appears that the high incidence of stomach cancer in Gansu is related to dietary factors. To ensure that such issues are more fully addressed and the public adequately informed, part of the health network (for example, the epidemic prevention network) needs to be given responsibility for preventive aspects of chronic diseases.

4.18 Even if there is a reduction in infectious diseases and an increased emphasis on the preventive aspects of chronic diseases, Gansu will need to expand its curative health services. The government's target of ensuring that there are three beds per thousand persons by 2000 seems quite reasonable in light of the relatively low level of bed availability in the province compared with the rest of China and in view of the anticipated future increase in chronic disease cases requiring hospital management. But more attention needs to be paid to the location of such facilities and particularly to the urgent needs for more hospital beds in rural areas and poorer counties. Ensuring that every county has at least three beds per thousand persons by 2000 would increase the size of the program (see difference between Scenarios A and B in Table 4.4) but would help to ensure a more equitable distribution. More attention also needs to be given to the staffing and equipping of hospitals and health centers and to the relationships between different levels of health service providers. In view of the major cost implications, trade-offs will have to be made and need careful analysis. In the case of equipment, for example, it may be more important at this time in Gansu's development to have a standardized scale in each village to weigh children than to have an ultrasound diagnostic capability at each village hospital. Although the availability of such sophisticated diagnostic equipment is important, it should be offered at higher levels on a referral basis. Distributing such resources to the lowest levels would be expensive and probably unnecessary.

**Table 4.4: PROJECTED HOSPITAL BED AND FINANCIAL RESOURCE REQUIREMENTS  
UNDER ALTERNATIVE SCENARIOS, 1983-2000**

	1983	2000		Growth rate (%)	
		Sce- nario A	Sce- nario B	Sce- nario A	Sce- nario B
Hospital beds	34,800	71,700	80,304	4.3	4.9
Investment costs (Y mln)	26.4	79.0	122.0	6.7	9.4
Curative	21.9	61.0	86.6	6.2	8.4
Preventive/other	4.5	18.0	35.4	8.5	12.9
Recurrent costs (Y mln)	367.2	752.9	843.2	4.3	5.0
Curative	342.4	709.5	743.5	4.4	4.7
Preventive/other	24.8	43.4	99.7	3.3	8.5

Source: Appendix D, Tables 17 and 18.

### C. Organization and Management of Social Services

#### Role of the Government

4.19 Improvements in the quantity and quality of social services in rural areas of Gansu will be crucially affected by the evolving responsibilities for managing and financing such services. Already much has been done to expand the role of government in providing social services. About half of all rural primary school teachers are now government employees. Seventy percent of township health personnel (but none of the village-level health personnel) are also government employees. In addition, education and health offices have been established at the township level, and the government is taking a more active role in supervising rural schools and health facilities. But the extent of the government's responsibilities for building, maintaining and staffing such facilities is still unclear.

4.20 Whether the government needs to take full responsibility for provision of such services will depend in part on the capacity of collective and other institutions to effectively carry out such responsibilities. In richer provinces of China, collective institutions are very active in provision of social services and may even be able to provide more and better services than the government. Such is not the case in most parts of Gansu, however. Some improvement may be possible in the institutional capacity of villages to develop and maintain an adequate level of social services, but the government will almost certainly need to expand its role if Gansu is to rapidly improve the quality of basic education and health programs.

## Decentralization

4.21 Such an expansion in governmental responsibilities does not necessarily mean increased centralization of responsibilities. In fact, in an effort to improve the administration of basic education and health programs, Gansu and China as a whole are now emphasizing the decentralization of management responsibilities to lower levels of government. The recognition of local responsibility for basic education and public health is a pattern common to many countries. It has frequently improved access to services for people in previously neglected communities, increased the capacity of local administrative leadership, and introduced new perspectives and interests into the policymaking process. But decentralization in other countries has not been an easy process, and some important lessons can be drawn. First, decentralization needs to start on a small scale and should be seen as an incremental process of building up the capacity of organizations to assume greater responsibilities. Second, the most successful decentralization efforts have been carefully designed and uncomplicated to administer and have specified the responsibilities of each participant. Third, to ensure that standards are maintained and services are equitably distributed, local administrations and institutions must be made accountable for their results to higher levels of government. Fourth, decentralization needs to be accompanied by provision of adequate financial resources, either through decentralization of revenue-raising power or through provision of funds from higher levels of government.

4.22 In basic education, Gansu is moving slowly to decentralize responsibilities, but the system is still characterized by compartmentalization and duplication of functions between different echelons in the hierarchy. As yet there is no clear delineation of responsibilities between the provincial, prefectural, county and township levels. For example, prefecture-, county- and township-level bureaus all operate primary and secondary schools. Both prefectures and counties have responsibility for inservice and preservice training of teachers for primary and lower secondary schools. In addition, the respective responsibilities of county and township levels for rural primary schools are still evolving. The achievement of educational goals and particularly the implementation of universal primary education would be greatly facilitated by a resolution of these issues and a clear definition of responsibilities and authority at each level of educational administration in the province.

4.23 In health, too, there is an overall emphasis on decentralization but no clear delineation of responsibilities and authority at different levels. This ambiguity makes county-level coordination and management of programs such as maternal and child health, tuberculosis, epidemic prevention, schistosomiasis, malaria control and family planning very difficult and leads to overlap and waste or duplication of resources. The role of township and village health facilities and particularly the village doctor in preventive versus curative programs also needs to be more clearly defined.

## Accountability

4.24 In both education and health, it will be essential that efforts to decentralize and more clearly delineate responsibilities between different

levels of administration are accompanied by measures to make each level more accountable for its performance. This will involve the introduction of improved systems for supervising and assisting different levels of administration. In education, for example, attainment of universal primary education will depend in part on a more professional and intensive system for school and teacher supervision. Such a system would have two purposes: first, technical assistance to townships and schools for development and implementation of educational plans; and, second, monitoring of student enrollment and attendance, and teacher and school effectiveness, as well as early detection of problem areas with respect to management of schools, achievement of targets, and so on. In health, there is also a need for some form of supervision and inspection system aimed at ensuring that preventive programs continue to be adequately developed and implemented at a local level.

4.25 Improved management of basic education and public health also requires the design and implementation of an information system for planning, mobilizing and evaluating educational and health goals and targets. In education, regular functions such as budget planning and resource allocation and implementation of new policies and programs are inadequately supplied by an education management information system. For the implementation of universal primary education at the county level, for example, the statistical yearbooks edited by the planning unit generally include information about the aggregate numbers of students enrolled, number of teachers employed, and recurrent and capital expenditures by type of school and year. But information on enrollment by age and sex, by urban and rural areas, and corresponding promotion rates, dropout rates, repetition rates, as well as information on student achievement, teachers' qualifications, revenues and expenditure are generally not available. A redesign of data requirements and an intensification of data collection and processing is therefore essential. It is also important that appropriate equipment for information storage and processing is introduced at each level of administration and that statistical and information resource personnel are assigned to different levels and properly trained.

4.26 In health, a similar situation prevails. Fairly reliable data on vital statistics are kept; notification of infectious diseases is well-structured; disease surveillance for important communicable diseases is now practiced in some areas through survey points in sample populations; and attempts are also being made to extend the range of data collection to include chronic diseases. However, counties do not yet collect and collate a wide range of health and socioeconomic data. This lack of information seriously affects their ability to prepare situational analysis, to prioritize needs effectively and to monitor trends. Decentralization efforts should therefore be accompanied by the establishment of a county health information system with trained staff who can bring together data collected by different units for different counties and prepare and distribute useful tabulations and analysis.

#### D. Alternative Financing Arrangements for Social Services

4.27 The present system for financing education and health expenditures in Gansu is characterized by a high degree of self-reliance and self-financing of rural services. This has reduced the pressures on the provincial budget to the point where public expenditures on education and health as a percentage of

GDP in Gansu (and in China as a whole) are low relative to other countries. However, in poor provinces such as Gansu, the system has also resulted in large inequities in expenditures between urban and rural areas because of the limited resources available to most townships and villages and the low levels of rural per capita income. Reforms in recent years have tended to shift the burden of financing rural services from collectives to households, but the nature of the problem has changed little because neither collectives nor households in most rural areas of Gansu have resources to finance a minimum level of social services.

4.28 Whether or not there are any formal changes in the responsibilities of the government for rural education, a further shift in financing from collectives and individuals to the government is clearly warranted. At present, rural families spend Y 6-9 per primary student per year on fees, textbooks and educational materials. Such expenditures, though small in absolute terms, are a burden for rural families who may have per capita incomes of as little as Y 60-80 and cash available for discretionary expenditures of as little as Y 5-10 per person. Rural schools also receive collective contributions in cash and kind but can only afford to pay minban teachers about Y 55 per month or 65% of the average earnings of a gongban teacher. This low pay is a major factor in the low qualifications, low morale, and low stability of employment among minban teachers. Both the quantity and the quality of rural primary education could therefore be greatly enhanced by the elimination of school fees and charges and by increased support and accelerated transfer of minban teachers to the government payroll. Such a shift in responsibility for education financing would clearly increase the burden on the state budget. The burden would be increased further if the government also took responsibility for school construction. But it should be noted that fees and collective contributions currently amount to only about 20% of public recurrent expenditures on primary and secondary education (see Table 4.5) and 15% of total public expenditures on education in the province. It is not, therefore, an impossible burden for the public finance system, particularly as the role of the budget in financing directly productive activities such as industry is expected to diminish in the future.

**Table 4.5: EXPENDITURES ON PRIMARY AND SECONDARY EDUCATION  
BY SOURCE OF FINANCE, 1983-2000 /a**  
(Y million at 1983 prices)

	1983	1990	2000
<u>Public</u>			
Capital	17	21	24
Recurrent	163	323	649
<u>Enterprise</u>			
Capital	3	3	4
Recurrent	9	19	40
<u>Other</u>			
Capital	39	41	45
Recurrent	35	21	-
<u>Total</u>			
Capital	59	65	73
Recurrent	207	363	689
<u>Total</u>	<u>266</u>	<u>428</u>	<u>762</u>

/a Covers only Scenario B.

Source: Annex <sup>C</sup> R, Tables F.3 to F.8.

**Table 4.6: HEALTH EXPENDITURES BY SOURCE OF FINANCE, 1983-2000**  
(Y million at 1983 prices)

	1983	2000	
		Scenario A	Scenario B
Ministry of Public Health	90.21	188.99	354.92
Government insurance schemes	19.60	27.54	27.54
Other sources	283.74	612.08	582.69
<u>Total</u>	<u>393.55</u>	<u>828.63</u>	<u>965.15</u>

Source: Appendix D, Tables 17 and 18.

4.29 In rural health, too, there appears to be an urgent need to shift financing responsibilities away from collectives and individuals and towards the government. At present, some township health personnel are on the government payroll and the remainder receive a fixed subsidy from the government. Village doctors in 30 counties also receive a fixed subsidy from the government. In order to improve the overall quality of health services and increase the emphasis on preventive medicine, such subsidies will need to be increased and consideration given to transferring more personnel, including qualified village doctors, to the government payroll. At the same time, the government should be cautious about increasing charges for health services in rural areas and may even want to consider reducing them, particularly for preventive measures such as immunization. It also appears that the present charges for curative services in rural areas seriously limit poor families' access to such services, and these charges may also need to be reduced. The government could explore the possibility of establishing a rural health insurance system, organised at the county or prefecture level. Although comprehensive coverage of all medical costs would be prohibitively expensive, catastrophic costs could be covered, perhaps by introducing a very high threshold level, or by making it available on a selective basis for severe illnesses. Unlike the village level health insurance schemes that have existed in the past, it would be desirable to cover several villages or counties in such a scheme, to pool the risks among a large number of people. As with rural education, such changes in financing arrangements would increase the burden on the state budget (see Table 4.6). But again, the changes seem manageable given the expected overall growth in the economy and the budget and the reduced responsibilities of the government in other sectors.

V. MANAGEMENT AND FINANCE

A. Scope and Allocation of Government Responsibilities

5.01 Economic reform in China is likely to lead to major change in the scope and nature of governmental responsibilities in Gansu, as in other provinces. Experience from other countries suggests that the expected changes should help to improve economic efficiency and social equity. Certainly there is a strong economic case for government involvement in provision of public goods such as large irrigation projects, transport systems, roads and other infrastructure which requires collective consumption. Government involvement in provision of goods and services that have "spillover" effects and benefit not only the immediate consumer but also the community as a whole also seems justified. Examples of these goods and services are public health and education facilities, which benefit the entire community by contributing to a healthy and well-trained labor force. Some continued direct government involvement in directly productive sectors such as agriculture and industry may also be justifiable but should probably decline as the banking system and other channels of finance become more developed. The removal of the government from investment in directly productive activities would mean a slower growth of provincial budget expenditures on capital construction (see differences between scenarios A and B in Table 5.1). On the other hand, recurrent expenditures would likely increase faster under Scenario B compared with Scenario A due to the more rapid growth and the government's expanded responsibility in provision of social and other services.

Table 5.1: GROWTH IN PROVINCIAL BUDGET EXPENDITURES UNDER ALTERNATIVE SCENARIOS, 1984-2000  
(% per year at constant 1984 prices)

	Scenario A	Scenario B
<u>Total Capital Expenditures</u>	<u>6.8</u>	<u>4.7</u>
Agriculture	2.5	-0.2
Industry	7.0	- /a
Education and Health	3.5	8.5
Other	10.0	10.7
<u>Total Recurrent Expenditures</u>	<u>5.9</u>	<u>7.1</u>
Agriculture	3.9	3.9
Industry	7.0	- /a
Education and Health	0.8	6.2
Other	7.5	8.8
<u>Total Budgetary Expenditure</u>	<u>6.2</u>	<u>6.6</u>

/a No budgetary expenditure on industry takes place under this scenario.

Source: Appendix D, Tables 3 and 7.

5.02 A major aspect of institutional reform is the establishment of townships as a new and lowest level of government below the county. By October 1985, 108 of the 1,532 townships in Gansu had been formally established as the lowest level of government and had assumed responsibility for expenditures in education, culture and health, social welfare and relief, assistance to agriculture, support for township and village enterprises and in other areas. So far these changes have involved a shift and not an expansion in overall governmental responsibilities. But the formal establishment of townships as the lowest level of government certainly opens up the possibility of a broadening in township government responsibility for provision of rural services.

5.03 With the addition of townships as the lowest layer of government, there are now four layers of government within Gansu--provincial, prefectural, county and township. The expenditure responsibilities of each of these levels need to be carefully and clearly delineated. One principle for clarifying responsibilities is that the level of government appropriate for the delivery of any given service should be the level whose jurisdiction includes the people likely to benefit from the provision of the service. Thus, farm to market roads could be handled by township governments, other rural roads by county governments, and more major provincial roads by prefectural and provincial governments, while national roads would be handled by the central government. Beyond this principle, experience from other countries offers no clear-cut prescriptions; the precise allocation of responsibilities depends on each country's aims for lower-level governmental authority, the nature and number of lower levels of government and the relations between the levels. It is important, however, that the government clearly specifies which tasks are the sole responsibility of provincial, prefectural, county and township levels and which tasks are the joint responsibility of two or more levels of government. Moreover, this allocation of responsibility needs to be consistent with the distribution of the revenue base between different levels of government.

5.04 Provincial and local governments will have a smaller role in financing directly productive activities in agriculture and industry, but they will continue to be involved in provision of supporting infrastructure, services and technical assistance. The provincial government needs to start planning for these changing functions and responsibilities by establishing new or reforming existing governmental institutions and ensuring that staff of these institutions have the skills necessary to carry out the government's new role. There will need to be particularly close attention to the staffing and responsibilities of the agricultural and industrial bureaus at different levels of the government.

5.05 With a larger role for enterprises and financial institutions in productive investment decisionmaking, the role of the provincial economic and planning commissions must also change. These commissions will still have a critical role in planning investments in infrastructure and services. However, there needs to be more rigorous economic analysis of these investments and the staff of both commissions will need to be provided with the training to undertake such economic analyses. In addition, both commissions need to become more deeply involved in outlining provincial goals and targets

and coordinating the plans and activities of different bureaus in support of this overall vision.

5.06 The central government will have a somewhat different, although still major, role in Gansu's development by providing national-level infrastructure and services, such as railways and telecommunications, that will affect the province's ability to trade and interact with other parts of the country. The pace of economic reform will also be of major significance for Gansu as for other provinces. The shift from plan to market allocation of goods and services has opened up new production and trading possibilities for the province, but the process of dismantling annual production planning and allocation and decontrolling prices is far from complete. Resolving the issue of labor mobility and whether some of the agricultural population of Gansu will be allowed to move to other parts of China will also be important for the province's future development. Finally, Gansu will be affected by the central government's policies on capital mobility and on the magnitude and direction of resource flows through the banking as well as the fiscal systems.

#### B. Revenue Raising

5.07 At present, China has a unitary fiscal system whereby all major aspects of tax policy are determined only by the central government, though different sources of revenue may be assigned to or shared with lower levels of government. There have been no indications that the central government intends to change from a unitary to a decentralized system and as long as interjurisdictional mobility of the population and businesses and other checks and balances on the authority of local governments remain quite limited, there are good reasons for maintaining the present system. However, major changes in tax instruments and tax rates can be expected in the coming years as part of the economic reform process, and, while a full discussion of such changes is beyond the scope of this report, some of the implications of potential changes for central-provincial and intraprovincial fiscal relations can be highlighted.

#### Forms of Taxation

5.08 Profits taxes and industrial and commercial taxes are currently the major sources of taxation in Gansu. However, profit taxes have only recently been substituted for profit remittances and are still akin to remittances in that the taxes are paid by each enterprise to the level of government by which it is owned. A clearer separation of government administration and business enterprise with respect to revenues as well as expenditures is desirable. One of the main ingredients of reform in this area could be to change the present system in which each enterprise remits profit taxes to the level of government that owns the enterprise. In most countries, taxes on profits accrue to the central government. In China, adopting such a system would help to more fully separate enterprises from government administration (which is one of the major objectives of economic reform) and would also reduce instability in provincial and local government budgets which results from the frequent transfer of enterprises between different levels of government. Gansu's revenues were severely affected by such transfers in 1979 and 1983. Such a tax collection system would imply a loss of revenue collected in the province, but this could

be offset through a tax-sharing system between levels of government or an increase in grants from higher to lower levels of government (see paras. 5.15-5.19). It would also be desirable to formalize and standardize the profit tax system in order to reduce the pervasive bargaining and negotiation over enterprise-specific, frequently negotiated profit and adjustment tax rates that generate uncertainty and instability and distort investment and production decisions.

5.09 The industrial and commercial tax, an indirect tax on the production and flow of commodities, has proved to be an effective means of raising revenues from rural as well as urban enterprises. This tax is likely to remain a major source of government revenue in the future, although some changes may occur in the form and structure of the tax. For example, as administrative price controls are relaxed, a more uniform rate structure would be necessary to reduce distortions and would also make tax collection easier and cheaper. Consideration might also be given to levying the tax on value added rather than gross turnover, as is already the case for a limited number of goods. This alternative would reduce the excessive tax burden on products which pass through several stages of production, discourage the cumbersome vertical integration in Chinese industry and encourage development of small-scale ancillary industry.

5.10 In the future it can also be expected that consideration will be given to regularizing or replacing some of the other taxes. For example, taxes accruing to the lowest levels of government are highly fragmented and, apart from their relatively low buoyancy, are expensive to administer and allow considerable scope for evasion and arbitrary changes in the rate of a tax by lower-level officials.<sup>19/</sup> These taxes could be replaced by a more broad-based tax on agricultural activities, possibly through a higher, more elastic land tax. In the future, as personal incomes rise and perhaps become more unequal, it may also be desirable to introduce a progressive individual income tax, to aid in redistribution as well as revenue-raising. However, such an income tax would probably accrue in the first place to the central government (which is the standard practice in other countries), though a tax-sharing arrangement with the province could be adopted.

#### User Charges

5.11 In recent years, local governments in Gansu, as in other provinces, have been making increasing use of user charges to supplement local tax revenues. In principle, user charges are appropriate whenever the benefits of government services identifiably accrue to particular households or firms in a locality, where there are not significant externalities (costs or benefits

---

<sup>19/</sup> These taxes include the salt tax, grazing tax, tax on the sale of live-stock, and taxes on abattoirs, boats, and a number of similar small transactions.

which accrue to persons other than those who buy the service),<sup>20/</sup> where the subsidization of potential users is not an objective and the costs of administering and collecting the fees do not outweigh the efficiency gains from having user charges. In other countries, user charges are seldom significant as tax revenues but can sometimes be important for lower levels of government. They are subject to abuse, however, especially in a unitary fiscal system where local authorities do not have autonomy in tax instruments and rates and may want to circumvent central government restrictions. Systems for user charges therefore need to be kept under review by higher levels of government.

5.12 In Gansu, there is certainly more room for higher user charges to finance a greater share of the costs of many urban services, because the urban population already receives a relatively high level of services and has relatively high per capita incomes. A prime example is housing, which in urban areas is provided largely by state enterprises and municipal governments, often at rents that do not even cover maintenance costs. Another area where the system of user charges could be improved is the provision of electric power to households and enterprises.

5.13 As discussed in Chapter IV, user charges for social services like education and health raise different and more complex issues in a poor province like Gansu. These services do have significant externalities and are potential instruments for providing everyone with a minimum level of basic needs and improving income distribution. In this context, user charges are undesirable if they prevent the poorest of the population from benefiting from a particular service. In Gansu, there appears to be justification for reducing or even eliminating fees for social services such as primary schools and preventive health services in the poorer rural areas. Cutting back on these fees would support a higher standard of living (because a smaller proportion of personal income would then be spent on these services) and help to meet the objective of universal provision of basic social services.

### C. Revenue Sharing

5.14 Whatever changes take place in the tax system and in the system of user charges, Gansu is likely to remain in a situation where provincial budget expenditures greatly exceed provincial budget revenues. Within Gansu, certain prefectures, counties and townships also will and should remain in a net deficit situation. There is already a revenue-sharing system to handle such differences between revenues and expenditures at the provincial and lower levels of government, but the present system appears to operate largely on the basis

---

<sup>20/</sup> One of the most notable examples of externalities is inoculation against an infectious disease like measles. The benefits to society from a person's inoculation are greater than those to the particular individual concerned. By being inoculated, a person protects others from infection, while on the other hand, if he refuses to be inoculated, he endangers others as well as himself. Basic education also carries similar external benefits.

of negotiations, which are conducted between levels of government without a clear guiding framework. The revenue-sharing arrangements between different governments have been individually negotiated, and there does not appear to be any general plan for distribution of resources across units at the same level of government. The treatment of unplanned surpluses or deficits is particularly variable, across jurisdictions and from one year to the next. The result is considerable uncertainty at all levels.

#### Forms of Transfer

5.15 Revenues are transferred downwards from departments of the central government to the Gansu provincial government, and within Gansu from higher to lower levels of government, primarily through fixed (unconditional) or special-purpose (conditional) transfers. Gansu receives a fixed subsidy of Y 200 million from the central government and a number of special-item subsidies, which amounted to nearly Y 500 million in 1984. The largest special subsidies are the "Two-Xis" fund for Y 160 million and the "aid to backward areas" of Y 55 million. The balance consists of a number of smaller funds. It is apparent that the use of discretionary special-purpose subsidies relative to fixed subsidies has increased greatly in recent years and at all levels of government despite the overall objective of decentralization of responsibilities.

5.16 Other countries also transfer revenues between different levels of government through conditional as well as unconditional grants. Whether transfers should be conditional or unconditional depends on a number of factors, including the basic aim of the transfer (allocative or redistributive) and the degree of discretion given to lower-level authorities. Theoretical prescriptions tend to favor unconditional block grants where the primary aim of the transfer is to achieve distributional objectives. Conditional grants are preferred in situations where the primary aim is to capture the externalities or "spillover" effects of certain types of social service. Conditional grants usually imply closer control and monitoring of expenditures by higher levels of government and are less likely to be diverted to non-development uses than unconditional transfers. On the other hand, conditional grants are more costly to administer than unconditional transfers and have a persistent tendency to grow ever more fragmented and compartmentalized, making it increasingly difficult to monitor and assess the overall effects of such grants.<sup>21/</sup>

5.17 Revenue can also be transferred between different levels of government by tax assignment or tax sharing, which is usually more automatic than grants, thus reducing the uncertainties of the system. The Gansu provincial government obtains some revenues from lower levels of government (primarily

---

<sup>21/</sup> In the United States, where most transfers from the federal to state governments are made on the basis of conditional grants, 539 different federal grant programs existed in 1981. By 1983 these had been consolidated and reduced to 409. Further consolidation into large unconditional block grants has been proposed.

municipalities which generally have surplus revenue) by means of tax-sharing. In other countries, however, where higher levels of government are usually in surplus, such tax-sharing arrangements are used to transfer revenue downwards. In India, for example, transfers from the center to the states are in the form both of grants and tax-sharing, with states receiving shares of central income tax, excise tax and estate duties. In Brazil, the value-added tax is assigned to provincial governments but is shared between provincial and local governments.

5.18 In other countries, revenues may also be transferred from higher to lower levels of government on a part loan finance basis. Thus, in India, plan outlays to individual states are made on a 30% grant/70% loan basis to most states, with a higher grant proportion to the poorer states. Australia also uses a mixture of grant and loan financing in its transfers to lower levels. Such loans take on the character of "matching grants" to the extent that a corresponding effort to repay the loans is required of the receiving level of government.

5.19 The choice between different instruments should be determined by the aims of the government--which level should have control over what--and also on the structure of the country and its administration, which determines how feasible and practical any given arrangement may be. Experience from other countries indicates that transfer mechanisms should be incorporated into formal revenue-sharing systems in order to provide continuity and stability and take account of broad equity considerations. The first consideration is horizontal balance, which requires that the distribution of transfers among governments at the same level be such that the benefits receivable in each are equal, and that the "fiscal effort" required to provide these across different jurisdictions should be the same. A second broad principle is the need for vertical balance between different levels of government, so that the revenues available to any given unit of government are in line with its expenditure responsibilities. Although the current revenue transfer system appears to improve the horizontal balance of resources both between Gansu and other provinces and between localities within Gansu, there is an urgent need for formalization of the system, thereby taking account of the general considerations described above, and reducing the uncertainty which currently arises through negotiation and bargaining.

#### Institutional Arrangements

5.20 To establish a more clearly defined system of revenue sharing, it will be necessary to consolidate institutional responsibilities at the central as well as the provincial government levels. In China, many different agencies are involved in the determination of special-item subsidies at each level of government, from the center down to the county, making it difficult to monitor and control the process. By contrast, in Australia responsibility for revenue transfers lies with one agency, the Commonwealth Grants Commission, while in India the bulk of transfers from higher to lower levels of government are arranged through just two agencies, the Planning Commission and the Finance Commission, working in close coordination.

5.21 In addition to consolidating institutional responsibilities, there is a need at both central and provincial government levels to establish formal procedures and timetables for determining both the level and the composition of revenue transfers between different levels of Government. In India, decisions on transfers for developmental and nondevelopmental expenditures are made on a quinquennial basis by the Planning Commission and the Finance Commission, respectively. Awards made by the Finance Commission are based on a state's projected revenue and "normal" expenditure requirements, and the projected total revenue available for distribution at the center. Awards are then distributed among the states, taking into account their population and per capita incomes. Grants given by the Finance Commission are explicitly taken into consideration by the Planning Commission in determining plan outlays to states. At one time, grants were provided on a project-by-project basis but now are allocated unconditionally based on population (60%), per capita income (10%), special power and irrigation schemes (10%), and the state's tax effort relative to its per capita income (10%), with a residue for some discretionary assistance (10%). In Australia, transfers from the central government to the provincial governments are made by the Commonwealth Grants Commission on the basis of estimates of the difference between actual revenues and expenditures in any category and the "standard" revenue-raising effort, or "standard cost," of all categories of revenues and expenditures. The broad principle of horizontal fiscal equalization is therefore adhered to in both these cases.

#### D. Other Resource Flows

5.22 Appropriate institutional arrangements for revenue-sharing are clearly a critical element in any overall strategy for poverty reduction and income growth in Gansu. But it is important to bear in mind that fiscal resources are only one element in the overall flow of financial resources between provinces. As a result of the gradual shift from budget to loan financing of investment projects and the increased role and autonomy of the banking system, more and more resources are flowing through banks and other financial institutions. There are also increased possibilities for interprovincial flows of investment resources through direct investment between economic units. It will be important that such flows be carefully monitored by the central government and fully taken into account in any overall assessment of interprovincial finance and the needs of poor provinces such as Gansu.<sup>22/</sup>

5.23 Central government policies on interprovincial flows of financial resources will also need to take account of the direction and magnitude of other types of resource flow and their costs and benefits for poor provinces, such as Gansu. For example, rather than channelling additional fiscal resources to the province it may be more efficient for the central government to assist Gansu by developing policies and programs to facilitate migration into the province of technical personnel and migration out of Gansu of

---

<sup>22/</sup> These issues will be discussed in detail in the World Bank's forthcoming report on investment finance issues in China.

unskilled labor. But policies to increase mobility of labor also run the risk of encouraging a net outflow of skilled personnel from the province. Likewise policies and programs to facilitate interprovincial movement of goods and services will have costs as well as benefits to the province. Without much more detailed analysis it is not possible to assess the relative significance of these costs and benefits. But the central and provincial governments need to be aware of the direction and magnitude of such resource flows and take them fully into account in developing an efficient strategy for poverty reduction and income growth in Gansu.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

This appendix contains working tables which have formed the basis for some of the analysis in the main text. The tables have been compiled using data provided by the provincial authorities and other information and assumptions as footnoted. The methodology employed is very similar to that used in the World Bank's recent economic report China: Long-Term Development Issues and Options, Johns Hopkins University Press, 1985, and is designed to facilitate analysis of the Gansu economy as well as comparisons with the rest of China and with other countries.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEConversion of Macroeconomic StatisticsChina: Structure of Employment, 1982 /a  
(Million)

Sector	1982 Census figures	Part-time agricultural workers excluded/b	Adjustment for concealed services/b	Distribution /c			
				State	Urban collective	Urban individual	Rural
Agriculture	384.3	324.1	322.7	8.1	0.5	-	314.1
Industry	71.8	71.8	67.3	34.6	15.1	0.1	17.5
Construction	11.7	11.7	11.4	6.8	2.7	-	1.9
Transport	9.0	9.0	8.8	5.1	2.2	-	1.5
Commerce	15.4	15.4	15.4	9.3	3.7	1.1	1.3
Other	33.6	33.6	40.0	21.1	1.9	0.1	16.9
<u>Total</u>	<u>525.8</u>	<u>465.6</u>	<u>465.6</u>	<u>85.0</u>	<u>26.1</u>	<u>1.3</u>	<u>353.2</u>

/a Mid-year.

/b See China: Economic Structure in International Perspective, Annex to World Bank Country Study, 1985, p. 64./c Statistical Yearbook of China, 1981, 1983, *op. cit.*

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEConversion of Macroeconomic Statistics

China: From NMP to GDP at Market Prices, 1982  
(Y billion at current prices)

	<u>NMP/a</u>	<u>Brigade ind./b</u>	<u>Social services/c</u>	<u>Depreciation/d</u>	<u>NMS/e</u>	<u>Rent/f</u>	<u>GDP</u>
Agriculture	186.8	-13.0	-1.9	+2.3	-	-	174.2
Industry	180.3	+10.1	-1.8	+13.5	-	-	202.4
Construction	20.9	+1.0	-0.2	+0.4	-	-	22.1
Transport	15.0	+0.6	-0.2	+2.3	-	-	17.7
Commerce	23.1	+1.3	-0.2	+0.7	-	-	24.4
NMS	-	-	+4.3	+3.9	+29.7	+14.8	52.1
<u>Total</u>	<u>426.1</u>	<u>0.0</u>	<u>0.0</u>	<u>+23.1</u>	<u>+29.7</u>	<u>+14.8</u>	<u>492.6</u>

/a Statistical Yearbook of China, 1984, op. cit.

/b See Appendix A, Table 14.

/c Estimated at 1% of NMP. Reference Report No. 3391-CHA, Annex A, para. A.10.

/d China - Recent Economic Developments, International Monetary Fund, October 1984, Table 2. Sectoral split of depreciation assumed as in Report No. 4072-CHA, Annex 2, Table 19.

/e Estimated at 7% of NMP. China - Recent Economic Developments, IMF, October 1984, Table 2.

/f Assumed to be 3% of GDP. China: Socialist Economic Development (Report No. 3391-CHA), Annex A, Statistical System and Basic Data, Appendix Table A.11).

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

China: Township-Village Enterprises Gross and Net Output, 1982  
 (Y billion)

	Gross output			Net output		
	Total/a	Township/b	Village/b	Total/c	Township/d	Village/d
Agriculture	4.0	2.3	1.7	3.4	1.9	1.5
Industry	57.7	32.7	25.0	23.5	13.4	10.1
Transport	2.9	1.6	1.3	1.4	0.8	0.6
Construction	7.5	4.3	3.2	2.3	1.3	1.0
Other	5.1	2.9	2.2	3.0	1.7	1.3
<u>Total</u>	<u>77.2</u>	<u>43.8</u>	<u>33.4</u>	<u>33.6</u>	<u>19.1</u>	<u>14.5</u>

/a Agricultural Yearbook of China, 1983, op. cit.

/b Totals based on ibid; sectoral breakdown prorated.

/c Total estimated by adding total wage bill + net profit + taxes and profits utilized in the current year; sectoral breakdown based on net output/gross output ratios from China: Economic Structure in International Perspective, Annex 5 to World Bank Country Study, 1985, Appendix Table C.1.

/d Prorated.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

China: Nonmaterial Services and Housing

	China	Gansu	Jiangsu
<u>Nonmaterial Services /a</u>			
Nonmaterial services as % of total employment (1982 Census)	5.6	5.4	7.5
Of which: Estimated state	4.2	4.1	2.8
Estimated nonstate	1.4	1.3	4.7
<u>Housing /b</u>			
Rural per capita expenditures on housing (Y) 1980	12.8	4.4	24.1
1981	18.7	7.0	33.1
1982	22.6	6.0	46.6
1983	27.8	8.0	5.7
1984	n.a.	8.3	n.a.

/a 1982 population census.

/b Household income and expenditure surveys.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEConversion of Macroeconomic StatisticsGansu: Structure of Employment, 1982 /a  
(Million)

Sector	1982 Census figures	Part-time agricultural workers excluded/b	Adjustment for concealed services/c	Distribution /d			
				State	Urban collective	Urban individual	Rural
Agriculture	8.40	6.27	6.24	0.11	-	-	6.13
Industry	0.87	0.87	0.83	0.65	0.10	-	0.08
Construction	0.19	0.19	0.18	0.14	0.03	-	0.01
Transport	0.15	0.15	0.15	0.14	0.01	-	-
Commerce	0.22	0.22	0.22	0.16	0.03	0.02	0.01
Other	0.53	0.53	0.61	0.40	0.02	-	0.19
<u>Total</u>	<u>10.36</u>	<u>8.23</u>	<u>8.23</u>	<u>1.60</u>	<u>0.19</u>	<u>0.02</u>	<u>6.42</u>

/a Mid-year.

/b This is assumed to be the difference between the census figure for total employment and the mid-1982 figure from provincial statistics, plus half of the 15-year-old age group.

/c Based on same assumptions as national assumptions made in China: Economic Structure in International Perspective, Annex 5 to World Bank Country Study, 1985, p. 64.

/d Based on adjustments to data in provided by the Gansu Statistical Bureau.

CHINA

GROWTH AND DEVELOPMENT IN GANSU, CHINA

Conversion of Macroeconomic Statistics

Gansu: Structure of Employment, 1983 /a  
 (Million)

Sector	Total	State	Urban collective	Urban individual	Rural
Agriculture	6.75	0.11	-	-	6.64
Industry	0.88	0.68	0.11	-	0.09
Construction	0.26	0.14	0.03	-	0.09
Transport	0.16	0.14	0.01	-	0.01
Commerce	0.25	0.17	0.03	0.04	0.01
Other	0.64	0.42	0.02	-	0.20
<u>Total</u>	<u>8.94</u>	<u>1.66</u>	<u>0.20</u>	<u>0.04</u>	<u>7.04</u>

/a Mid-year; based on Table 5 and growth rates for the Gansu Statistical Bureau.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

Gansu: Structure of Employment, 1984 /a  
 (million)

Sector	Total	State	Urban collective	Urban individual	Rural
Agriculture	6.96	0.11	-	-	6.85
Industry	0.93	0.70	0.11	0.01	0.11
Construction	0.30	0.13	0.04	-	0.13
Transport	0.17	0.14	0.01	-	0.02
Commerce	0.29	0.15	0.05	0.07	0.02
Other	0.67	0.44	0.02	-	0.21
<u>Total</u>	<u>9.32</u>	<u>1.67</u>	<u>0.23</u>	<u>0.08</u>	<u>7.34</u>

/a Mid-year; based on same methodology as 1983 data in Table 6.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

Gansu: From NMP to GDP, 1983 /a  
 (Y million at current prices)

	<u>NMP/a</u>	<u>Village enter- prises/b</u>	<u>Social/c services</u>	<u>Depre-/d ciation</u>	<u>NMS/e</u>	<u>Rent/f</u>	<u>GDP</u>
Agriculture	2,661	-88	-27	+30	-	-	2,576
Industry	3,129	+61	-31	+488	-	-	3,647
Construction	520	+23	-5	+8	-	-	546
Transport	305	+2	-3	+46	-	-	350
Commerce	811	+2	-8	+26	-	-	831
Nonmaterial services	-	-	+74	+63	+628	+106	871
<u>Total</u>	<u>7,426</u>	<u>0</u>	<u>0</u>	<u>+661</u>	<u>+628</u>	<u>+106</u>	<u>8,821</u>

/a Gansu Statistical Bureau.

/b From Table 10.

/c Assumed to be 1% of NMP, which is the assumption used for national data.

/d In industry represents 3% of value of fixed assets.

/e From Table 4 and assuming that value added per employee in Gansu is the same as the national average for state employees but less for nonstate employees.

/f From Table 4.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

Gansu: GDP Estimates, 1980-84 /a  
 (Y million at current prices)

	1980	1981	1982	1983	1984
Agriculture	1,643	1,753	1,906	2,576	2,622
Industry	3,605	3,061	3,273	3,647	4,335
Construction	406	403	495	546	632
Transport	286	308	325	350	455
Commerce	662	678	686	831	988
Nonmaterial services	710	673	725	871	982
<u>Total</u>	<u>7,312</u>	<u>6,876</u>	<u>7,410</u>	<u>8,821</u>	<u>10,014</u>

/a Data for 1983 from Table 8; data for other years based on the assumption that the ratio between GDP and NMP in each sector is the same as in 1983.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

Gansu: Township-Village Enterprises Gross and Net Output, 1983  
(Y million)

	Gross output			Net output /b		
	Total	Township/a	Village/a	Total	Township	Village
Agriculture	13	9	4	10	7	3
Industry	272	159	113	127	66	61
Transport	30	20	10	7	5	2
Construction	105	70	35	54	31	23
Other	25	17	8	5	3	2
<u>Total</u>	<u>445</u>	<u>275</u>	<u>170</u>	<u>203</u>	<u>112</u>	<u>91</u>

/a Breakdown available for industry and for total; breakdown for other sectors based on assumption that 67% of gross output accrues to township enterprises.

/b Data available on total net output, on profits of all township and all village enterprises and on profits of township industrial enterprises; remaining figures based on assumption that township and village enterprises have the same average wage of Y 640 but that wages are generally higher in industry, transport and commerce (Y 750) than in agriculture and construction (Y 540); and that profits of village enterprises accrue almost entirely to industry (as is the case for township enterprises).

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

Gansu: Gross Investment, 1984  
(Y million)

	Agriculture	Industry	Culture, education, science and health	Other sectors	Total
Fixed investment /a	250	1,240	215	746	2,451
Working capital /b	25	229	-	120	374
<u>Total Gross Investment</u>	<u>275</u>	<u>1,469</u>	<u>215</u>	<u>866</u>	<u>2,825</u>

/a Total fixed investment and the sectoral breakdown of state sector fixed investment provided by the Gansu Statistical Bureau. Nonstate investment has been allocated as follows: agriculture, Y 60 million (which represents about half of rural private investment, excluding housing); industry, Y 40 million (Y 25 million in urban collectives and Y 15 million in rural collectives); culture, education, science and health, Y 25 million and the balance to other sectors.

/b Total working capital was assumed to be the same ratio of total gross investment as the national ratio; the breakdown between sectors was based on the assumption that the ratio is higher in industry and in other sectors relative to agriculture, and is zero in culture, education and health.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEConversion of Macroeconomic StatisticsJiangsu: Structure of Employment, 1982 /a  
(Million)

Sector	1982 Census figures	Part-time agricultural workers excluded/b	Adjustment for concealed services/c	Distribution /d			
				Stace	Urban collective	Urban individual	Rural
Agriculture	22.99	20.63	20.54	0.37	0.03	-	20.14
Industry	7.33	7.33	6.99	1.98	1.38	0.01	3.62
Construction	1.07	1.07	1.04	0.21	0.15	-	0.68
Transport	0.72	0.72	0.70	0.24	0.25	-	0.21
Commerce	1.00	1.00	1.00	0.60	0.27	0.03	0.10
Other	1.62	1.62	2.10	0.90	0.39	-	0.81
<u>Total</u>	<u>34.73</u>	<u>32.37</u>	<u>32.37</u>	<u>4.30</u>	<u>2.47</u>	<u>0.04</u>	<u>25.56</u>

/a Mid-year.

/b This is assumed to be the difference between census total employment figure and mid-1982 figure estimated from the Agricultural Yearbook of China, 1982 and 1983, op. cit., plus half of the 15-year-old age group.

/c Based on reconciliation with employment-by-ownership data.

/d Based on data from different sources including Jiangsu's Thirty-Five Years, 1949-83, Jiangsu Statistical Bureau (May 1984) and the Agricultural Yearbook of China, 1982 and 1983, op. cit.; and data provided by Jiangsu Statistical Bureau, 1984.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

Jiangsu: From NMP to GDP, 1982 /a  
 (Y billion at current prices)

	<u>NMP/a</u>	<u>Village enter-prises/b</u>	<u>Social/c services</u>	<u>Depre-/d ciation</u>	<u>NMS/e</u>	<u>Rent/f</u>	<u>GDP</u>
Agriculture	14.77	-1.95	-0.13	+0.17	-	-	12.90
Industry	13.69	+1.91	-0.16	+0.56	-	-	16.00
Construction	1.62	+0.04	-0.02	+0.07	-	-	1.67
Transport	0.93	-	-0.01	+0.20	-	-	1.12
Commerce	2.50	-	-0.03	+0.08	-	-	2.55
Nonmaterial services	-	-	+0.35	+0.05	+2.39	+1.82	4.61
<u>Total</u>	<u>33.51</u>	<u>0.00</u>	<u>0.00</u>	<u>+1.13</u>	<u>+2.39</u>	<u>+1.82</u>	<u>38.85</u>

/a Jiangsu Statistical Bureau, 1984.

/b From Table 13.

/c Assumed to be 1% of NMP, which is the assumption used for national data.

/d Based on Table 2.1 of China: Economic Structure in International Perspective, Annex 5 to World Bank Country Study, 1985, except for industry in which Jiangsu is assumed to be relatively more efficient.

/e From Table 4 and assuming that value added per employee in Jiangsu is 1.3 that of the national average.

/f From Table 4, assuming housing expenditure per capita in Jiangsu is twice that of the national average.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Conversion of Macroeconomic Statistics

Jiangsu: Township-Village Enterprises Gross and Net Output, 1982  
 (Y million)

	<u>Gross output /a</u>			<u>Net output /c</u>		
	<u>Total</u>	<u>Township</u>	<u>Village</u>	<u>Total</u>	<u>Township</u>	<u>Village</u>
Agriculture	0.15	0.15	-	0.12	0.12	-
Industry	13.42	8.32/b	5.10/b	4.90	2.99	1.91
Transport	0.36	0.36	-	0.20	0.20	-
Construction	0.85	0.70	0.15	0.25	0.21	0.04
Other	0.32	0.32	-	0.20	0.20	-
<u>Total</u>	<u>15.10</u>	<u>9.85</u>	<u>5.25</u>	<u>5.67/d</u>	<u>3.72</u>	<u>1.95</u>

/a Agricultural Yearbook of China, 1983, op. cit. and staff estimates.

/b Jiangsu's Thirty-Five Years, 1949-83, Jiangsu Statistical Bureau (May 1984), p. 44.

/c Based on Table 2.1 of China: Economic Structure in International Perspective, Annex 5 to World Bank Country Study, 1985.

/d Agricultural Yearbook of China, 1983, op. cit.: total wage bill + net profit + taxes and profits utilized in the current year.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Estimates of Rural Per Capita Income

1. Estimates of rural income per capita in Gansu vary quite widely, depending on which data source is used. Data collected through the administrative reporting system suggests that average rural income per capita was Y 107.78 in 1983, whereas the figure from the rural household sample survey for 1983 was Y 213. (The national average rural annual income per capita from the same sample survey was Y 309.77 in 1983.) Provincial officials believe that, due to difficulties in collecting data from remote areas, the sample survey in Gansu is more representative of the wealthier areas close to the cities than of poor, rural areas. It is also likely that the administrative reporting systems fail to account for some private income.
2. In an effort to better assess the reliability of the two sets of figures, Tables 1 and 2 provide some additional estimates based on analysis of production data. The analysis indicates that the sample survey may overestimate rural per capita incomes while the data from the administrative reporting system appear to be underestimated. It is interesting to note, however, that the distribution of income as measured by Gini coefficients is quite similar whether one uses the administrative reporting system data or the estimates based on production data (0.39 and 0.40, respectively). However, the ranking of prefectures in terms of per capita incomes is somewhat different.
3. In the main text of this report, the household income and expenditure survey data has been used for interprovincial analysis and the administrative reporting system data has been used for intraprovincial analysis.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Estimates of Rural Per Capita Income

Gansu: Estimates of Rural Output and Income per Capita by Prefecture, 1983

Prefecture	GVAO		NVAO	Agriculture population/c (million)	NVAO per capita/d ----- (Y)	Estimated income per capita /d -----
	At 1980 prices -----	At 1983 prices/a (Y million)	at 1983 prices/b -----			
Lanzhou	264.22	286.15	174.55	-	-	-
Jiayuguan	79.85	86.48	52.75	-	-	-
Jinchang	8.76	9.49	5.78	-	-	-
Jiuquan	277.85	300.91	183.56	0.55	331	384
Zhangye	362.29	392.36	239.80	0.92	261	303
Wuwei	394.99	427.79	260.94	1.51	172	200
Dingxi	422.81	457.90	279.32	2.52	111	129
Tianshui	518.11	561.11	342.28	3.36	102	118
Wudu	247.19	267.71	163.31	1.54	106	123
Pingliang	293.16	317.49	193.67	1.61	120	139
Qingyang	370.82	401.60	244.96	1.75	140	162
Linxia	191.37	207.25	126.43	1.31	97	113
Gannan	104.33	112.99	68.92	0.49	154	179
<b>Total</b>	<b>3,535.75</b>	<b>3,829.21</b>	<b>2,335.83</b>	<b>16.98</b>	<b>138</b>	<b>160</b>

/a The national average agriculture product price index is used, which is derived from pp. 23 and 28, Statistical Yearbook of China, 1984, op. cit.:

$$\frac{1983\text{'s GVAO at 1983 prices}}{1983\text{'s GVAO at 1980 prices}} = \frac{3,212.00}{2,881.84} = 1.083.$$

/b NVAO (net value of agricultural output) is derived by multiplying GVAO of each prefecture by 61%, the provincial average level in 1983.

/c The agriculture population of each municipality (Lanzhou, Jiayuguan and Jinchang) is not available; the total rural population in the three municipalities is approximately 1.42 million.

/d The estimated income per capita is derived by multiplying NVAO per capita by 116%. This is based on the following assumptions:

- (a) NVAO is totally distributed to the agriculture population.
- (b) Besides NVAO, government subsidies account for about 14% of annual income, which is calculated from the provincial rural household sample survey in 1982. Also from the survey, the income from services, which is not in the NVAO, is about 1% of annual income and the taxes paid to the Government from the annual income is also about 1%. The net result is that income from sources other than NVAO accounts for about 14% of annual income.

The formula to estimate the rural annual income is as follows:

$$\begin{aligned} &\text{Rural annual income per capita} \\ &= \text{NVAO per capita} + \text{income from other sources} \\ &= \text{NVAO per capita} \times (1 + 0.16) \\ &= \text{NVAO per capita} \times 1.16 \end{aligned}$$

Source: Data provided by the Gansu Statistical Bureau.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Estimates of Rural Per Capita Income

Gansu: Alternative Estimates of Rural Income per Capita by Prefecture, 1983  
 (Y per capita)

Prefecture	Administrative reporting system	Household sample survey	Estimates from production data
Lanzhou	128.19	n.a.	n.a.
Jiayuquan	214.92	n.a.	n.a.
Jinchang	228.21	n.a.	n.a.
Jiuquan	374.36	n.a.	384
Zhangye	243.56	n.a.	303
Wuwei	147.92	n.a.	200
Dingxi	71.04	n.a.	129
Tianshui	74.59	n.a.	118
Wudu	74.40	n.a.	123
Pingliang	79.01	n.a.	139
Qingyang	97.20	n.a.	162
Linxia	82.35	n.a.	113
Gannan	81.40	n.a.	179
<u>Total</u>		<u>107.78</u>	<u>213160</u>

Source: Data provided by the Gansu Statistical Bureau.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

The Provincial Budget: Structure and Flows

1. State budgets in China are prepared by each level of government -- the center, the province, prefecture, county, and recently, the township. Each budget is a consolidated statement of revenues and expenditures which includes the revenues and expenditures of each lower level of government (for example, a prefecture budget would state revenues and expenditures by counties and townships), net of transfers between levels. Although budgetary expenditures form a significant part of GDP (about 30% at the central level, and about 21-22% for Gansu), budgetary revenues and expenditures do not include all state government revenues and expenditures. Individual government departments and bureaus also have some independent revenues and expenditures. It must also be noted that provincial (or lower level) budget statements do not include expenditures made directly by the central (or higher level) government on central (or higher level) institutions within the jurisdiction of the province (or lower level).

Revenues

2. The principal items on the revenue side of each budget are enterprise receipts and taxes. These two categories together accounted for over 95% of the country's revenue in 1984, and over 80% of Gansu's total budgetary revenue (see Tables 1 and 2; IMF definitions have been used for total revenue). Over the last five years, however, the share of enterprise receipts in Gansu's total revenue has fallen sharply from over 40% to under 10%. This is partly a reflection of a national trend. In China, the share of enterprise receipts in total revenue fell from 52% to 35% over the same period. This has been due to the substitution of income taxes on state enterprise profits, for the remittance of profits to the government. In the case of Gansu, the fall in enterprise receipts has been more marked and is partly due to the transfer of several large enterprises from the province to the center, and a consequent loss of their revenues (see Table 3).

3. Indirect taxes on goods, levied mostly on the basis of gross sales turnover, still constitute the most important source (around 95%) of Gansu's tax revenues. Such indirect taxes are payable to the jurisdiction in which an enterprise operates, and therefore Gansu still benefits from ICT receipts of the transferred enterprises. There are also several smaller taxes which are assigned primarily to the county level of government. The most significant of these, the agricultural tax, is in the form of a charge on land and has been fixed in nominal terms since 1956. In overall terms, revenues raised in Gansu province have shown a declining trend since 1980. Revenue in 1984 was lower in nominal terms than in 1980. This has been due to both the fall in enterprise revenue and the low output levels of 1981-83. Some signs of recovery appeared in 1984.

4. The revenue structure of Gansu province, and indeed of China in general, is different from that of most market economies in two major respects. The first is the accrual of enterprise receipts (and also the accrual of the recently substituted profit taxes) to the level of government which owns an enterprise. Typically, in market economies, taxes on corporate units accrue to the central government. The second difference in the Chinese system is the absence of any individual income tax. Income taxes on individuals and corporations usually constitute the base of central government revenues in market economies, especially the more advanced economies. The absence of these taxes is one reason why the central government in China is in the unusual position of being a net recipient of funds from lower levels of government.

#### Expenditures

5. In contrast to revenue, the composition of Gansu's expenditures has altered relatively little over the last few years (see Tables 4 and 5). The shares of education and health have remained unaltered, but there has been a small decline in the share of capital construction and 'simple' construction (taken together) and a somewhat larger decline (17% to 11%) in operating expenditures on agriculture. Capital construction expenditure on agriculture, however, has increased due to the setting up of the special "Two-Xis" fund for agricultural development in Hexi and Dingxi.

6. Despite the stagnation in its revenues, Gansu's expenditures have been growing since 1980, at an annual average rate of 14.5% -- considerably higher than the rate of growth of China's expenditures, which has been around 8% per year over 1981-84.<sup>1/</sup> In 1980, Gansu's revenues exceeded its expenditures by over 20%; by 1984, total expenditure was 60% greater than total revenue. Gansu was able to finance its increase in expenditures through the institution of a fixed subsidy from the center, and a variety of special purpose subsidies.

#### Transfers

7. By 1984, special purpose and fixed subsidies accounted for around 30% of Gansu's total expenditures. From 1983, Gansu began to receive a subsidy of around Y 200 million from the center, fixed in amount for 5 years, which accounted for a little over 10% of its expenditures in that year. The major special subsidies received by Gansu are a sum of Y 55 million per year for "aid to backward areas," and about Y 160 million p.a. under the "Two-Xis" fund, which began in 1983. However, these two funds constituted less than half the total special subsidies of Y 491 million in 1984. The balance is made up of several small, individually negotiated transfers, through a number of different government departments. Some will continue for several years, while others are ad hoc or annually negotiated. All such special subsidies are categorized and earmarked for different purposes.

---

<sup>1/</sup> Between 1983 and 1984, capital construction expenditure rose by 76%, culture, education, science and health by 32%, and urban and transport operating expenditures by 56%.

Revenues, Expenditures and Transfers at Different Levels of Government

8. The fiscal system is essentially a unitary one in the sense that levels of government below the center have no discretion over the determination of taxable bases or the setting of tax rates. While certain taxes are clearly assigned to specific levels of government, a few taxes are shared by arrangement between levels of government. Thus the ICT payable by certain large enterprises in Lanzhou municipality is shared between Lanzhou and the province. Until 1981, Gansu, like several other provinces, had a tax-sharing arrangement with the center, because it was a surplus province. For one year, in 1982, the arrangement was changed to a total revenue-sharing system in which Gansu submitted a negotiated fixed sum to the center. Since 1983, Gansu has been the recipient of net transfers from the center.

9. Under the present system of revenue-sharing between the province and lower levels of government, targets for revenues and expenditures are formulated for each level of government with its immediate superior. These targets are negotiated after an assessment of the revenue resources and expenditure requirements of the unit. If planned or expected revenue exceeds expenditure, a portion of the difference (a fixed sum or a fixed proportion of revenue) is transferred upwards. If planned revenue is less than planned expenditure, a fixed subsidy is paid to that level of government. These transfers are usually negotiated for a period of five years, but annual adjustments are often possible.

10. Deficit regions also receive special item transfers from higher levels which are negotiated in detail, usually each year, and are usually earmarked for specific capital construction projects. Unplanned surpluses or deficits are also shared between upper and lower levels of government. Arrangements for such sharing are negotiated for each unplanned surplus or deficit. A significant feature of the present system is the absence of any general norms or guidelines for revenue-sharing between levels of government or across the units under the jurisdiction of each level. The annual negotiations imply that most levels of government face considerable uncertainty, and the outcome of negotiations could depend critically upon the relative bargaining power of the parties concerned.

11. Eleven of the 13 prefectures within Gansu province are deficit prefectures. Dingxi, for example, receives an annually negotiated fixed subsidy from the province. Five of the six counties in Dingxi are also deficit regions. In 1984, these counties had unplanned deficits, of which less than 50% was covered by the province. The remaining deficits were left to the prefectures to cover by cutting back on expenditures in the following year.

12. Over the last five years, there appears to have been some decentralization within the province in revenue collection. In 1980, 50% of total revenues accrued directly to the provincial-level government; by 1984, this share had declined to 27%. However, this shift is at least partly due to the fall in aggregate revenue from enterprise receipts, which constituted the bulk of province-level receipts (72%) in 1980. The proportion of expenditures being made at the provincial, prefectural and county levels are broadly similar, although expenditure shares are somewhat higher at lower levels. Thus,

about 20% of total expenditures are made at the provincial level, and around 60% at the county level. The relative shares of higher levels increased slightly during 1982-84. There is, however, a difference in composition of expenditures at different levels. Lower-level government outlays consist mainly of operating expenses. In 1984, almost 60% of province-level expenditures consisted of capital construction, while the share in county expenditures was less than 20%. It therefore seems that while the degree of vertical imbalance is not high, lower levels of the provincial government have relatively little authority over capital construction.

13. The horizontal distributions of revenues and expenditures, however, are considerably different, with a higher relative dispersion in revenues than in expenditures, at both the prefecture and the county levels (see Tables 6 and 7). These distributions show that the province has successfully reduced the total variance in the availability of budgetary resources across its different regions.

#### The Role of the Township

14. Beginning in 1984, the township was incorporated as a new layer of government below the county level. Townships are not new entities but rather new names for entities known as "people's communes." Communes were, however, productive units, while townships have financial functions and imply a separation of political and financial roles. The township also assists in developing rural industry and collective enterprises and in organizing the financial affairs of nonprofit organizations at the township level, such as government offices, schools and hospitals. By the end of 1985, there were 1,532 townships in Gansu. Revenue-gathering and expenditure-channeling functions have been adopted by 108 of the townships, which already have financial bureaus.

15. The principal revenues of townships are enterprise receipts from township-run collective enterprises, and small taxes on livestock and agricultural produce. Townships can also raise finances from surcharges which may be levied on some of these taxes to use as extrabudgetary resources. Township expenditures consist almost entirely of recurrent costs on education, culture and health, agriculture and social welfare. The share of expenditures on education and health is particularly high.

16. Revenues collected by townships do not augment total state budget revenues. Formerly, these would have been submitted to the state at the county level and would therefore have appeared in each consolidated budget statement. Under the new arrangements, however, the township is allowed to retain a portion of any surplus revenues collected, and higher levels of government finance only a portion of any unplanned deficits incurred by townships. There is therefore a new emphasis on self-reliance at lower levels, and, with revenue retention, an increased incentive to raise output and improve tax collection.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEThe Provincial Budget: Structure and FlowsGansu: Conversion of Budgetary Expenditure and Revenue  
to IMF Basis, 1984  
(Y million)

	Sector: <u>Industry</u>	<u>Agriculture</u>	<u>Other</u>	<u>Total</u>	
<u>EXPENDITURE</u>					
<u>State Budgetary Expenditure</u>					
Fixed	180.07	171.94	212.94	564.95	
Recurrent /a	139.18	144.08	1,266.84	1,550.10	
<u>Total</u>	<u>319.25</u>	<u>316.02</u>	<u>1,479.78</u>	<u>2,115.05</u>	
<u>Adjustment to IMF Basis</u>					
Add: Subsidies (recurrent) /b	-	-	82.81	82.81	
Add: Enterprise losses (recurrent) /c	33.12	2.81	110.63	146.56	
<u>Total Adjustment</u>	<u>33.12</u>	<u>2.81</u>	<u>193.44</u>	<u>229.37</u>	
<u>Adjusted Budgetary Expenditures</u>					
Fixed	180.07	171.94	212.94	564.95	
Recurrent	172.30	146.89	1,460.28	1,779.47	
<u>Total</u>	<u>352.37</u>	<u>318.83</u>	<u>1,673.22</u>	<u>2,344.42</u>	
	Source: <u>Enterprise revenue</u>	<u>Taxes</u>	<u>Other</u>	<u>Depre- ciation</u>	<u>Total</u>
<u>REVENUE</u>					
<u>State budgetary revenue</u>	216.61	1,044.32	15.59	46.86	1,323.38
Add: Enterprise losses	146.56	-	-	-	146.56
Add: Subsidies /d	82.81	-	-	-	82.81
<u>Adjusted Revenue</u>	<u>445.98</u>	<u>1,044.32</u>	<u>15.59</u>	<u>46.86</u>	<u>1,552.75</u>

/a "Aid to commune and brigade enterprises" has been included under recurrent expenditure on industry and not on agriculture.

/b Grain, edible oil, cotton and coal. All subsidies have here been added to "other" on the assumption that these are given directly to consumers. However, if some are given to the industrial production units concerned, this may not be appropriate.

/c Enterprise losses have been allocated to sectors on the basis of actual data, available by type of enterprise. All losses have been assumed to be "recurrent" costs.

/d Subsidies have been added to enterprise revenue, since they are deducted from this revenue category in the Chinese system.

Source: Gansu Bureau of Finance.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

The Provincial Budget: Structure and Flows

Gansu: Provincial Budget Revenues and Expenditures, 1980-84,  
Reconciliation of Chinese and IMF Definitions  
 (Y million)

	1980	1981	1982	1983	1984
Total revenue, Chinese definition	1,493.5	1,298.6	1,247.1	1,090.0	1,323.4
Plus: Subsidies /a	75.61	88.92	113.45	101.49	82.81
Operating losses of state-owned enterprises	210.61	238.41	272.25	187.32	146.56
<u>Total Additions</u>	<u>286.22</u>	<u>327.33</u>	<u>385.70</u>	<u>288.81</u>	<u>229.37</u>
Equals: Total revenue, IMF format	1,779.72	1,625.93	1,632.80	1,378.81	1,552.77
Total expenditure, Chinese definition	1,230.50	1,119.60	1,278.60	1,552.60	2,115.10
Plus: Subsidies /a	75.61	88.92	113.45	101.49	82.81
Operating losses of state-owned enterprises	210.61	238.41	272.25	187.32	146.56
<u>Total Additions</u>	<u>286.22</u>	<u>327.33</u>	<u>385.70</u>	<u>288.81</u>	<u>229.37</u>
Equals: Total expenditure, IMF format	1,516.72	1,446.93	1,664.30	1,841.41	2,344.57

/a These refer to price subsidies for grain and edible oil, cotton and coal. Fixed or special-purpose "subsidies" from the center are not included.

Source: Gansu Bureau of Finance.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

The Provincial Budget: Structure and Flows

Gansu, Jiangsu and China: Budgetary Revenues, 1982/83

	1982			1983		
	Gansu -- (Y million)	Jiangsu - (Y bln)	China (Y bln)	Gansu -- (Y million)	Jiangsu - (Y bln)	China (Y bln)
<u>Revenues</u>						
Enterprise receipts	353.1	1,652	29.6	138.5	1,829	24.1
Taxes	823.4	4,984	70.0	890.7	5,457	86.9
Of which: ICT	789.2	4,660	55.7	848.7	5,150	56.9
Agricultural tax	33.1	209	2.9	41.2	230	3.3
Other /a	70.5	25	12.8	60.8	21	13.9
<u>Total Revenues, Chinese Format</u>	<u>1,247.2</u>	<u>6,661</u>	<u>112.4</u>	<u>1,089.9</u>	<u>7,307</u>	<u>124.9</u>
Less: Foreign loan receipts /b	-	-	4.0	-	-	3.8
Less: Treasury bonds /b	-	-	4.4	-	-	4.2
Plus: Subsidies /c	113.5	2,050	32.0	101.5	2,013	32.2
Plus: Enterprise losses	272.3	275	4.3	187.3	175	2.8
<u>Total Revenues, IMF Format</u>	<u>1,632.9</u>	<u>8,986</u>	<u>140.3</u>	<u>1,378.7</u>	<u>9,495</u>	<u>151.9</u>
GDP	7,410	38,850	493.7	8,821	n.a.	546.9
Tax revenue as a % of GDP	11.11	12.83	14.18	10.10	n.a.	15.89
Total revenue as a % of GDP						
Chinese format	16.83	17.15	22.77	12.36	n.a.	22.84
IMF format	22.04	23.13	28.42	15.63	n.a.	27.77

/a This is a residual for all unallocated amounts.

/b These are receivables of the central government only.

/c Data on subsidies and enterprise losses are not available for Jiangsu. These have, therefore, been answered to by the same proposition of total revenues as in China as a whole. In the case of Gansu, the subsidies are given for the consumption of grain, edible oil, coal and cotton. In the entry for China, subsidies on agricultural inputs are also included.

Sources: Gansu Bureau of Finance; Statistical Yearbook of China, 1983 and 1984, op. cit.; IMF data; data collected from Jiangsu Province.

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## The Provincial Budget: Structure and Flows

## Gansu, Jiangsu and China: Budgetary Expenditures, 1982/83

	1982			1983		
	Gansu -- (Y million)	Jiangsu -- (Y million)	China -- (Y bln)	Gansu -- (Y million)	Jiangsu -- (Y million)	China -- (Y bln)
<b>Expenditures</b>						
Capital construction	161.9	329	30.9	234.2	533	38.3
Modernization	63.3	95	4.3	117.7	159	4.3
Aid to agriculture	226.8	345/b	8.0	198.9	203/b	8.7
Of which: Aid to commune and brigade enterprises	107.0		n.a.	86.6		n.a.
Urban maintenance	57.4	146	/c	64.5	250	/c
Culture, education, science and health	341.2	869	19.7	370.8	1,062	22.4
Administration	172.1	272	8.2	215.2	368	10.7
Other /d	256.3	407	26.6	351.7	654	27.1
<b>Total Expenditure, Chinese Format</b>	<b>1,279.0</b>	<b>2,463</b>	<b>97.7</b>	<b>1,553.0</b>	<b>3,229</b>	<b>111.5</b>
Less: Domestic and overseas loan repayments /e	-	-	4.8	-	-	3.3
Plus: Subsidies /f	113.5	851	32.0	101.5	961	32.2
Plus: Operating losses of enterprises /f	272.3	114	4.3	187.3	84	2.8
<b>Total Expenditure, IMF Format</b>	<b>1,664.7</b>	<b>3,428</b>	<b>129.2</b>	<b>1,841.8</b>	<b>4,274</b>	<b>143.2</b>

/a Defense expenditure (Y 17.6 billion in 1982, Y 17.7 billion in 1983) has been excluded from national expenditure.

/b There is no such entry as "aid to agriculture" in Jiangsu, though "aid to commune and brigade enterprises" is listed. In Gansu, however, this is only a subentry under "aid to agriculture." The other component in this category is "operating expenses for agriculture, forestry, irrigation, etc." Jiangsu may have included these among "other" expenditures; alternatively, the figure given here may represent a total of both subentries.

/c Not separately available for China as a whole.

/d This is a residual for all unaccounted-for amounts.

/e Provincial governments do not have domestic loans and few have overseas loans. The provinces here do not.

/f Subsidies for cotton, coal, edible oil and grain for Gansu. These plus agricultural subsidies and enterprise losses for Jiangsu have been calculated on the basis of their shares in China.

Sources: Gansu Bureau of Finance; data collected from Jiangsu Province; Statistical Yearbook of China, 1983, 1984, *op. cit.*; IMF data.

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## The Provincial Budget: Structure and Flows

Gansu, Jiangsu and China: Per Capita Revenues and Expenditures, 1982/83  
(Yuan)

	1982			1983		
	Gansu	Jiangsu	China /a	Gansu	Jiangsu	China /a
<u>Total Population /b</u> (million)	19.75	60.89	1,015	19.88	61.35	1,025
<u>Total Revenue per Capita, Chinese format</u>	63.1	109.4	110.7	54.8	119.1	121.9
<u>Total Revenue per Capita, IMF Format /a</u>	82.7	147.6	138.1	69.4	154.8	148.2
Enterprise receipts	17.9	27.1	29.2	7.0	29.8	23.5
Taxes	41.7	81.9	69.0	44.8	88.9	84.8
Of which: ICT	40.0	76.5	54.9	42.7	83.1	55.5
Agricultural tax	1.7	3.4	2.8	2.1	3.7	3.2
Other	3.6	0.4	12.6	3.1	0.3	13.6
Plus: Subsidies /c	5.1	33.7	31.5	5.1	32.8	31.4
Plus: Operating losses of enterprises /c	13.8	4.5	4.2	9.4	2.9	2.7
Plus: Foreign loan receipts and treasury bonds /d	-	-	8.3	-	-	7.8
<u>Total Expenditure per Capita, Chinese format</u>	64.8	40.4	96.3	78.1	52.6	108.8
<u>Total Expenditure per Capita, IMF format</u>	84.3	56.3	127.3	92.6	69.7	139.7
Capital construction	8.2	5.4	30.4	11.8	8.7	37.4
Modernization	3.2	1.6	4.2	5.9	2.6	4.2
Aid to agriculture	11.5	5.7/e	7.9	10.0	3.3	8.5
Of which: Aid to commune and brigade enterprises	5.4	5.7/e	n.a.	4.4	3.3	n.a.
Urban maintenance	2.9	2.4	n.a.	3.2	4.1	n.a.
Culture, education, science and health	17.3	15.3	19.4	18.7	17.3	21.9
Administration	8.7	4.5	8.1	10.8	6.0	10.4
Other	13.0	6.7	26.2	17.7	10.7	26.4
Plus: Subsidies	5.1	33.7	31.5	5.1	32.8	31.4
Plus: Operating losses of enterprises	13.8	4.5	4.2	9.4	2.9	2.7

/a Expenditures for all China exclude defense.

/b Year-end figures.

/c These are revenues of the central government only.

Sources: Gansu Bureau of Finance; data collected from Jiangsu Province; Statistical Yearbook of China, 1983 and 1984, op. cit.; IMF data.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEThe Provincial Budget: Structure and FlowsGansu: Inequalities in the Distribution of Per Capita  
Revenues and Expenditures Among Prefectures, 1983  
(Yuan)

Prefecture	Revenue per capita Total	Expenditures per capita		
		Total	Culture, education, science and health	Social welfare
Lanzhou	178.91	76.10	17.11	2.57
Jiaugun	162.69	87.41	19.86	1.73
Jiuquan	83.40	95.30	23.21	1.22
Zhangye	27.33	65.32	17.62	1.26
Wuwei	20.55	43.55	14.73	1.44
Dingxi	15.30	36.47	11.83	4.13
Tianshui	17.93	33.34	11.92	2.06
Wudu	11.91	39.42	11.12	2.51
Pingling	13.15	43.92	14.88	2.56
Qingyang	15.09	50.15	14.27	2.90
Lingxia	42.67	46.26	13.06	1.93
Gannan	20.95	117.96	32.12	2.99
Jinchang	115.83	86.22	13.20	1.57
<u>Average</u>	<u>54.84</u>	<u>78.12</u>	<u>18.65</u>	<u>2.48</u>
Inequality index, I /a	0.49	0.18	0.14	0.15

/a The inequality index, I, is defined as follows:

$$I = \frac{\sum_{j=1}^n [x_j - \bar{x}]^2}{2(n-1) \bar{x}^2} \quad j = 1, 2, \dots, n. \quad 0 \leq I \leq 1$$

where  $x_j$  are the values of the distribution,  $\bar{x}$  is the average value and  $n$  is the number of observations. In this statistic,  $I = 0$  if the distribution is perfectly equal (all values are identical) or  $I = 1$  if the distribution is perfectly unequal (the entire distribution is concentrated in a single observation and all other observations are zero). Thus, the greater the value of  $I$ , the higher the degree of inequality, or, the higher the dispersion of the distribution. This measure has the advantage over such measures as the coefficient of variation ( $\sigma/\bar{x}$  where  $\sigma$  is the variance of the distribution), that it varies from 0 to 1. The coefficient of variation is not similarly scaled.

Source: Estimated from data provided by Gansu Bureau of Finance.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

The Provincial Budget: Structure and Flows

Gansu: Inequalities in the Distribution of Per Capita  
Revenues and Expenditures Among Counties in Dingxi Prefecture, 1983 /a

County	Total population ( <sup>1</sup> 000)	Total revenue (Y <sup>1</sup> 000)	Total expenditure (Y <sup>1</sup> 000)	Per capita revenue total (Y)	Per capita expenditure total (Y)	Health expenditure			Education expenditure		
						Total (Y <sup>1</sup> 000)	Per capita (Y)	% of total expenditure (%)	Total (Y <sup>1</sup> 000)	Per capita (Y)	% of total expenditure (%)
Dingxi	371.9	5,093	10,862	13.69	29.40	708	1.90	6.5	2,853	7.67	26.3
Tongwei	351.2	2,056	8,914	5.85	25.38	517	1.47	5.8	2,400	6.83	26.9
Longxi	382.0	9,922	10,455	25.97	27.37	581	1.52	5.6	2,939	7.69	28.1
Weiyuan	283.8	1,526	8,047	5.38	25.35	427	1.50	5.3	2,039	7.18	25.3
Lintao	426.3	3,872	11,840	9.08	27.77	85	2.00	7.2	3,912	9.18	33.0
<u>Average</u>	<u>363.0</u>	<u>4,494</u>	<u>10,024</u>	<u>12.00</u>	<u>26.95</u>	<u>464</u>	<u>1.68</u>	<u>6.1</u>	<u>2,829</u>	<u>7.71</u>	<u>27.9</u>
Index of inequality, I /b				0.26	0.025		0.06			0.04	

/a This includes the five "permanent" counties of Dingxi which have belonged to it over all of the last five years. Counties leaving or joining Dingxi during this period have not been included.

/b For a definition and explanation of this statistic, see footnote /a in the previous table.

Source: Estimated from data provided by Gansu Bureau of Finance.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

1. The macroeconomic scenarios presented here for Gansu, Scenarios A and B, are closely related to the QUADRUPLE and BALANCE scenarios presented in the recent World Bank economic report entitled China: Long-Term Development Issues and Options (1985). In both cases, the shift from the first to the second scenario represents a change in the sectoral composition of investment and output, with a shift towards light industry, a lower rate of growth of industry relative to services, and a lower volume of investment required to achieve the same overall growth rate. The rates of growth of GDP in Gansu in each scenario are taken from the rates of growth of GDP in China, which are required to achieve the targets of QUADRUPLE (quadrupling of GVIAO between 1981 and 2000) and BALANCE. Unlike the all China model, the Gansu projections are not based on an intermediate target of doubling GVIAO by 1990. The sectoral output and investment figures for 1990 therefore represent a point on a growth path that is linear between 1984 and 2000.

2. Sectoral Output and Sectoral Rates of Growth (Tables 1 and 5). Both Scenarios A and B are based on an overall rate of growth of GDP consistent with the targets of QUADRUPLE and BALANCE. In Scenario A, the sectoral rates of growth of GDP for "industry", "education and health" and "other" have also been taken from the projected national rates for QUADRUPLE, weighted by Gansu's shares of different subsectors within these groups. The rate of growth of agriculture was determined as a residual. In Scenario B, national rates from BALANCE were used for industry and education and health. The rate of growth of agriculture was kept at the same value as in Scenario A, and "other" was determined as a residual.

3. Sectoral and Total Investment (Tables 2 and 6). The sectoral and total investment estimates are also based on the QUADRUPLE and BALANCE models. Net ICORs for each sector were estimated for China as a whole, in each of these models, and in the case of agriculture and industry were then explicitly adjusted to take account of Gansu conditions. The national agricultural ICORs were raised for Gansu, based on data on returns to different forms of agricultural investment in Gansu, given in Annex A. An industrial ICOR for Gansu was devised by weighting national ICORs by Gansu's sectoral shares of heavy and light industry. The ICOR used for 'other' sectors however was kept at the national figure. In the case of education and health, direct sectoral estimates of investment have been used, based on data available in their respective annexes, instead of using national ICORs.

4. Budgetary Investment Requirements (Tables 3 and 7). In the case of agriculture, industry, education and health, budgetary investment requirements have been estimated directly from sectoral data, given in Tables 11-20. In the case of industry it has been assumed that the proportion of expenditure which is financed by the budget remains the same as in 1984 in scenario A, but in scenario B it is assumed that no budgetary expenditure is incurred on industry. The proportion of expenditure financed by the budget for "other" is assumed to remain the same as in 1984 in both scenarios.

5. Ratios, Coefficients and ICORs Used (Tables 4 and 8). The ratios of fixed to working capital, budget to fixed investment, and budget investment to total budget expenditures are provided for each of the scenarios. ICORs for Gansu and their relationship to projected national ICORs are also summarized.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Sectoral GDP Shares under Scenario A, 1984-2000  
 (Y million at 1984 prices)

	1984 (Actual)	1990 (Projected)	2000 (Projected)	Rate of growth /a 1984-2000
Agriculture	2,622	3,289	4,799	3.85
Industry	4,335	6,574	13,161	7.19
Education & Health /b	352	569	1,268	8.34
Other	2,705	4,141	8,418	7.47
<u>GDP</u>	<u>10,014</u>	<u>14,573</u>	<u>27,646</u>	<u>6.55</u>

/a These are the rates which would be consistent with the target of quadrupling the value of China's gross industrial and agricultural output between 1981 and 2000. Rates used for "industry" "education and health" and "other" are the same as the national rates for these sectors, with national rates for different subsectors in "industry" and "other" weighted to correspond to their shares in Gansu. The rate for agriculture was determined as a residual to achieve consistency between the aggregate and other sectoral targets.

/b The output of education and health in 1984 has been estimated as a proportion of other services (i.e. excluding infrastructure). It has been assumed that the proportion in Gansu is the same as the national proportion.

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## Macroeconomic and Fiscal Projections: Method of Estimation

Investment Required under Scenario A, 1984-2000 /a  
(Y million at 1984 prices)

	1984 (Actual)			1990 (Projected) /b			2000 (Projected) /b		
	Fixed invest-ment	Working capital	Total	Fixed invest-ment	Working capital	Total	Fixed invest-ment	Working capital	Total
Agriculture	250	25	275	297	30	327	433	43	476
Industry	1,240	229	1,469	1,830	338	2,168	3,646	673	4,319
Education & health /b, /c	174	-	174	104	-	104	130	-	130
Of which:									
Education	132	-	132	52	-	52	52	-	52
Health	42	-	42	52	-	52	78	-	78
Other	787	120	907	2,024	309	2,333	3,634	554	4,188
<u>Total</u>	<u>2,451</u>	<u>374</u>	<u>2,825</u>	<u>4,255</u>	<u>677</u>	<u>4,932</u>	<u>7,843</u>	<u>1,270</u>	<u>9,113</u>

/a Derived for "industry", "agriculture" and "other" using the ICORS in table 4 and assuming that the ratios of fixed to working capital remain the same in future years as in 1984.

/b The aggregate figure for 1984 for "education and health" is derived from the investment figures for culture, education, science and health, given in Appendix A, Table 11, assuming that education and health account for 80% of total investment in this category, which is the same as the national proportion. Individual data for education and health are based on the figures for these sectors given in Annex C, Table 6.2 and Appendix D, Table 19. These figures, which are for 1983, have been increased by 60%, which is the proportional increase in state sector investment in this category between 1983 and 1984.

/c Figures for 1990 and 2000 for education and health are based on projected sectoral estimates of Annex C, Table 6.2 and Appendix D, Table 17. These estimates, which are in 1983 prices, have been increased by 3% (the general price increase from 1983 to 1984) to convert them to a 1984 base.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Budgetary Expenditure Requirements under Scenario A, 1984-2000  
 (Y million at 1984 prices)

	1984 (Actual)			2000 (Projected) /a		
	Fixed/b capital	Recur- rent costs	Total	Fixed/b capital	Recur- rent costs	Total
Agriculture	172	144	316	254	264/f	518
Industry	180	139/c	319	530	409/c	939
Education /d	34	261	295	26	273	299
Health /e	15	123	138	60	163	223
Other	164	883	1,047	754	2,796/c	3,550
<u>Total</u>	<u>564</u>	<u>1,550</u>	<u>2,114</u>	<u>1,624</u>	<u>3,905</u>	<u>5,529</u>

/a Figures for 1990 and 2000 for agriculture, industry, health and education are based on their estimated sectoral outlays (Appendix D, Tables 11-20). The figures for industry and "other" are based on the assumption that the ratios of budgetary investment to total fixed investment, and recurrent budgetary expenditure to fixed capital budgetary expenditure, will remain unchanged. Projected figures for health and education are increased by 3% to adjust them to a 1984 base, as the estimates of Tables 16-20 used a 1983 base. The increment is based on the general price index from 1983 to 1984.

/b Capital construction, modernization and "small construction."

/c Note that "loans to rural industry," though usually classified under "Aid to Agriculture" in Chinese state budgetary statistics, have here been included under recurrent costs on industry, which is in keeping with international sectoral classifications.

/d Figures do not include educational expenditures by state enterprises.

/e Recurrent costs on health include the government insurance scheme but not the enterprise-run labor insurance schemes.

/f Assumed to grow at the same rate as output.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Coefficients Used Under Scenario A, 1984

	Ratio of fixed invest- ment to work- ing capital 1984	Budgetary investment/ total fixed investment in Gansu 1984	Budgetary fixed investment/total budgetary expen- diture in Gansu 1984	Rate of growth of budgetary expenditure 1984-2000	Gansu ICORs		Gansu ICORs/ China ICORs	
					1990	2000	1990	2000
Agriculture	10.00	0.69	0.54/ <u>c</u>	3.14	2.58	2.58	1.48	1.43
Industry	5.41	0.15	0.56	6.97	4.59	4.57	1.03	1.02
Education & Health	/ <u>c</u>	0.29	0.11	1.16	/ <u>d</u>	/ <u>d</u>	/ <u>d</u>	/ <u>d</u>
Other	6.56	0.21	0.16	10.03	7.66	6.77	1.00	1.00
<u>GDP</u>	<u>6.55</u>	<u>0.23</u>	<u>0.27</u>	<u>7.58</u>	<u>5.16</u>	<u>5.03</u>	<u>1.13</u>	<u>1.12</u>

/a Details of the derivation of these are in Appendix A, Table 11.

/b Incremental capital output ratios in total investment (in fixed and working capital) for growth in net output.

/c See footnote C on table 8.

/d See footnote D on table 8.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Sectoral GDP Shares under Scenario B, 1984-2000  
 (Y million at 1984 prices)

	Actual 1984	Projected 1990	Projected 2000	Rate of growth 1984-2000 <u>/a</u>
Agriculture	2,622	3,289	4,799	3.85
Industry	4,335	6,200	11,257	6.15
Education and health	352	583	1,355	8.79
Other	2,705	4,492	10,458	8.82
<u>GDP</u>	<u>10,014</u>	<u>14,564</u>	<u>27,869</u>	<u>6.61</u>

/a These are the rates consistent with the achievement of an overall growth rate of GDP of 6.61% p.a., as in the BALANCE scenario for all of China. The growth rate for industry in Gansu is derived from the national rates for heavy and light industry, appropriately weighted by the shares of heavy and light industry in Gansu's industrial sector. The rate for agriculture has been kept the same as in Scenario A, the rate for education and health is the same as the national rate for this sector in BALANCE, and the rate for "other" has been determined as a residual.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Investment Required under Scenario B, 1984-2000 /a  
 (Y million at 1984 prices)

	1984			1990			2000		
	Fixed invest- ment	Working capital	Total	Fixed invest- ment	Working capital	Total	Fixed invest- ment	Working capital	Total
Agriculture	250	25	275	246	25	271	360	36	396
Industry	1,240	229	1,469	1,468	113	1,581	2,578	198	2,776
Education & health /b	<u>174</u>	-	<u>174</u>	<u>165</u>	-	<u>165</u>	<u>235</u>	-	<u>235</u>
Of which:									
Education	132	-	132	95	-	95	109	-	109
Health	42	-	42	70	-	70	126	-	126
Other	787	120	907	2,130	325	2,454	4,024	614	4,638
<u>Total</u>	<u>2,451</u>	<u>374</u>	<u>2,825</u>	<u>4,009</u>	<u>462</u>	<u>4,471</u>	<u>7,197</u>	<u>848</u>	<u>8,045</u>

/a Investments for industry, agriculture and others are based on projected ICORs in Table 8.

/b Figures for 1990 and 2000 for education and health are based on projected sectoral estimates of Annex C, Table 6.2 and Appendix D, Table 17. These estimates, which are in 1983 prices, have been increased by 3% (the general price increase from 1983 to 1984) to convert them to a 1984 base.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Budgetary Expenditure Requirements under Scenario B, 1984-2000  
 (Y million at 1984 prices)

	1984 (Actual)			2000 (Projected) /a		
	Fixed capital	Recur- rent costs	Total	Fixed capital	Recur- rent costs	Total
Agriculture /a	172	144	316	165	264/e	429
Industry /b	180	139	319	-	-	-
Education /c	34	261	295	59	730	789
Health /c	15	123	138	126	268	394
Other /d	164	883	1,047	835	3,414/e	4,249
<u>Total</u>	<u>565</u>	<u>1,550</u>	<u>2,115</u>	<u>1,185</u>	<u>4,676</u>	<u>5,861</u>

/a Based on estimates in Tables 11-13.

/b Assuming all expenditures for industry are shifted to nonbudgetary sources.

/c Based on estimates in Tables 16-20. Projected figures for health and education given in these tables are increased by 3% to adjust them to 1984 prices, as the estimates of Tables 16-20 are in 1983 prices. The increment is based on the general price increase from 1983 to 1984.

/d Based on the assumption that the ratios of budgetary investment to total fixed investment, and recurrent budgetary expenditure to fixed capital budgetary expenditure, will remain unchanged.

/e Assumed to grow at the same rate as output.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Coefficients Used under Scenario B

	Ratio of fixed invest- ment to work- ing capital 1984	Budgetary investment/ total fixed investment in Gansu 1984	Budgetary fixed investment/total budgetary expen- diture in Gansu 1984	Rate of growth of budgetary expenditure 1984-2000	Gansu ICORs		Gansu ICORs/ China ICORs	
					1990	2000	1990	2000
Agriculture	10.00	0.69	0.54	1.93	2.14	2.14	1.26	1.11
Industry	5.41	0.15	0.56	0.00	4.15	4.01	1.03	1.02
Education and health	-	0.29	0.11	6.47	-	-	-	-
Other	6.56	0.21	0.16	10.74	6.20	5.03	1.00	1.00
<u>GDP</u>	<u>6.55</u>	<u>0.23</u>	<u>0.27</u>	<u>7.73</u>	<u>4.60</u>	<u>4.37</u>	<u>1.14</u>	<u>1.11</u>

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Comparison of China and Gansu: GDP Shares

	1984		2000	
	Gansu Scenario A	China QUADRUPLE	Gansu Scenario A	China QUADRUPLE
Agriculture	26.2	33.1	17.4	25.5
Industry	43.3	39.9	47.6	43.0
Education and health	3.5	2.9	4.6	3.8
Other	27.0	24.1	30.4	27.7
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

	1984		2000	
	Gansu Scenario B	China BALANCE	Gansu Scenario B	China BALANCE
Agriculture	26.2	33.0	17.2	26.6
Industry	43.3	38.7	40.4	35.2
Education and health	3.5	2.9	4.9	4.1
Other	27.0	25.4	37.5	37.4
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Sources: Figures for Gansu are from Appendix D, Tables 1-8; figures for China are estimated from China: Long-Term Development Issues and Options, op. cit.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Comparison of China and Gansu: Rates of Growth  
 (%)

	1984-90	1990-2000	1984-2000
<u>Rate of Growth of GDP</u>			
Gansu, Scenario A	6.55	6.55	6.55
China, QUADRUPLE	6.83	6.31	6.55
Gansu, Scenario B	6.61	6.61	6.61
China, BALANCE	6.92	6.33	6.61
<u>Rate of Growth of Total Investment</u>			
Gansu, Scenario A	9.73	6.33	7.60
China, QUADRUPLE	7.37	6.16	6.73
Gansu, Scenario B	7.95	6.05	6.76
China, BALANCE	6.00	6.13	6.07

Sources: Figures for Gansu are from Appendix D, Tables 1-8; figures for China are estimated from China: Long-Term Development Issues and Options, op. cit.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Gansu: Agricultural Investment Requirements, 1984-2000  
 (Y million at 1984 prices)

	1984	2000 /a	
		Scenario A	Scenario B
<u>Total Fixed Investment Requirements</u>			
Loess hills rehabilitation	5	88	146
Irrigation	140	180	51
Migration to irrigated areas	5	5	2
Other	100	161	161
<u>Total</u>	<u>250</u>	<u>434</u>	<u>360</u>
<u>Budgetary Investment Requirements</u>			
Loess hills rehabilitation /b	2	19	29
Irrigation /c	105	135	38
Migration to irrigated areas /d	5	5	2
Other /e	60	96	96
<u>Total</u>	<u>172</u>	<u>255</u>	<u>165</u>

- /a In Scenario A, irrigation projects covering close to 300,000 ha are taken up, and all the proposed migration to irrigated areas is completed. However, only 60% of the total Loess Plateau rehabilitation is undertaken by 2000. In Scenario B, all the necessary loess hill rehabilitation (Zone II and a third of Zone I) is completed by the year 2000, but aside from projects already underway no new large irrigation projects are undertaken. Migration to irrigated areas also slows down, as a consequence.
- /b The budgetary share of the cost of loess hill rehabilitation consists of the grants given to cultivators for this purpose. It is assumed that the grants are made at the rate of Y 10 per mu for Zone II and Y 5 per mu for Zone I. This is equivalent to about a third of the daily wage of Y 1, in Zone II.
- /c Assuming 75% of irrigation investment requirements are financed by the state budget.
- /d Migration is assumed to be fully financed by the budget.
- /e The share of budgetary investment in this, over time, is assumed to stay the same as it is in 1984.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Gansu: Loess Hills Rehabilitation Costs  
(Y million at 1984 prices)

	1986-91	Total 1986-2000	
		Sce- nario A	Sce- nario B
<u>Area /a ('000 ha)</u>			
Zone I	-	598.7	997.8
Zone II	250.0	1,410.6	2,184.4
<u>Total</u>	<u>250.0</u>	<u>2,009.3</u>	<u>3,182.2</u>
<u>Investment Costs /c</u>			
Zone I	-	179.6	299.3
Zone II	150.0	846.4	1,310.6
<u>Total</u>	<u>150.0</u>	<u>1,026.0</u>	<u>1,609.9</u>
<u>Budgetary Costs /d</u>			
Zone I	-	44.9	74.8
Zone II	37.5	211.6	327.7
<u>Total</u>	<u>37.5</u>	<u>256.5</u>	<u>402.5</u>

/a The total area requiring rehabilitation is assumed to be all of Zone II plus a third of Zone I.

/b In Scenario A, 60% of the required rehabilitation is undertaken by 2000; in Scenario B, all the required rehabilitation is undertaken by 2000.

/c Investment costs for 1986 to 1991, for 250,000 ha of land, have been estimated to be Y 40 million for capital costs and Y 110 million for labor costs, with an input of 110 million man-days, at a daily wage of Y 1 per day. The per hectare cost is Y 600. Zone I costs are estimated to be half this level.

/d Budgetary costs are calculated at the rate of Y 5 per mu for Zone I and Y 10 per mu for Zone II.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Gansu: Estimated Irrigation Development Investment Requirements, 1986-2000  
 (Y million at 1984 prices)

Project	Area ( '000 ha)	Total costs /a (Y million)
Jingtai	33.0	285
Yindaruqin	57.0	649
Changma	42.0	383
Yinli	50.0	455
Jiuquan	13.0	118
Dunhuang	3.3	30
Linzhe	4.0	36
Yongdeng	5.3	48
Xicha	3.5	30
Xingbuzhiquan	3.5	30
Linding	22.0	250
<u>Total /b</u>	<u>236.6</u>	<u>2,314</u>

/a Costs in Jingtai and Yindaruqin are actual project estimates. Costs for Linding are assumed to be the same per ha as Yindaruqin, and costs per ha for Xicha and Xingbuzhiquan are assumed to be the same as for Jingtai. All other costs have been estimated as 0.8 times the per ha cost of Yindaruqin.

/b In addition to these, other irrigation projects may be taken up bring the total to about 300,000 ha.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEMacroeconomic and Fiscal Projections: Method of EstimationGansu: Industrial Investment Requirements Under Alternative Scenarios  
(Y million at 1984 prices)

	1984 (Actual)		2000 (Projected)	
	Y mln	% share	Scenario A (Y mln)	Scenario B (Y mln)
<u>Fixed Investment</u>				
State sector	1,171	94.4	2,968	1,720
Of which: Heavy	985	79.4	2,414	1,204
Light	186	15.0	554	516
Collectives, urban	30	2.4	292	429
Collectives, rural	39	3.2	386	429
Subtotal	<u>1,240</u>	<u>100.0</u>	<u>3,646</u>	<u>2,578</u>
Working capital	229		673	198/a
<u>Total Investment</u>	<u>1,469</u>		<u>4,319</u>	<u>2,776</u>

/a In scenario B it is assumed that the working capital requirements fall, relative to the present ratio, due to greater efficiency in the turnover of working capital.

Notes: Scenario A assumes that investment grows at 7.0% p.a. compared with an output growth rate of 7.2%. Investment is still mainly in the heavy industry sector.

Scenario B assumes a slower growth of investment and output but investment growth slows down much more rapidly than output growth. Output shifts markedly towards light industry and collective industry, and the investment requirements per unit of output on average are reduced. The overall industrial ICOR falls between 1984 and 2000, from 4.5 to 4.0, and investment grows at only 4.1% p.a. compared with output growth of 6.2% p.a.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Sources of Finance for Fixed Investment in Industry  
Under Alternative Scenarios, 1984-2000  
(Y million at 1984 prices)

	1984	2000 /a	
		Scen- nario A	Scen- nario B
<u>State Enterprise Investment</u>			
Total	1,171	2,967	1,720
Central budget /b	148.4	434	0
Provincial budget	181	529	0
Bank loans and retained earnings	841.6	2,004	1,719
<u>Urban Collective Investment</u>			
Total	30	292	429
Provincial budget	2	20	0
Bank loans and retained earnings	28	272	429
<u>Rural Collective Investment</u>			
Total	39	387	429
Provincial budget	0	0	0
Bank loans and retained earnings	39	387	429
<u>Total</u>	<u>1,240</u>	<u>3,646</u>	<u>2,578</u>

/a Scenario A assumes that the proportion of budgetary and nonbudgetary financing remain the same, while Scenario B assumes that all budgetary financing is shifted to nonbudgetary sources.

/b It is assumed that the ratio of central budget investment in industry to provincial budget investment on industry is the same as their ratio in aggregate investment in all sectors.

Source: Table 14 and Gansu Bureaus of Finance and Statistics.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Education Expenditures by Source of Finance, 1983-2000 /a  
(Y million at 1983 prices)

	1983	1990	2000
<u>Primary and Secondary</u>			
Public			
Capital	17	21	24
Recurrent	163	323	649
Enterprise			
Capital	3	3	4
Recurrent	9	19	40
Other			
Capital	39	41	45
Recurrent	35	21	-
Total			
Capital	59	65	73
Recurrent	207	363	689
<u>Total</u>	<u>266</u>	<u>428</u>	<u>762</u>
<u>Other Education</u>			
Public			
Capital	23	27	33
Recurrent	35	34	60
<u>Total Education</u>			
Public			
Capital	40	48	57
Recurrent	198	357	709

/a Covers only Scenario B.

Source: Annex C.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Gansu: Fixed Capital Expenditure Requirements  
for the Health Sector, 1983-2000  
(Y million at 1983 prices)

	1983	1990 /a		2000 /a	
		Sce- nario A	Sce- nario B	Sce- nario A	Sce- nario B
<u>Hospital Beds (no.)</u>					
Ministry of Public Health and collectives /b	24,350	34,132	37,582	50,907	69,854
Enterprise sector	10,450	13,813	10,450	20,793	10,450
<u>Total</u>	<u>34,800</u>	<u>47,945</u>	<u>48,032</u>	<u>71,700</u>	<u>80,304</u>
<u>Fixed Capital Outlays (Y mln)</u>					
<u>Ministry of Public Health</u>	<u>15.66</u>	<u>39.19</u>	<u>67.71</u>	<u>58.43</u>	<u>121.96</u>
Curative	11.12	27.85	48.08	41.53	86.60
Preventive	1.57	3.90	6.79	5.81	12.23
Other /c	2.97	7.44	12.84	11.09	23.13
<u>Other /d</u>	<u>10.74</u>	<u>11.53</u>	<u>-</u>	<u>17.35</u>	<u>-</u>
Curative	10.74	11.53	-	17.35	-
Preventive	-	-	-	-	-
Other	-	-	-	-	-
<u>Total /e</u>	<u>26.40</u>	<u>50.72</u>	<u>67.71</u>	<u>75.78</u>	<u>121.96</u>
Curative	21.86	39.38	48.08	58.88	86.60
Preventive	1.57	3.90	6.79	5.81	12.23
Other	2.97	7.44	12.84	11.09	23.13

/a Under Scenario A: (i) hospital beds grow at a constant rate to reach 3 per 1,000 persons in the province as a whole by the year 2000; (ii) the Ministry of Public Health (MOPH) contribution to curative health facilities remains at its present average level of Y 1,713 per bed; (iii) preventive health services grow at the same rate as curative services. Under Scenario B: (i) hospital beds reach the target of at least 3 per 1,000 persons in each county of the province by 2000; (ii) the MOPH capital contribution to curative health facilities rises to Y 1,908 per bed to bring the subsidy of collective hospital beds up to the MOPH level; (iii) preventive health facilities increase as barefoot doctors rise to 2 per administrative village and are subsidized at Y 85 per month. New beds in rural areas are provided by the MOPH rather than the enterprise sector, so that there is no investment in the number of beds of the enterprise sector.

/b Collective sector beds are also largely financed by the MOPH.

/c The ratio of "other" to curative is assumed to stay constant at 27%. "Other" includes teaching, research and some facilities used for both curative and preventive medicine.

/d Calculated on the difference between MOPH and total capital outlays.

/e Estimated based on the ratio of capital expenditure for health in Gansu in 1981, reported in China: The Health Sector (World Bank, 1983) and the figure provided by the Gansu provincial health bureau.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEMacroeconomic and Fiscal Projections: Method of EstimationGansu: Recurrent Expenditure Requirements for the Health Sector, 1983-2000  
(Y million at 1983 prices)

	1983	1990 /e		2000 /e	
		Scen- nario A	Scen- nario B	Scen- nario A	Scen- nario B
<u>Ministry of Public Health</u>	<u>74.55</u>	<u>87.55</u>	<u>148.54</u>	<u>130.56</u>	<u>232.96</u>
Curative /a	49.79	58.47	71.71	87.20	133.28
Preventive /b	14.72	17.29	55.63	25.78	72.80
Of which: Barefoot doctors	(0.84)	(0.99)	(35.64)	(1.47)	(35.64)
Other	10.04	11.79	21.20	17.58	26.88
<u>Government Insurance Schemes /c</u>	<u>19.60</u>	<u>22.54</u>	<u>22.54</u>	<u>27.54</u>	<u>27.54</u>
Curative	19.60	22.54	22.54	27.54	27.54
Preventive	-	-	-	-	-
Other	-	-	-	-	-
<u>Other Sources</u>	<u>273.00</u>	<u>393.34</u>	<u>332.26</u>	<u>594.73</u>	<u>582.69</u>
Curative	273.00	393.34	332.26	594.73	582.69
Preventive	-	-	-	-	-
Other	-	-	-	-	-
<u>Total /d</u>	<u>367.15</u>	<u>503.43</u>	<u>504.34</u>	<u>752.85</u>	<u>843.19</u>
Curative	342.39	474.35	427.51	709.47	743.51
Preventive	14.72	17.29	55.63	25.78	72.80
Other	10.04	11.79	21.20	17.58	26.88

/a Assuming an MOPH capital cost contribution of Y 1,713 per bed in Scenario A and Y 1,908 in Scenario B.

/b Preventive services other than barefoot doctors are assumed to grow at the same rate as curative services.

/c Assumed to grow at 2% p.a. These do not include labor insurance schemes, which are included in "other sources."

/d Assumes a total recurrent expenditure of Y 10,500 per hospital bed.

/e See Appendix D, Table 17 for the various elements of each scenario.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Gansu: Total Health and Education Costs in Scenarios A and B, 1983-2000  
(Y million at 1983 prices)

	1983 (Actual)	1990			2000		
		Sce- nario A	Sce- nario B	Dif- ference	Sce- nario A	Sce- nario B	Dif- ference
<u>Capital Costs</u>							
Health	26.1	50.7	67.7	17.0	75.8	122.0	46.2
Education	82.3	50.0	92.0	42.0	50.0	106.0	56.0
<u>Total</u>	<u>108.4</u>	<u>100.7</u>	<u>159.7</u>	<u>59.0</u>	<u>125.8</u>	<u>228.0</u>	<u>102.2</u>
<u>Recurrent Costs</u>							
Health	367.2	503.4	504.3	0.9	752.9	843.2	90.3
Education	241.5	195.0	398.0	203.0	322.0	749.0	427.0
<u>Total</u>	<u>608.7</u>	<u>698.4</u>	<u>902.3</u>	<u>203.9</u>	<u>1,074.9</u>	<u>1,592.2</u>	<u>517.3</u>
<u>GRAND TOTAL</u>	<u>717.1</u>	<u>799.1</u>	<u>1,062.0</u>	<u>262.9</u>	<u>1,200.7</u>	<u>1,820.2</u>	<u>619.5</u>

Sources: Annex C and Appendix D, Tables 17 and 18.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Macroeconomic and Fiscal Projections: Method of Estimation

Gansu: Budgetary Expenditures on Health and Education, 1983-2000  
(Y million at 1983 prices)

	1983 (Actual)	1990			2000		
		Sce- nario A	Sce- nario B	Dif- ference	Sce- nario A	Sce- nario B	Dif- ference
<u>Capital Costs</u>							
Health	15.66	39.19	67.71	28.52	58.43	121.96	63.53
Education /b	43.49	24.00	48.00	24.00	24.00	57.00	33.00
<u>Total</u>	<u>59.15</u>	<u>63.20</u>	<u>115.71</u>	<u>52.52</u>	<u>82.40</u>	<u>141.40</u>	<u>59.00</u>
<u>Recurrent Costs</u>							
Health /a	94.15	110.09	171.08	60.99	158.12	260.05	103.28
Education	206.54	160.00	358.00	198.00	265.00	709.00	444.00
<u>Total</u>	<u>300.69</u>	<u>270.10</u>	<u>529.08</u>	<u>258.99</u>	<u>423.10</u>	<u>969.05</u>	<u>547.28</u>
<u>Total Costs</u>							
Health	110.81	149.28	238.79	89.51	216.55	382.01	166.81
Education	250.03	184.00	406.00	222.00	289.00	766.00	477.00
<u>Total</u>	<u>360.84</u>	<u>333.20</u>	<u>644.79</u>	<u>311.51</u>	<u>505.50</u>	<u>1,148.01</u>	<u>643.81</u>

/a Ministry of Public Health and government insurance schemes.

/b This includes state enterprises.

Sources: Annex C and Appendix D, Tables 17 and 18.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Notes on Projections of Urban/Rural Population and Employment, 1980-2000

1. Two sets of projections of the population of Gansu from 1980 to 2000 have been run (See Tables 1-6). Assumptions about initial population age distributions, fertility and mortality are identical for both sets; the fertility and mortality assumptions approximate the assumptions underlying the official Gansu projections. The two sets of projections differ with respect to assumptions about migration flows, as described below.
2. Initial Population Age Distribution. The 1982 census provides the age distribution of the population of Gansu by sex and single years of age for mid-1982; the total population and the urban and rural breakdown are given in a number of sources, with minor inconsistencies, but no age/sex distribution is given by type of place. In order to obtain separate urban and rural projections, age distribution by type of place for mid-1982 had to be approximated. The proportion of urban population in Gansu is estimated to be about 16% compared with 20.6% nationally. The sex ratio of the Gansu population, 107.2 males per 100 females, was higher than the national average of 105.2. It was therefore necessary to use two steps to approximate the urban-rural age distributions. The first step was to calculate proportional age distributions by sex for the urban and rural population of China as a whole (the urban population was taken as that living in cities and towns, the rural as the county population). The urban and rural populations by sex of Gansu were then obtained by assuming that the same absolute difference between urban and rural sex ratios existed in Gansu as in the country as a whole, though around a higher average. The urban and rural totals by sex were then distributed by age group following the national proportional distributions.
3. Fertility Assumptions. The fertility assumptions were taken from the medium variant of the official projections, with total fertility of 2.7 for calendar year 1981 and 1.7 for the period mid-1990 to mid-2000. From 1981 to 1990, fertility was assumed to decline in a linear pattern. Age-specific fertility rates were assumed to have the age pattern of those reported for 1981 and were scaled throughout to the assumed fertility level, that is, total fertility. The same fertility assumptions were used for both urban and rural areas.
4. Mortality Assumptions. The mortality assumptions were also taken from the official Gansu projections, using the expectations of life at birth given for 1981, 1990 and 2000, interpolating as necessary, and then assuming that the mortality conditions for a given period could be approximated by a Coale-Demeny "West" family model life table with the corresponding expectation of life at birth. The same mortality assumptions were used for urban and rural areas.

5. Migration Assumptions. The first set of projections assume no migration, either from rural to urban areas or from Gansu as a whole. The second set of projections is based on no migration up to mid-1985, but from 1985 to 2000 rural-urban migration was assumed (at a constant numerical level, 60% male) to increase the proportion of urban population to 24% in 2000, and emigration from the province as a whole was calculated to result in zero population growth for the province from 1985 to 2000.

6. Employment Assumptions. The first set of assumptions is closely related to the QUADRUPLE scenario presented in the recent World Bank economic report; the second set of projections is closely related to the BALANCE scenario.

7. Limitations of the Assumptions. For lack of a sound basis for alternative assumptions, both fertility and mortality were assumed to be the same in rural as in urban areas; in fact, both are probably higher in rural than in urban areas. The official mortality assumptions imply a more rapid increase in male than in female expectation of life at birth (giving a lower male than female infant mortality rate by the 1995-2000 period); this assumption is unlikely to be correct, and the initial male-female differential is probably too low. The migration model used in the projections is highly simplistic; net numbers of male and female migrants are distributed by age on the basis of the proportion of male migrants, assumed throughout to be 60 males for every 100 migrants. The numbers of migrants by age group are thus independent of the population of each age group (since numbers, not rates, are used); this is implausible, and nearly wipes out the male rural cohort aged 20-24 in 1980 (the cohort born during the demographic crisis in the late 1950s). The special age groups and populations by single calendar years are based on a mixture of interpolation and forward projection that will not always work well when applied to an age distribution with marked irregularities in numbers by five-year age groups; the numbers should not, however, be absurd.

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## Notes on Projections of Urban/Rural Population and Employment, 1980-2000

Gansu Total Population: No Net Migration  
(<sup>000</sup>)

Age group	1980	1985	1990	1995	2000
<b>Males</b>					
0-4	974	960	944	951	919
5-9	1,227	965	952	937	946
10-14	1,458	1,222	961	949	934
15-19	1,237	1,450	1,216	957	945
20-24	601	1,227	1,439	1,207	951
25-29	1,036	595	1,216	1,427	1,198
30-34	683	1,025	589	1,205	1,415
35-39	504	675	1,013	583	1,193
40-44	488	496	664	998	575
45-49	489	476	484	649	977
50-54	404	470	458	467	627
55-59	329	380	443	433	442
60-64	257	299	346	404	397
65-69	191	221	258	300	353
70-74	117	151	176	206	241
75+	95	124	161	197	237
<b>Total</b>	<b>10,091</b>	<b>10,733</b>	<b>11,317</b>	<b>11,869</b>	<b>12,350</b>
<b>Females</b>					
0-4	882	905	889	896	865
5-9	1,139	872	896	881	889
10-14	1,351	1,134	869	893	879
15-19	1,185	1,344	1,129	865	889
20-24	569	1,176	1,335	1,122	860
25-29	945	564	1,165	1,124	1,114
30-34	620	934	558	1,154	1,312
35-39	442	612	922	551	1,141
40-44	416	435	602	908	543
45-49	433	407	425	589	890
50-54	359	419	394	412	572
55-59	308	342	400	377	395
60-64	256	286	318	373	352
65-69	210	228	255	285	335
70-74	146	173	189	212	238
75+	154	180	214	242	275
<b>Total</b>	<b>9,414</b>	<b>10,009</b>	<b>10,558</b>	<b>11,083</b>	<b>11,548</b>
<b>Total Males and Females</b>	<b>19,505</b>	<b>20,742</b>	<b>21,875</b>	<b>22,952</b>	<b>23,899</b>
	<b>1980-85</b>	<b>1985-90</b>	<b>1990-95</b>	<b>1995-2000</b>	
<b>Related Indicators</b>					
Birth rate	19.6	18.1	17.3	15.9	
Death rate	7.2	7.4	7.6	7.8	
Rate natural increase	1.24	1.07	0.97	0.81	
Growth rate	1.23	1.06	0.96	0.81	
Total fertility	2.527	1.978	1.699	1.699	
Gross reproduction rate	1.227	0.960	0.825	0.825	
Net reproduction rate	1.128	0.889	0.768	0.774	

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## Notes on Projections of Urban/Rural Population and Employment, 1980-2000

Gansu Urban Population: No Migration  
(<sup>1</sup>000)

Age group	1980	1985	1990	1995	2000
<b>Males</b>					
0-4	108	181	157	136	118
5-9	141	107	179	156	135
10-14	197	140	106	179	156
15-19	208	196	140	106	178
20-24	141	206	195	139	105
25-29	192	139	205	193	138
30-34	127	190	138	203	192
35-39	94	126	188	136	201
40-44	100	93	124	185	135
45-49	101	98	90	121	181
50-54	77	97	94	87	117
55-59	51	72	91	89	83
60-64	39	47	66	83	82
65-69	28	33	40	57	73
70-74	17	22	26	32	46
75+	14	18	24	29	36
<b>Total</b>	<b>1,635</b>	<b>1,765</b>	<b>1,863</b>	<b>1,932</b>	<b>1,974</b>
<b>Females</b>					
0-4	98	171	148	128	111
5-9	130	96	169	147	127
10-14	182	129	96	168	147
15-19	191	131	128	96	168
20-24	128	189	180	128	95
25-29	171	127	187	178	127
30-34	105	169	126	186	177
35-39	75	103	167	124	184
40-44	85	74	101	165	123
45-49	81	84	72	99	161
50-54	58	79	81	70	96
55-59	45	56	75	77	67
60-64	36	42	52	70	72
65-69	29	32	37	46	63
70-74	21	24	27	31	39
75+	24	27	31	35	40
<b>Total</b>	<b>1,460</b>	<b>1,583</b>	<b>1,678</b>	<b>1,748</b>	<b>1,795</b>
<b>Total Males and Females</b>	<b>3,095</b>	<b>3,347</b>	<b>3,541</b>	<b>3,680</b>	<b>3,769</b>
<b>Related Indicators</b>					
	<b>1980-85</b>	<b>1985-90</b>	<b>1990-95</b>	<b>1995-2000</b>	
Birth rate	23.1	18.7	15.4	12.8	
Death rate	7.3	7.4	7.6	8.0	
Rate natural increase	1.58	1.13	0.78	0.48	
Growth rate	1.57	1.12	0.77	0.48	
Total fertility	2.530	1.980	1.700	1.700	
Gross reproduction rate	1.228	0.961	0.825	0.825	
Net reproduction rate	1.128	0.889	0.768	0.774	

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## Notes on Projections of Urban/Rural Population and Employment, 1980-2000

Gansu Rural Population: No Migration  
(<sup>1</sup>000)

Age group	1980	1985	1990	1995	2000
<b>Males</b>					
0-4	866	779	786	815	802
5-9	1,086	858	772	781	810
10-14	1,261	1,082	855	770	778
15-19	1,029	1,254	1,076	851	767
20-24	460	1,020	1,244	1,069	846
25-29	844	456	1,011	1,234	1,061
30-34	556	835	451	1,002	1,224
35-39	410	549	825	446	992
40-44	388	403	540	813	440
45-49	388	378	393	528	796
50-54	328	373	364	379	510
55-59	278	308	351	344	359
60-64	218	252	280	321	315
65-69	163	188	218	243	280
70-74	100	129	149	174	196
75+	80	105	138	168	201
<b>Total</b>	<b>8,456</b>	<b>8,968</b>	<b>9,454</b>	<b>9,937</b>	<b>10,377</b>
<b>Females</b>					
0-4	784	734	741	767	755
5-9	1,010	776	727	734	762
10-14	1,169	1,005	773	725	732
15-19	994	1,163	1,001	770	722
20-24	441	987	1,155	994	765
25-29	773	437	978	1,146	987
30-34	516	765	432	968	1,136
35-39	367	508	755	427	958
40-44	331	361	500	743	421
45-49	352	323	353	490	729
50-54	300	340	313	342	476
55-59	263	286	325	299	327
60-64	219	244	266	303	280
65-69	180	195	218	238	272
70-74	125	149	162	181	199
75+	130	153	183	208	235
<b>Total</b>	<b>7,954</b>	<b>8,427</b>	<b>8,880</b>	<b>9,335</b>	<b>9,753</b>
<b>Total Males and Females</b>	<b>16,410</b>	<b>17,395</b>	<b>18,335</b>	<b>19,272</b>	<b>20,130</b>
<b>Related Indicators</b>	<b>1980-85</b>	<b>1985-90</b>	<b>1990-95</b>	<b>1995-2000</b>	
Birth rate	18.9	18.0	17.7	16.5	
Death rate	7.2	7.4	7.6	7.7	
Rate natural increase	1.18	1.06	1.01	0.88	
Growth rate	1.17	1.05	1.00	0.87	
Total fertility	2.530	1.980	1.700	1.700	
Gross reproduction rate	1.228	0.961	0.825	0.825	
Net reproduction rate	1.128	0.889	0.768	0.774	

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Notes on Projections of Urban/Rural Population and Employment, 1980-2000

Gansu Total Population: Zero Overall Growth  
(<sup>000</sup>)

Age group	1980	1985	1990	1995	2000
<b>Males</b>					
0-4	974	960	885	952	795
5-9	1,227	965	898	831	809
10-14	1,458	1,222	927	865	804
15-19	1,237	1,450	1,178	889	834
20-24	601	1,227	1,352	1,094	822
25-29	1,036	595	1,098	1,237	1,001
30-34	683	1,025	486	997	1,153
35-39	504	675	937	413	932
40-44	488	496	612	877	371
45-49	489	476	453	571	837
50-54	404	470	444	425	542
55-59	329	380	436	413	397
60-64	257	299	343	396	377
65-69	191	221	257	297	345
70-74	117	151	176	206	239
75+	95	124	161	197	237
<b>Total</b>	<b>10,091</b>	<b>10,733</b>	<b>10,642</b>	<b>10,560</b>	<b>10,492</b>
<b>Females</b>					
0-4	882	905	832	801	747
5-9	1,139	872	842	777	756
10-14	1,351	1,134	834	809	750
15-19	1,185	1,344	1,095	801	781
20-24	569	1,176	1,271	1,031	750
25-29	945	564	1,090	1,194	970
30-34	620	934	500	1,029	1,142
35-39	442	612	883	460	989
40-44	416	435	579	850	437
45-49	433	407	414	557	825
50-54	359	419	389	397	537
55-59	308	342	398	370	378
60-64	256	286	317	370	345
65-69	210	228	254	283	332
70-74	146	173	189	212	236
75+	154	180	214	242	275
<b>Total</b>	<b>9,414</b>	<b>10,009</b>	<b>10,100</b>	<b>10,182</b>	<b>10,250</b>
<b>Total Males and Females</b>	<b>19,505</b>	<b>20,742</b>	<b>20,742</b>	<b>20,742</b>	<b>20,742</b>
<b>Related Indicators</b>					
	<b>1980-85</b>	<b>1985-90</b>	<b>1990-95</b>	<b>1995-2000</b>	
Birth rate	19.6	18.1	17.3	16.0	
Death rate	7.2	7.5	7.9	8.4	
Rate natural increase	1.24	1.06	0.94	0.76	
Growth rate	1.23	0.00	0.00	0.00	
Total fertility	2.527	1.978	1.699	1.699	
Gross reproduction rate	1.227	0.960	0.825	0.825	
Net reproduction rate	1.128	0.889	0.768	0.774	

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## Notes on Projections of Urban/Rural Population and Employment, 1980-2000

Gansu Urban Population: 24% Urban by 2000  
(<sup>000</sup>)

Age group	1980	1985	1990	1995	2000
<b>Males</b>					
0-4	108	181	178	172	167
5-9	141	107	197	194	189
10-14	197	140	118	208	205
15-19	208	196	152	130	220
20-24	141	206	223	180	157
25-29	192	139	244	261	218
30-34	127	190	172	276	293
35-39	94	126	213	196	299
40-44	100	93	141	227	211
45-49	101	98	101	148	233
50-54	77	97	99	102	148
55-59	51	72	94	96	99
60-64	39	47	67	87	89
65-69	28	33	41	58	76
70-74	17	22	26	33	47
75+	14	18	24	29	37
<b>Total</b>	<b>1,635</b>	<b>1,765</b>	<b>2,089</b>	<b>2,397</b>	<b>2,687</b>
<b>Females</b>					
0-4	98	171	168	163	158
5-9	130	96	187	185	179
10-14	182	129	107	198	195
15-19	191	181	140	118	208
20-24	128	189	201	160	139
25-29	171	127	212	224	184
30-34	105	169	145	230	241
35-39	75	103	180	156	240
40-44	85	74	109	185	162
45-49	81	84	76	110	185
50-54	58	79	83	76	109
55-59	45	56	76	80	73
60-64	36	42	52	71	75
65-69	29	32	37	47	64
70-74	21	24	27	31	39
75+	24	27	31	35	40
<b>Total</b>	<b>1,460</b>	<b>1,583</b>	<b>1,831</b>	<b>2,067</b>	<b>2,291</b>
<b>Total Males and Females</b>	<b>3,095</b>	<b>3,347</b>	<b>3,920</b>	<b>4,464</b>	<b>4,978</b>
	<b>1980-85</b>	<b>1985-90</b>	<b>1990-95</b>	<b>1995-2000</b>	
<b>Related Indicators</b>					
Birth rate	23.1	18.8	15.7	13.4	
Death rate	7.3	6.9	6.8	6.8	
Rate natural increase	1.58	1.19	0.89	0.66	
Growth rate	1.57	3.16	2.60	2.18	
Total fertility	2.530	1.980	1.700	1.700	
Gross reproduction rate	1.228	0.961	0.825	0.825	
Net reproduction rate	1.228	0.889	0.768	0.774	

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## Notes on Projections of Urban/Rural Population and Employment, 1980-2000

Gansu Rural Population: 76% Rural by 2000  
(<sup>000</sup>)

Age group	1980	1985	1990	1995	2000
<b>Males</b>					
0-4	866	779	708	680	628
5-9	1,086	858	701	637	620
10-14	1,261	1,082	809	657	599
15-19	1,029	1,254	1,026	760	614
20-24	460	1,020	1,129	914	664
25-29	844	456	854	976	783
30-34	556	835	314	721	860
35-39	410	549	723	217	633
40-44	388	403	471	650	160
45-49	388	378	352	423	604
50-54	328	373	345	322	394
55-59	278	308	343	318	298
60-64	218	252	276	309	288
65-69	164	188	216	239	269
70-74	100	129	149	173	192
75+	80	105	138	168	200
<b>Total</b>	<b>8,456</b>	<b>8,968</b>	<b>8,553</b>	<b>8,164</b>	<b>7,806</b>
<b>Females</b>					
0-4	784	734	664	638	589
5-9	1,010	776	655	593	577
10-14	1,169	1,005	727	611	555
15-19	994	1,163	955	682	573
20-24	441	987	1,070	871	611
25-29	773	437	878	970	786
30-34	516	765	355	799	901
35-39	369	508	703	303	749
40-44	331	361	470	665	275
45-49	352	323	338	447	640
50-54	300	340	306	321	428
55-59	263	286	322	290	305
60-64	219	244	265	299	270
65-69	180	195	217	236	267
70-74	125	149	162	181	197
75+	130	153	183	208	235
<b>Total</b>	<b>7,954</b>	<b>8,427</b>	<b>8,269</b>	<b>8,114</b>	<b>7,958</b>
<b>Total Males and Females</b>	<b>16,410</b>	<b>17,395</b>	<b>16,822</b>	<b>16,278</b>	<b>15,764</b>
<b>Related Indicators</b>					
	<b>1980-85</b>	<b>1985-90</b>	<b>1990-95</b>	<b>1995-2000</b>	
Birth rate	18.9	17.9	17.7	16.8	
Death rate	7.2	7.6	8.2	8.8	
Rate natural increase	1.18	1.03	0.95	0.79	
Growth rate	1.17	-0.67	-0.66	-0.64	
Total fertility	2.530	1.980	1.700	1.700	
Gross reproduction rate	1.228	0.961	0.825	0.825	
Net reproduction rate	1.128	0.889	0.768	0.774	

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Notes on Projections of Urban/Rural Population and Employment, 1980-2000

Population and Employment Under Alternative Scenarios, 1982-2000  
(Millions)

	1982	1990		2000	
		Scenario A	Scenario B	Scenario A	Scenario B
<u>Total Population</u> /a	19.57	1.88	20.74	23.90	20.74
Urban	3.06	3.54	3.92	3.77	4.97
Rural	16.51	18.34	16.82	20.13	15.76
<u>Working-Age Population</u> /b	11.78	15.11	14.27	16.79	14.42
Urban	2.11	2.50	2.78	2.68	3.58
Rural	9.67	12.61	11.49	14.11	10.84
<u>Labor Force Total</u> /c	8.23	10.53	10.00	11.68	10.21
Urban	1.70	2.02	2.24	2.16	2.89
Rural nonagricultural /d	0.29	0.67	0.71	1.90	2.20
Agricultural /e	6.24	7.84	7.05	7.62	5.12

/a The projections under Scenario A are taken from Appendix E, Tables 1-3; the projections under Scenario B are taken from Appendix E, Tables 4-6.

/b Defined as those aged 15-64.

/c Based on the assumption that urban and rural labor force participation rates remain the same as in 1982; i.e., 0.806 in urban areas and 0.675 in rural areas.

/d Assuming that by the year 2000, nonagricultural employment accounts for 20% of rural employment under Scenario A and 30% under Scenario B.

/e Residual.

ANNEX A: An Agricultural Development Program for Dingxi and Hexi

Table of Contents

	<u>Page No.</u>
I. <u>OVERVIEW OF THE AGRICULTURAL SECTOR IN GANSU</u> .....	137
The Natural Resource Base.....	137
Agricultural Production.....	139
Agricultural Incomes.....	140
Intraprovincial Disparities in Agricultural Resources and Incomes.....	141
Agricultural Zones in Dingxi.....	143
Rural Energy in Dingxi.....	145
II. <u>GOVERNMENT OBJECTIVES AND STRATEGY FOR DEVELOPMENT     OF DINGXI AND HEXI</u> .....	149
Rainfed Agricultural Investments.....	149
Irrigation Development.....	150
Resettlement.....	150
Rationale for Strategy.....	151
III. <u>LOESS HILLS REHABILITATION</u> .....	152
Rehabilitation Measures.....	153
Crops and Cropping Systems.....	155
Animal Production.....	158
Fuelwood Forestry.....	159
Rural Household Energy Considerations.....	159
Institutional Arrangements.....	162
Financing Arrangements.....	162
Employment and Population Implications.....	166
Economic and Financial Analysis.....	168
Principal Issues.....	175

	<u>Page No.</u>
IV. <u>IRRIGATION DEVELOPMENT</u> .....	177
The Irrigation Program.....	177
Types of Development.....	180
Design of Irrigation Systems.....	181
Irrigated Crop Production Systems.....	182
Role of Forestry and Livestock.....	185
Organization and Management.....	186
Financing Arrangements.....	188
Economic and Financial Returns.....	189
Principal Issues.....	190
V. <u>RESETTLEMENT</u> .....	196
Methodology and Schedule of Resettlement.....	196
Organization and Management.....	199
Financing Arrangements.....	200
Principal Issues.....	200
VI. <u>AN INTEGRATED DEVELOPMENT PROGRAM FOR THE "TWO XIS"</u> .....	201
Loess Hills Rehabilitation.....	201
Irrigation Development.....	202
Resettlement.....	202
Planning and Implementation.....	203
 <u>Text Tables</u>	
Table 1.1: Area, Yield and Production of Major Crops.....	139
Table 1.2: Intraprovincial Disparities in Agricultural Resources and Incomes.....	142
Table 1.3: Growth Rates of Agricultural Output, 1980-84.....	143
Table 1.4: Agricultural Zones in Dingxi.....	144
Table 3.1: Crop Yields.....	156
Table 3.2: Payments for Land Rehabilitation and Other Activities.....	164
Table 3.3: Public Expenditures on Land Rehabilitation, 1984....	165
Table 3.4: Land Use in the Dingxi Region by County.....	167
Table 3.5: Distribution of Land and Population in the Dingxi Region by Zone.....	168
Table 3.6: Loess Hills Rehabilitation Investment Costs per Mu..	170
Table 3.7: Loess Hills Rehabilitation - Crop Budget at Full Development, Economic Values per Mu.....	171
Table 3.8: Farmgate Prices for Major Products and Inputs.....	172
Table 3.9: Summary of Loess Hills (Zone II) Economic Analysis..	174

	<u>Page No.</u>
Table 4.1: Irrigation Development 1950-95.....	178
Table 4.2: Irrigation - Crop Budget at Full Development, Economic Values per Hectare.....	191
Table 4.3: Yindaruqin - Summary of Economic Benefits and Costs.....	192
Table 4.4: Jingtai - Summary of Economic Benefits and Costs....	193
Table 4.5: Sensitivity Analysis .....	194
Table 5.1: Current Population, Carrying Capacity and Resettlement Plans for the Dingxi Region.....	197
Table 5.2: Location of Sites and Schedule of Resettlement for the Two-Xis Region.....	198

Figures

Figure 1.1	Competing Demands for Village Biomass Products.....	146
Figure 3.1	Organizational Structure of the Gansu Provincial People's Government and the Agricultural and Two-Xis Commission.....	163
Figure 4.1	Crop Calendar.....	183
Figure 4.2	Organizational Structure of the Gansu Provincial Water Resources Bureau.....	187



## I. OVERVIEW OF THE AGRICULTURAL SECTOR IN GANSU

### The Natural Resource Base

1.01 Agriculture in Gansu province is characterized by a natural resource endowment in which the essential elements, namely soils, rainfall and topography, typically are such that crop and livestock production cannot easily be achieved. Central and eastern Gansu is dominated by the great Loess Plateau which covers over 630,000 km<sup>2</sup> and extends into northern Shaanxi, southern Ningxia and the western part of Shanxi province. This is a unique land form of windblown soils that has been transformed largely by human intervention into a ragged topography with massive gullies with extremely steep slopes, and dissected hills of comparatively uniform height, the summits of which represent the level of the original plateau. Transecting the province is the fast flowing silt-laden Yellow River.

1.02 Gansu has a surface area of some 45.4 million ha classified roughly as follows (in millions of hectares):

Cultivated land	:	3.5
Natural or planted forest	:	3.6
Grassland	:	14.3
Mountain meadows	:	4.5
Barren land with potential for forest	:	6.7
Sand or stony desert	:	12.0
Other (classified as unreclaimed)	:	0.8

Of the 3.5 million ha of cultivated land some 65% is classified as sloping, of which just over one quarter is terraced. Irrigation systems cover an area of about 900,000 ha but no more than some 600,000 ha of this total receive a fully guaranteed supply of water.

1.03 The population of Gansu province in late 1984 was 20.2 million (2% of the national population) of whom some 79% or 16.1 million were classified as rural, and 21%, or 4.1 million, were classified as urban with the bulk of the urban population located in the region of the provincial capital at Lanzhou. Ninety eight percent of the agricultural labor force works in the collective sector, mostly on individual responsibility plots. In per capita terms the rural population has 0.2 ha of cultivated land (1.0-1.2 ha per family) and 2.0 ha of other land (excluding desert).

1.04 Soils and Topography. The soils of Gansu can be grouped into six categories. Desert soils occur mainly in the west and northeast and are used only for grazing. Much more significant from an agricultural viewpoint is the category of loess soil. When undisturbed by erosion they are unique in their extremely deep and undifferentiated profiles. Loess soils are generally silty loams typically comprising 60-80% silt, 15-20% clay, and 5-15% sand. Deposition began over one million years ago and loess soils of more recent origin in geological time tend to have a higher clay content and less sand than older deposits. Loess soils are usually alkaline (p.H. 7.5 to 8.5) with a high

(10-20%) calcium carbonate content which can cause surface capping. Gypsum content increases significantly in the northeast, causing salinity problems when cultivated.

1.05 The topographic features of the loess deposits are closely associated with the underlying strata. On ancient rolling terrain the loess appears in the form of elongated or rounded mounds. But where the bedrock is broad and flat, the loess appears as high, flat plains with abrupt edges. Although originally wooded, agricultural activities have caused progressive removal of vegetation, leading to massive erosion and creating a land form heavily dissected with gullies, caused by seasonal rainfall runoff, which have cut through to the underlying bed rock.

1.06 Climatic Factors. There are three principal climatic factors affecting agriculture in Gansu. First, rainfall is low, erratic, and largely confined to a short period of three to four months in the summer. Mean annual rainfall varies from less than 50 mm in the northwest of the province to over 500 mm in the southeast. In central Gansu, the principal geographic area of this annex's focus, means range from 180 - 450 mm. More than 70% of the rain falls in the period June to September although the precise amount varies substantially from one year to the next.

1.07 Second, the provincial climate is characterized each year by a prolonged period of low temperature. Thus, mean air temperatures are at or below 0°C from November through February. The average frost free period is rarely more than five or six months and any soil moisture is normally frozen to a depth of about one meter during the winter.

1.08 The third significant climatic factor is that of large temperature fluctuations between the winter and summer, from minus 25°C in winter to over 30°C in summer, and between night and day temperatures in the short growing season. Sunshine per year is in the range of 2,000 to 3,000 hours which, given adequate soil moisture and temperatures at least five or ten degrees above freezing, serves to facilitate photosynthesis and hence crop growth in the summer months.

1.09 The long cold period precludes crop growth even where irrigation is available. When soil and ambient temperatures first rise sufficiently for germination, rainfall is erratic and usually inadequate. Thus, traditional varieties of crops grown under rainfed conditions cannot normally be safely planted until May or early June. Crops grown under irrigation can normally be planted in late March. In both situations plants are faced with periods of rapidly changing day length (increasing in spring and early summer, and decreasing in late summer and autumn) plus very rapid temperature accumulation. These factors cause crops to pass rapidly from one growth stage to the next which can seriously restrict yields unless varieties and production techniques are carefully matched to climatic conditions. In summary, traditional rainfed annual crop agriculture in Gansu is hampered by climatic factors, and production potential is limited to regions with higher mean annual rainfall.

Agricultural Production

1.10 Gansu has about 3.5 million ha cultivated in crops annually, of which around 2.8 million are sown for food, including just over 1.5 million ha for wheat. Average areas, yields and production of principal crops are summarized in Table 1.1. During 1981 to 1984, wheat production increased significantly from 2.3 to 3.4 million tons, production of oilseeds doubled, sugarbeet production nearly tripled and fruit production also increased. It should be noted, however, that such increases in production have followed a long period of very slow and erratic growth in agricultural output. Between 1950 and 1981 grain output increased by only 2.2% p.a. which was barely enough to keep up with population growth. There was a substantial expansion in irrigation over the same period and an increase in the percentage of the cultivated area under irrigation from 10% to 24%. This was offset, however, by major erosion and progressive loss of productivity in rainfed areas.

Table 1.1: AREA, YIELD AND PRODUCTION OF MAJOR CROPS  
(1981 and 1984)

	1981			1984		
	Area '000 ha	Yield kg/ha	Production '000 mt	Area '000 ha	Yield kg/ha	Production '000mt
Wheat	1,393	1,665	2,320	1,534	2,232	3,423
Corn	300	2,245	674	227	3,022	685
Rice	4	3,750	15	4	4,000	16
Soybeans	33	1,019	34	41	1,713	48
Other	1,137		1,085	994	-	1,226
Total	(2,687)		(4,128)	(2,800)		(5,398)
Rapeseed	48	646	31	58	1,052	61
Linseed	126	508	64	142	725	103
Total	(174)		(95)	(200)		(164)
Cotton	6	714	4	8	975	8
Sugarbeet	5	20,000	106	9	31,395	270
Tobacco	-	-	1	1	2,057	2
Fruits	34	3,235	110	35	4,686	164
Total	(45)		(221)	(53)		(445)

Source: Provincial data.

1.11 Data on animal populations and production are relatively imprecise. It appears that the population of large animals in Gansu in 1984 was approximately 4.7 million, of which 2.6 million were cattle kept under extensive management systems for meat, milk and traction. The balance of some 2.1 million, including horses, mules, donkeys and camels, were used for traction. The number of large animals is reported to have increased steadily from

4.1 million in 1981, with production of beef and cow milk also increasing from 5,400 to 8,500 tons and 27,300 to 34,500 tons, respectively, over the period 1981-1984. Small ruminants, sheep and goats, on the other hand numbered about 8.8 million in 1984 with a reported decline from 11.6 million in 1981, especially in the goat population. Sheep and goats are produced for meat, milk, and hides, and both provide a wool clip for the provincial blanket industry, which produces some exports. Mutton production increased from 12,700 to 21,000 tons between 1981 and 1984, whereas production of sheep and goat milk remained roughly constant at around 1,200 tons. The wool clip from sheep increased from 8,000 to 9,000 tons while that from goats increased five-fold from 125 to 700 tons over the four-year period.

1.12 The number of pigs has increased from 4.1 million in 1981 to 4.4 million in 1984, with recorded pork production more than doubling, from 6,500 to 15,000 tons in the same period. As with other livestock, pigs are kept under no more than semi-intensive production systems based on crop residues.

1.13 Provincial timber production has declined by 20% over the past 20 years and the present area under forest is less than 0.05 ha per capita compared with a national average of about 0.12. While some 1.3 million ha have been afforested over the past 30 years, plantings on only about 560,000 ha (40%) are reported to have survived. Premature and illegal cutting of young trees on public lands for fuel has been a major problem. The introduction of the PRS, which provides long-term control over lands by individuals who plant the trees, has improved the situation. The afforestation rate has increased from less than 70,000 ha annually (1981) to 240,000 (1983), and survival rates on newer plantings reportedly are in excess of 60%. Commercial timber production in Gansu is confined principally to the less arid southern and south eastern parts of the province.

#### Agricultural Incomes

1.14 Gansu's agriculture, including crops, livestock, forestry and fisheries, accounts for about 30% of provincial gross industrial and agricultural output and 26% of provincial GDP (see Appendix A of Main Report). Within agriculture, crops (largely grains) make up more than 70% of total production. Reflecting in large part the vagaries of weather, production varies from year to year but rarely has been adequate to meet provincial grain requirements. In 1979-83, grain imports into the province averaged about 600,000 tons annually, equivalent to some 30 kg per capita per year. A large part of this grain was provided on a credit basis to food deficit families; about 80% has gone to the 18 counties of central Gansu which make up much of the relatively poor Dingxi region (see para. 1.18). Per capita grain production in the very early 1980s was no better than in the early 1950s and seems to have declined relative to the average for the 1970s.

1.15 The gross output of the agricultural sector in Gansu appears to have grown by about 8% annually since 1981, largely as a result of favorable weather and improved incentives from introduction of the production responsibility system (PRS). Notwithstanding these gains, national sample surveys suggest that average rural household per capita income in Gansu in 1984 was

Y 221, the lowest in China and only about 70% of the national average of Y 310.<sup>1/</sup> Income differentials between the richer and poorer rural areas in China are substantially wider--rural per capita income in 1983 in Dingxi county was only about one quarter that of prosperous Wuxi County in Jiangsu province. Within Gansu there are also wide income disparities between the better endowed and poor rural areas.

1.16 In rural areas of Gansu scarcities extend to basic consumption goods other than grain. Drinking water for humans and livestock must be trucked to many areas during several months each year. As noted below, although Gansu has extensive coal supplies, some of which are made available to rural residents at subsidized prices, fuelwood and plant residues remain the basic energy sources in the countryside. Strong demand for these materials has led to destructive cutting of shrubs and timber and harmful burning of dung, straw and plant roots.

#### Intraprovincial Disparities in Agricultural Resources and Incomes

1.17 Rural incomes are highest in the region of the province which comprises 17 counties in the Hexi corridor west of the Yellow River <sup>2/</sup> and accounts for 15% of the province's population (see Table 1.2). The Hexi area has two distinct soil types. Of agricultural significance are the shallower loess soils of the chernozem type, and alluvial silt soils which occur adjacent to rivers and are referred to as oasis soils. Further to the north and northwest are large areas of grey brown desert soils. Mean annual rainfall in this region ranges from 50 mm to 200 mm with estimated evapotranspiration at 1,500-2,000 mm, thus making crop agriculture virtually impossible without irrigation. Elevations are generally below 1,000 meters and topography is relatively flat. Mean monthly temperatures are higher than provincial averages and the number of hours of annual sunshine (2,600-3,300) is also greater. The winter is nonetheless severe with only 130-170 frost-free days per year. Although the Hexi region has many favorable attributes for developing irrigation, production potential is still restricted due to temperature constraints.

---

<sup>1/</sup> It should also be noted that the sample survey in Gansu appears to be biased in favor of the wealthier areas close to cities and towns due to difficulties in collecting data from more remote and poorer areas.

<sup>2/</sup> The region includes all of the counties in Jiuquan and Zhangye prefectures and all of the counties in Wuwei prefecture except Jingtai and Gulang, which are included in the Dingxi region.

**Table 1.2: INTRAPROVINCIAL DISPARITIES IN AGRICULTURAL RESOURCES AND INCOMES**

		<u>Hexi region</u>	<u>Dingxi region</u>	<u>Other regions</u>	<u>Total province</u>
Population, 1983	Total (%)	15.1	28.8	56.2	100.0
	Agricultural (%)	14.9	31.6	53.5	100.0
Sown land, 1983	Area per agric. pop. (ha)	0.2	0.3	0.2	0.2
	% irrigated	79.3	13.2	13.8	23.1
Grain production, 1983-84	Yield (kg/ha)	4,380	1,300	1,720	1,900
	Output per agric. pop. (kg)	615	256	261	313
Gross value of agricultural output per capita, 1982	Average (Y)	300	113	146	161
Rural per capita income, 1983	Average (Y)	241	74	86	108
	Range (Y)	86-478	40-116	34-251	34-478

Source: Provincial data.

1.18 Rural incomes are lowest in the Dingxi region of the province which comprises 18 dry counties in six prefectures in central and eastern Gansu <sup>3/</sup> and accounts for about 30% of the province's population. The Dingxi region is characterized by the deep loess soil, the so-called yellow cotton or soft loess (mainly sierozems or xerosols in the world classification). Gully development is deep and dramatic and general elevations range from 1,400-1,800 meters. Mean annual rainfall differs from north (200-400 mm) to south (400-650 mm); frost-free days vary from 120-216 per annum, with 2,100 to 2,800 annual hours of sunshine. Sown area per capita is a little higher than in Hexi (0.3 compared with 0.2 ha) but only 13% of the land is irrigated compared with 79% in Hexi. Consequently grain yields are less than a third those obtained in Hexi. Annual grain production per capita in Dingxi averaged only

<sup>3/</sup> The counties are: Yongdeng, Gaolan and Yuzhong in Lanzhou municipality; Dingxi, Huining, Jingyuan, Tongwei, Longxi and Lintao in Dingxi prefecture; Zhuanglang and Jingning in Pingliang prefecture; Huachi and Huanxian in Qingyang prefecture; Qinan in Tianshui prefecture; Yongjing and Dongxiang in Linxia prefecture; and Jingtai and Gulang in Wuwei prefecture.

256 kg in 1983/84 and many households had to rely on relief grain from the state to meet minimum food consumption requirements.

1.19 Average incomes in southern Gansu are only a little higher than in the Dingxi region but the range of incomes and resource conditions is much greater. Most of Gansu's minority nationalities live in the mountainous southwest of the province (Gannan and Linxia prefectures) and many are nomadic herdsmen. In some of the more remote counties, average income per capita is as low as Y 30-40, while in other parts of the region incomes are significantly above those prevailing in Dingxi, primarily because of higher rainfall (400-600 mm per year) and better conditions for rainfed agriculture.

1.20 The Dingxi region and, to a lesser extent, southern Gansu are characterized not only by very low average incomes but also by great instability in production and incomes from year to year (see Table 1.3). This results in part from variations in rainfall and other climatic factors. It is also apparent that progressive devegetation of large parts of the Dingxi region has led to significant reductions in the productivity of potentially fertile soils and a very fragile resource base.

Table 1.3: GROWTH RATES OF AGRICULTURAL OUTPUT, 1980-84  
(% p.a.)

Region	County	1981	1982	1983	1984
Dingxi	- Dingxi	-30.4	+3.5	+99.6	-3.2
	Lintao	-6.5	+9.4	+23.2	+41.5
	Longxi	-11.7	+1.7	+55.1	+29.2
	Tongwei	-5.3	-5.4	+63.6	+28.9
	Yongdeng	-20.7	+3.2	+15.7	+24.4
Southern	- Hui	-15.6	+30.8	+4.1	-5.1
	Xiahe	+6.4	-2.1	-12.6	+11.8

Source: Two Xis Commission and mission estimates.

#### Agricultural Zones in Dingxi

1.21 Within the Dingxi region there are substantial variations in rainfall and in the accumulated temperature above freezing. Moreover, variations in accumulated temperature typically do not correspond to those in precipitation. The juxtaposition of the temperature and rainfall patterns gives rise to a variety of aridity situations, which have a significant impact on agricultural potentials under rainfed conditions. With an aridity index, which relates total rainfall to accumulated temperature for the months when air temperature rises above 0°, the Dingxi region can be divided into three climatic zones. Within each of these zones, part of the gross area is designated as "irrigated", supporting about 27% of the rural population, and therefore not subjected to the aridity classification.

1.22 The most arid of the three zones, basically the area north of Lanzhou, is designated the Arid Zone and commonly known as Zone I (see Table 1.4). It covers 31% of the Dingxi region and is occupied by about 18% of the regional population. About 21% of Dingxi's cultivated area is in Zone I. The low agricultural productivity is partially offset by lower population density and larger per capita cultivated area. Because of the northerly location, domestic heating is required for ten months of the year. Though vegetation cover has become very sparse, the very low rainfall results in the threat of soil erosion being less serious than elsewhere in the Dingxi region.

Table 1.4: AGRICULTURAL ZONES IN DINGXI

	Zone I Arid	Zone II Semi-Arid	Zone III Semi-Humid	Irrigated
Annual rainfall (mm)	150-350	350-500	450-550	--
Area (Km <sup>2</sup> )	21,844	29,935	6,216	11,622
Households (000)	170	452	100	270
Population (000)	978	2,427	525	1,440
Cultivated land (000 ha)	295	701	138	262
Typical counties =	Gaolan Yongdeng Jingtai Jingyuan	Dingxi Huining Jingning	Lintao Zhuanglang Huachi	

Source: Two Xis Commission

1.23 The semi-arid land area immediately to the south of Lanzhou is Zone II, which constitutes 43% of the gross area and contains about half the population, with a similar percentage of cultivated land. Soil erosion is a major problem and is seriously aggravated by cropping and fuel demand from high population densities. Most parts of Dingxi, Huining, Jingning and Dongxian counties lie in this critical Zone II. Many of the government's rehabilitation efforts are concentrated in this area.

1.24 The hilly areas in the southern part of the Dingxi region receive a considerably higher rainfall. Such areas are classified as semi-humid, Zone III. Where rainfall reaches an even higher level at greater elevations, the areas are considered to be humid, and a Zone IV designation is sometimes applied. The semi-humid zone covers about 9% of the gross area and has 10% of the farming area, giving a per capita average of about 4 mu (or about 1.4 ha per farm family). However, in Zone III the winters are generally longer and more severe than in the other zones, putting much more pressure on fuelwood demand which leads to serious destruction of the forest cover.

## Rural Energy in Dingxi

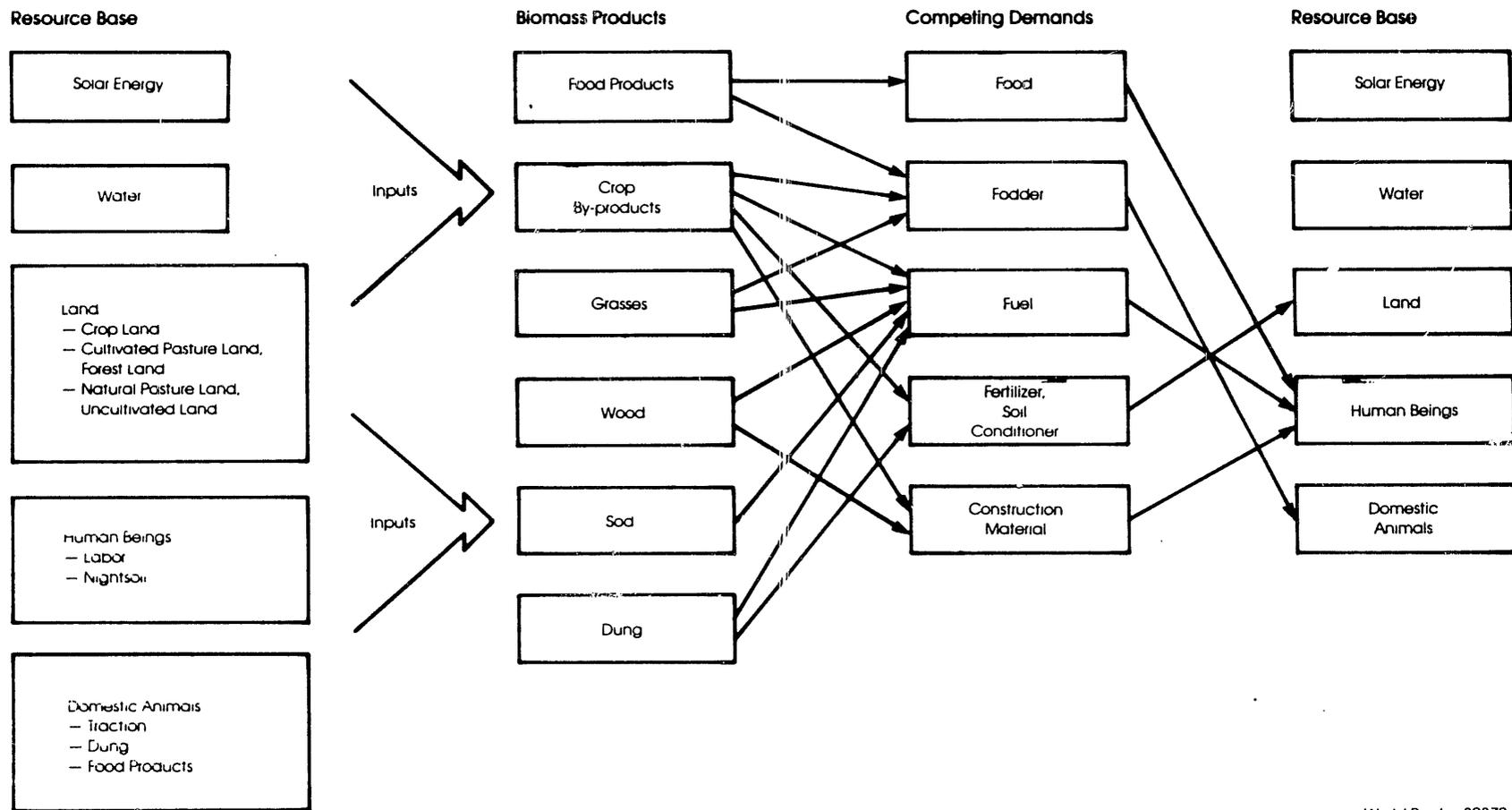
1.25 The Rural Energy Problem. Biomass fuels, consisting primarily of crop by-products, animal dung, grass and sod foraged from uncultivated hillsides, currently account for almost 90% of rural household fuel use in Dingxi. Given the region's low total biomass production relative to population (due to constraints posed by natural conditions, current technology and land utilization practices, and the existence of a variety of competitive demands for biomass), household biomass fuel supplies are in chronic shortage. Current rural household cash incomes are so low that most households are unable to purchase adequate quantities of alternative fuels such as coal. Fuel shortages--especially for heating during the severe winter months--represent one of the most pressing hardships facing the rural population. Moreover, in the rainfed areas, where three-quarters of the rural population lives, the continual search for fuel results in the annual stripping of vegetation from the loess hillsides. About 35% of rural household fuel supply in the region consists of grass and grass roots (caopi, or sod) which is literally dug up from surrounding hillsides every year. The removal of sod not only requires diversion of available labor from other tasks, but is a primary cause of the accelerating soil erosion and environmental degradation in Dingxi.

1.26 Current Fuel Supply and the Agricultural Ecosystem. Biomass fuel supply and use cannot be properly viewed in isolation; food production, fuel supply and use, and animal husbandry are all closely interlinked as parts of the chain of biomass production and use which underpins the traditional agricultural ecosystem (see Figure 1.1). Hence, when biomass is used as fuel, there are costs in terms of opportunities foregone in agricultural and/or animal husbandry development, in terms of either alternative utilization of land or alternative use of the product itself. In utilization of land to yield biomass, there are trade-offs not only in choices concerning which products to cultivate on level and hillside land, but also in utilization of hillside land for grazing and random fuel collection or for controlled cultivation and harvesting of biomass products. Trade-offs involved in the use of biomass products include:

- (a) use of crop by-products for fuel (primarily for cooking), for fodder (especially for ruminants), for composting, or as a construction material;
- (b) use of grasses and bushes produced on either cultivated or uncultivated land for fodder or for fuel; and
- (c) use of animal dung as a fertilizer/soil conditioner or as fuel (primarily for heating).

1.27 In many of the rainfed areas of Dingxi, the current patterns of biomass supply and use are not sustainable, and without intervention, per capita supplies of food, fodder, fuel and fertilizer will continue to diminish. Judging from surveys conducted in 1983, sod foraging and animal grazing on surrounding uncultivated hillsides are often relied on to meet 50% or more of total fuel and animal fodder needs. Particularly in comparison with

### Competing Demands for Village Biomass Products



World Bank – 30372:1

Figure 1.1

neighboring irrigated areas, supplies of crop by-products are exceedingly low, averaging 1,750-2,250 kg per household and accounting for only some 20-25% of total fuel and fodder needs.

1.28 Crop by-products are used predominantly as fodder in rainfed areas but generally satisfy no more than half of total fodder requirements. While cultivated grasses have begun to make a contribution to fodder requirements in some localities, most of the balance is still met through uncontrolled and destructive grazing, particularly of sheep and goats. In Dingxi county, the existing natural pastureland is estimated to carry two and one-half times as many animals as can be supported on a sustained basis with existing patterns of uncontrolled grazing.

1.29 With most or all of the crop by-products being used as fodder, dried dung represents the dominant source of fuel from the agricultural system. Some 80% of the manure from large animals and 50% of sheep and goat manure is collected, and most is used to heat the kang.<sup>4/</sup> Thus, pig manure and night-soil often represent the only residual manure sources for composting. Nevertheless, dried dung provides on average only 30-35% of total fuel requirements. Adding a portion of available crop by-products, fuel supplies from within the agricultural system appear to account for no more than about one-half of total fuel requirements in the rainfed areas of the region.

1.30 Use of coal for fuel has a key advantage as a source of energy from outside of the ecosystem. Coal consumption by rural households has been increasing in recent years, largely as a result of government policies to supply coal free of charge in exchange for commitments to pursue more extensive scrub fuel or fodder planting, and with increased development of small scale collectively owned mines in areas where coal deposits are concentrated. However, as of 1983 coal continued to account for only a small portion of consumption in areas without local coal resources. In areas of Dingxi where there are few coal deposits, coal accounted for less than 15% of fuel requirements, on average.

1.31 Although efforts to cultivate scrub fuel have begun to bring significant results in some areas, the gap between crop by-products, dung and coal supplies and fuel requirements is basically met by the foraging of sod. The share of sod in total fuel use varies widely from area to area, but in areas where biomass production is particularly constrained and coal supplies are minimal, sod accounts for one to two-thirds of fuel use. In one production team surveyed in Xinji Township in northern Dingxi county, sod accounted for 67% of total household fuel use in 1983. Only 3% of available crop by-products were used as fuel, and even with new supplies of coal provided by the government, coal accounted for only 13% of total fuel use. Even in 1983, a year of relatively good harvests, about three-quarters of the surrounding uncultivated land was dug up to yield sod. In addition to the resulting

---

<sup>4/</sup> A kang is a heated bed.

degradation of the hillsides, sod removal also absorbs a large portion of household labor -- in two villages in northern Yuzhong County, sod collection has required an average of 170 work days per household per year over the last six years.<sup>5/</sup>

---

<sup>5/</sup> In the irrigated areas of the Dingxi region, sod accounts for an almost negligible share of fuel consumption. A primary reason is that with higher crop yields, per capita supplies of crop by-products are far higher than in the dry, rainfed areas. Per capita large animal ownership is also about one-half of that in Zones I and II, implying reduced fodder needs. Coal supplies have been more significant and appear to account for about one-third of fuel consumption on average, most likely due to higher per capita income.

## II. GOVERNMENT OBJECTIVES AND STRATEGY FOR DEVELOPMENT OF DINGXI AND HEXI

2.01 A key element in the government's broad development strategy for agriculture in the province is to relieve the population pressure in the crowded and poverty stricken Dingxi region by resettlement to irrigated areas both within the region and in the Hexi corridor. Resettlement would be complemented by the rehabilitation of eroded river basins and watersheds in the loess hills of Dingxi using measures that are now being tested in an experimental area of the region. Alleviation of population pressure through resettlement will permit reduction of annual cropping of steep hill slopes, and protect them from further erosion by terracing, gully plugging and the planting of trees, shrubs, and fodder legumes and grasses. The government strategy is also designed to encourage the development of off-farm sideline enterprises and selected industries as appropriate to the natural resource base, including the exploitation of minerals in specific areas.

### Rainfed Agricultural Investments

2.02 Government strategy for investment in rainfed agriculture in Dingxi and Hexi (the Two Xis) focusses primarily on the rehabilitation of the loess hills of the Dingxi region. Expanding and exploitative agriculture over the last several centuries has progressively removed the vegetative cover from most of the area. Since unprotected loess soil is extremely susceptible to erosion by both wind and water, severe environmental degradation has occurred widely with a significant reduction in the agricultural productivity of most of the 100,000 km<sup>2</sup> involved. The loess plateau as a whole, i.e., including those parts in neighboring provinces, now sheds an estimated one billion tons of silt annually into the Yellow River. This massive silt load has led to enormous increases in the operating and maintenance costs for downstream irrigation and related water conservancy systems, and severe reductions in the hydroelectric and flood control potential of existing and planned works in these fields.

2.03 The government has responded to the limited effectiveness of activities undertaken in the past 30 years by increasing research on erosion control and appropriate agricultural production systems via an experimental comprehensive land rehabilitation program on a number of small watersheds in the Dingxi region. A large statistical data base has been established and experience is being rapidly accumulated and analyzed. This suggests that an erosion control strategy, consisting of an integrated package of new farming practices involving land rehabilitation measures which will improve the productivity of land and labor whilst greatly reducing soil erosion, is economically viable. It is predicated, however, on significant reduction of population pressure by outmigration, strictly controlled grazing or zero grazing animal production systems, extensive terracing of land with slopes of more than 25° coupled with tree, shrub and grass/legume planting, and annual crop planting, principally wheat, faba beans, linseed, potatoes and millet, on land having less than 15° slopes unless previously terraced.

### Irrigation Development

2.04 In Gansu, as elsewhere in China, the most attractive irrigation possibilities have already been developed and none of the newer projects planned or under construction in the Two Xis are without economic or technical difficulties. Further, within the 900,000 ha of irrigated land in the province only two thirds receives a fully guaranteed supply of water. In both Dingxi and Hexi there is recognition by the provincial authorities that much can be done to improve the overall water conveyance and efficiency of existing systems, many of which are operating far below their designed capacities. Nonetheless, much, if not most, of the attention of provincial staff is presently focussed on new construction rather than on existing systems.

2.05 Strategic planning of water conservancy activities in Gansu gives priority to the Two Xis for several reasons. Both areas are perceived to have climatic conditions that seriously limit crop production under rainfed conditions while also having tracts of land with topography that is suitable for irrigation. Both areas have sources of river water that can be conveyed to command areas, mainly by high lift pumping or diversions in Dingxi, or by relatively simple gravity diversions in the Hexi corridor. But Dingxi already has unsustainable population levels for rainfed agriculture. Therefore the irrigation potential in Hexi and the much lower population pressures in presently arid but potentially irrigable areas lend themselves to development and provide a perceived settlement pole for people from Dingxi. Other areas of the province, such as southeast Gansu have less harsh climatic conditions and significantly less land topographically suited to large-scale irrigation. Thus Dingxi and Hexi are seen as areas in which irrigation development is a logical means of alleviating poverty and significantly reducing provincial food deficits.

### Resettlement

2.06 Gansu's previous experience with migration was in the late-1950s when large numbers of settlers from densely populated agricultural areas of southeast China were resettled to the Hexi Corridor. The resettlement program was launched during the Great Leap Forward period (1958-59) as a means of both reducing overpopulation in southeast China and increasing labor availability in the Hexi corridor. However, most of the settlers returned to their hometowns in southeast China in the early-1960s and the program was seen as a failure. A similar failure occurred during the Cultural Revolution period in the late-1960s when a number of youths from Tianjin were sent out to the Hexi corridor. Most of these youths have only recently received permission to return to Tianjin and most have now departed Gansu. These earlier programs appear to have failed because the resettlement was involuntary and involved a move to a harsh new environment which most settlers found inferior to their previous situation.

2.07 In response to these earlier failures, the current resettlement program is strictly confined to voluntary resettlement to areas with improved conditions. Settlers retain cultivation rights over their previous lands for a period of three years and are allowed to move back to their original homes at any time. Experience to date suggests the personal income and standard of

living of most settlers has improved after relocating to irrigated areas and that the number of settlers returning to their previous homes has been very low.

2.08 Provincial government thinking on migration appears to be concentrated on intraprovincial movement. The possibility of population movement outside provincial boundaries is thought not to be feasible, except on a minor and marginal scale.

#### Rationale for Strategy

2.09 The preceding paragraphs have outlined the three major elements of the government's overall strategy for agricultural development in the Dingxi and Hexi regions. The elements are closely interlinked. Loess Hills rehabilitation cannot proceed without a substantial reduction in the existing agricultural population; irrigation development could help provide additional employment opportunities; and formal resettlement programs could help facilitate the movement of people from the heavily eroded rainfed areas and into new irrigation schemes.

2.10 To facilitate implementation of the overall development strategy for Dingxi and Hexi as well as for an adjoining area in the neighboring province of Ningxia, the central government established a special commission known as the "Three Xi" Commission, in 1980. Within Gansu a provincial commission, known as the "Two Xis" Commission was also established. The commission includes several specialized divisions for coordinating land rehabilitation with resettlement and irrigation development; it is represented at the prefecture and county levels by special agricultural development offices. Through these commissions at various levels the central government is now allocating about Y 200 million per year for agricultural development in Dingxi and Hexi and expects to continue such support for at least the next ten years.

2.11 In the following chapters the major elements of the government's overall strategy and the institutional and financial arrangements for strategy implementation are reviewed in detail. A number of issues are raised and options for improving the returns both to the different elements of the program and to the program as a whole are discussed. The remaining chapters do not, however, address broader issues of provincial development strategy such as the potential for resettlement of some of the agricultural population outside of agriculture or outside of the province. These issues and their possible implications for the government's overall strategy for agricultural development in Dingxi and Hexi are discussed in other annexes and in the main report.

### III. LOESS HILLS REHABILITATION

3.01 This chapter addresses an area of approximately 100,000 km<sup>2</sup> in central Gansu and more specifically the 70,000 km<sup>2</sup> Dingxi region. As noted in Chapter I, unprotected loess soil is subject to extraordinary erosion, and the removal of the vegetative cover has brought severe environmental degradation over most of the plateau. Streams, which have in many areas cut through to the underlying sandstone, have heavily dissected the plateau, leaving a landscape of steeply sloped hills of relatively uniform height marked by deep gullies. Devegetation of the plateau has resulted in a significant reduction in agricultural productivity over this large area of potentially fertile soil in central Gansu.

3.02 Erosion control work on the Loess Plateau as a whole began in the 1950s with the construction of wide terraces on hillsides, soil dams in gullies, and large-scale afforestation. The pace of erosion control was accelerated in the 1970s with the adoption of a comprehensive national plan to construct hundreds of soil dams in each of the counties along the middle reaches of the Yellow River (an area representing about 85% of the Loess Plateau). Despite these national plans and local efforts to bring erosion under control, it was obvious by the end of the 1970s that the plateau's vegetative cover had continued to decline and the Yellow River's silt load had continued to increase.

3.03 The government has responded to the limited effectiveness of past erosion control measures by increasing research on erosion control and appropriate agricultural production systems. The Dingxi Loess Plateau Comprehensive Control Experiment Station was established by the national government and Gansu provincial authorities in 1982 as a key facility in this research effort. The Dingxi Station has been given the responsibility for: (a) collecting a statistical data base for the Dingxi region; (b) developing and testing soil erosion control measures; and (c) implementing a comprehensive land rehabilitation program in several micro watersheds. Work on these tasks has proceeded rapidly; a large statistical data base has now been established and operations are well advanced in the selected micro-watersheds. Analysis of the available data suggests that the Dingxi Station has developed an economically viable erosion control strategy, namely, an integrated package of new farming practices and rehabilitation measures which improve productivity and profitability while greatly reducing soil erosion. In conjunction with the research program of the Dingxi Station, the Two Xis Commission is coordinating work on an action plan for the comprehensive rehabilitation and reduction of poverty in the Dingxi region.

3.04 Rehabilitation programs are necessarily being conceived in terms of comprehensive development of watersheds. The model that was developed in Mizhi County, Shaanxi <sup>6/</sup> and replicated by the Dingxi Station involves three

---

<sup>6/</sup> Comprehensive Control Experiment Station of the Loess Plateau, Mizhi, Shaanxi.

steps. Step one is the development of land use plans for individual gullies (micro watersheds). This work requires: soil mapping; slope and topographic mapping; collection of data on current land use, population, and livestock numbers; and preparation of farm budgets. Step two is to determine the population's needs and goals. The third step is the integration of the land use plan into an action program. This sequence is required for each micro-watershed within the river basin to be rehabilitated. Survey work has been completed in almost 600 watersheds by the Dingxi authorities and detailed proposals prepared for the watersheds in two river basins (Guanchuan and Qinxi) covering about 4,000 km<sup>2</sup>.

### Rehabilitation Measures

3.05 Soil loss from erosion is a function of the following factors:

- (a) topography (steepness and length of slope),
- (b) soil (vulnerability of the soil to erosion which in turn is a function of its texture, structure, dispersibility, surface condition, organic matter content, and moisture status),
- (c) rainfall (its capacity to erode which depends on its velocity, intensity and duration), and
- (d) plant cover (the extent of interception of rainfall energy).

The loess soils of central Gansu are extremely susceptible since the slopes are steep and long, the soils are highly vulnerable to rainfall which occurs normally in heavy and sporadic storms, and the plant cover has been more or less totally removed.

3.06 Early programs began to apply the principles for rehabilitation by terracing to break the slopes and reforestation to restore plant cover at least on the steeper slopes. Their limited effectiveness was due largely to the failure to recognize the needs of the rural population, and from apparent shortcomings in design and application. Early bench terracing did not provide negative slope or adequate maintenance. In respect of reforestation, the low establishment rate was largely due to choice of inappropriate varieties, poor site preparation and planting techniques, which continued to leave the surface extremely vulnerable. These shortcomings have now been recognized and addressed in recent programs. Experience in China as well as in other countries such as Nepal, India, Pakistan, and Tunisia confirms that an integrated program must take into account the need to develop a stable ecosystem with a rural population of sustainable density remaining in place.

3.07 The Dingxi strategy is based on the concept of land use capability. It thus aims to intensify crop production on flat land in valley bottoms or on wide bench terraces built on the milder slopes while returning the steep slopes and hill tops to the controlled production of tree products and fodder. In general terms, land above 25° slope is planted to forest or productive ground cover with trees and shrubs on the steeper slopes. Land between 15° and 25° slope is cropped only if it has been terraced, and slopes of less than

15° are not terraced and can be used for crop production. This results in substantial reductions in the ratios of annual cropping to forestry and to animal fodder, and hence in the carrying capacity of the land, most of which currently supports a rural population far in excess of its sustained carrying capacity.

3.08 Forest establishment. In Dingxi trees and shrubs are being planted for fuel, fodder or commercial timber on narrow terraces, contour ledges or in fish scale pits. Climate limits the range of suitable species and present planting is wisely conservative in using the few species known to succeed such as populus, pinus, platycladus, robinia, tamarix, elaeagnus, caragana. However, more extensive study is being undertaken at the Mizhi Experiment Station and the North West Institute of Botany, in Yanling, Shaanxi. Dingxi authorities need to use the experience of the other two institutions and expand their testing program. The choice of establishment method between narrow terraces, contour ledges and fish scale pits seems to be haphazard and few performance data are available. Observation suggests that the use of narrow terraces is excessive compared with other methods and is overly costly, particularly in the low rainfall zones, for the growth rates that can be expected.

3.09 Fruit trees. The general criteria used for rehabilitation suggests that the 3% of the area to be forested could be planted to fruit trees. Apples and pears produce satisfactorily with yields on the order of 30-40 kg/tree. The same three systems of establishment are used but in this case the narrow terrace is preferable in order to facilitate the more frequent maintenance that fruit trees require.

3.10 Establishment of Planted Ground Cover. Heavy emphasis has been given to a limited number of species: These are erect milkvetch (*astragalus adsurgens*), common Sainfoin (*onobrychis viciaefolia*), alfalfa (*medicago sativa*), sweet vetch (*hedysarum* sp.) and the shrub *caragana korshinskii*. They are planted by hand from seed on unterraced steep slopes. More often they are harvested for fuel than for animal feed. This has influenced the choice of species, although given the climate none of these is an unreasonable choice whatever the use. Some successful aerial seeding has been achieved in Shaanxi province but the technique has been used only to a very limited extent in Gansu. Alfalfa has established satisfactorily using 2 kg seed/ha without pelleting or fertilizing. Further investigation on varieties for aerial seeding and ways to expand the range of species is urgent. The preoccupation with fuel makes other materials that are likely to be successful as ground cover and fodder plants unattractive to farmers at the present time. Legumes such as *vicia villosa* and grasses like *agropyrum*, *elymus* and *stipa* are likely to provide better ground cover and more fodder.

3.11 Gully Plugging and Grassed Waterways. Treatment of sharply eroded gullies and gully-head erosion depends on the shape of the gully and the degree of damage. In general, treatment involves limited earth moving to form small retaining walls (gully-plug dam) and level sites on which to plant trees, with hand planting of cover crops on the sides. Grassed waterways to carry runoff water from terraced or contoured slopes or in gully bottoms require some land levelling and soil movement to ensure that water moves to

the water disposal strip which must have a suitable vegetative cover. Dimensions depend on gradient and spacing of terraces.

3.12 Wide Bench Terraces. Land with slopes between 15° and 25° can best be used for annual cropping with wide (7 meter) bench terraces. This practice is widely known, and cost estimates are readily available. In Dingxi many existing bench terraces are forward sloping and need to be converted to a negative slope. This process is under way to a limited extent and can be carried out with a simple animal drawn plow. In both cases, and in the case of narrow terraces, the vertical face of the terrace is extremely stable, although maintenance is normally required after 10 years.

3.13 Land dams. Flat land for annual cropping can be created by building soils dams which stop or retard the movement of erosion products from existing gullies. Retaining walls of earth are built and the dam so formed is allowed to silt up to a satisfactory level. Large dams typically have walls up to 60 m wide and 25 m high, are equipped with masonry spillways, take two years to build by hand, 8-10 years to silt up, and yield 3 to 7 ha of flatland. Small dams, 20 m wide or less and proportionately smaller, are less costly and silt up in 2-4 years. Small dams are common throughout, but large dams have not been installed in Gansu to the extent that they have in Shaanxi, due to either technical or conceptual factors.

3.14 Storage wells and ponds. Dry wells and surface ponds to catch runoff water for domestic and livestock use and to water trees during their establishment period are an important part of the rehabilitation measures.

3.15 Combinations of the measures outlined above should be applied according to the particular situation defined in the preliminary land use plan which incorporates appropriate improved farming practices.

### Crops and Cropping Systems

3.16 In Dingxi rainfed annual cropping is based on wheat with consistent but small areas of grain legumes and linseed also planted in the spring and harvested in mid to late summer. Potatoes are planted in the spring but harvested in the autumn. Summer planted cereals such as millet (*setaria italica*) are the most common with smaller areas of broom corn millet (*panicum miliacium*) and maize. Whilst not preferred over wheat, both millets are used as human food and are more popular than maize which is much less drought resistant.

3.17 Crop yields are restricted by climatic factors, topography, variety and cultural practices. In the rainfed areas of loess soils in Dingxi, 80-85% of the land now cultivated is sloping and 30-35% of this sloping land is terraced so that some 55% of crops are planted on slopes which are consistently greater than 25°. Suitability of varieties and cultural practice varies between crop, location and farmers. Present yields and provincial government targets are provided in Table 3.1.

Table 3.1: CROP YIELDS (tons/ha)

	Average	Range	Target
Wheat	0.7	(0.4 to 1.5)	3.4
Faba beans	1.4	(0.8 to 1.8)	1.7
Peas	0.9	(0.4 to 1.4)	2.3
Linseed	0.4	(0.2 to 0.5)	1.5
Potatoes	6.3	(3.1 to 10.7)	15.0
Maize	2.2	(0.8 to 4.1)	3.0
Millet (Panicum)	0.6	(0.3 to 1.1)	1.8
Millet (Setaria)	0.9	(0.3 to 1.2)	1.9

Source: Provincial data.

3.18 Wheat is the main crop covering some 65-70% of the cultivated area. Spring wheat is dominant since the winter wheats available do not perform well under hard winter conditions. Yields are extremely variable due to variety, cultural practice and the unpredictable spring climate. They are best when the crop is planted in mid-March but neither rainfall nor temperature conditions can be relied upon at that time. Crops planted later in the year suffer from rapidly increasing day length and temperature accumulation which moves the wheat plants from the vegetative phase to the reproductive phase without permitting sufficient tillering. Farmers commonly use high seeding rates (200-225 kg/ha) to compensate for an inadequate density of tillers. More attention has been given to introducing new varieties of wheat than other crops but more work is needed to match variety to the unusual climatic situation. Equally important is refinement of the fertilizer strategy which should focus on applications that stimulate early growth and tillering.

3.19 Grain legumes, particularly Faba beans, are important. Faba beans perform comparatively well with good density and absence from disease or insect damage as they begin to flower in late May. Pea crops by contrast appear sparse and unattractive.

3.20 Linseed (huma), although regularly planted as a cash crop, is consistently poor. Linseed is generally regarded as a high rainfall crop so it is difficult to appreciate its appearance in the rainfed cropping pattern, though it is more drought tolerant than the alternative, rapeseed.

3.21 Potatoes, except when grown on the very steep slopes as they frequently are, should yield better than they do with the growing period (mid May to September) coinciding well with rainfall. Poor performance can likely be attributed to poor quality and diseased planting material, and inadequate fertilizer.

3.22 Summer cereals such as millets are referred to frequently by officials but are rarely seen in the field. These crops benefit from the rainfall incidence that coincides with high temperatures but they are not favored in the diet and few farmers have the capacity or inclination to grow them as stock feed.

3.23 In addition to rational land use planning and erosion control measures, crop rotations, water use efficiency, improved varieties, and fertilizer strategy are key areas to address in improving crop yield and integrating livestock into the farming system. Rearrangement of the ratios of cropping, forestry and ground cover for erosion control in the strategy of land rehabilitation implies that crops will be grown on areas that are flat or have low slopes. A proper sequence of crops that gives priority to wheat as the staple and bestows the usual advantages of crop rotation is a high priority. Given improved and hardier winter varieties, one attractive option would be to split the wheat break between spring and winter types, consolidate the area of grain legumes as faba beans, introduce a fodder legume, and include a greater area of summer cereal. However, this course of action presupposes a significant reduction of population pressure.

3.24 The primary measure to improve water use efficiency in areas with erratic rainfall is to ensure maximum infiltration. The action of land leveling alone has been shown in the area to double yields of wheat from 750 kg/ha to 1.5 tons/ha. Planting wheat on flat valley bottoms or terraces instead of steep slopes can be expected to improve yields markedly. A second major action is to improve infiltration and water holding capacity by building up soil organic matter. Less significant measures include improved varieties, plant spacing, and timing of cultural practices.

3.25 Fitting the right fertilizer strategy to the crop in the particular rainfall situation of Dingxi is complicated due to the erratic rainfall pattern. Both nitrogen and phosphorus are deficient due to agricultural exploitation and erosion. However, there are no signs of micronutrient deficiencies even in the more sensitive species. In the short- to medium-term, emphasis should be given to testing the use of nitrogenous and phosphatic fertilizers, especially to promote tillering, in combination with rotations that build up organic matter.

3.26 With the exception of wheat, where a 2.5 tons/ha goal appears to be more realistic than the 3.5 tons quoted by provincial authorities, all other yield targets (Table 3.1) seem attainable in the medium-term provided there is adequate attention to erosion control and the other factors that have been discussed. In addition to raising yields of individual crops, output on a whole farm basis could be made both higher and more stable. The extent to which diversification to other annual crops could be practiced with overall benefit depends on the perceived needs of farmers to achieve grain self sufficiency and also on the limited number of alternatives. Given the climatic constraints, the alternatives to wheat, linseed and grain legumes are other winter cereals such as barley, which could be used for animal feeds, or alternative grain legumes. Special medicinal and food crops do not lend themselves to the growing conditions in Gansu's rainfed areas. Fruit orchard development is feasible but is likely to be confined to the areas of narrow

terraces. The greatest scope for diversifying and increasing farm production is in the proper integration and expansion of livestock.

### Animal Production

3.27 Typical households in the region average three sheep or goats, one pig and five hens, and less than one draft animal (horse, mule or ox) each, though some "shepherd" families run mixed flocks of about 40 sheep and goats. All are maintained at extremely low levels of productivity due to the acute shortage of crop residues and stock feed. Integrating animal production into the production system is important and relatively uncomplicated on both technical and social grounds once crop production is more stabilized. It should be seen in the context of a total system which uses pasture and fodder species as key elements in soil conservation and rehabilitation. This will ultimately produce large amounts of fodder that can be utilized by ruminants, preferably sheep, and nonruminant traction animals. It is of vital importance that direct grazing be avoided in order to protect the slopes from further erosion. Instead fodder should be cut and carried to level areas where livestock are confined. This is a labor intensive activity that requires the farmer to coordinate the use of crop residues and fodder crops that can be conserved from the cultivated land. In view of the strong demand for livestock products, the pivotal role to be played by edible crop species in rehabilitation measures, and the fact that these plants and their effectiveness as ground cover will generally benefit from cutting and limited grazing make this form of diversification a rational strategy to pursue.

3.28 The form of the integrated livestock production system derives from these considerations. The production of fodder plants, edible trees and shrubs, used on a cut and carry basis, would meet the needs of the animals during the growing season. The requirements for the remainder of the year would be met from crop by-products and conserving fodder crops. A typical farm <sup>7/</sup> in Zone II of the Dingxi region could support either about ten sheep units <sup>8/</sup> or seven sheep units plus one donkey, assuming that each small animal unit would consume 400-450 feed units.<sup>9/</sup> The system would focus on fattening offspring for sale in the autumn or early winters and would reduce the number of breeding animals carried through the winter in order to minimize requirements for conserved feed. An alternative system would be to buy young animals from other breeders in the pastoral area with the objective of fattening them for sale on the spring-summer growth.

---

<sup>7/</sup> Hypothetical farm = 2.76 ha cropland (40% wheat, 20% each of grain legume, millet and fodder crop), 1.7 ha of forest and 2.3 ha of grassland.

<sup>8/</sup> Small animal unit = adult female sheep plus offspring in equivalent terms.

<sup>9/</sup> Feed unit (FU) = nutritional value equivalent to 1 kilo barley.

3.29 The pace at which integrated livestock production systems can be introduced is governed by the predominant needs of the population to use fodder for fuel. Gradual development of fuelwood forestry would initially release crop by-products and then grassland products for animals. The timing issue should be carefully considered in planning the implementation of these production strategies.

#### Fuelwood Forestry

3.30 Fuel shortage is at the core of the land use problem in the loess plateau. Much of the destruction of the hill vegetation is due to the heavy demand for fuel. Expansion of alternative fuel sources is vital to successful rehabilitation. Fuelwood plantations are a key to rehabilitation of such areas, as has been well demonstrated in the Himalayas. Nitrogen-fixing species should be used where possible, while species capable of regrowing from coppice have substantial advantages. The particularly harsh Gansu environment rules out many of the world's highest-yielding fuelwood species. This emphasizes the need to collect and test additional species suitable to this environment and then to select among them for rapid growth and high yield. At present such studies appear to be restricted to comparisons of material from neighboring provinces of China. A much wider range should be tested. Useful cooperation would be available from the Northwest Institute of Botany, Yangling, and Mizhi Experiment Station, Shaanxi, which engages in loess vegetation studies, and from forestry institutes outside of China. The area assigned for forest in the province's proposed rehabilitation program is approximately 30% of the agricultural land. Local authorities suggest that 18% be used for fuelwood, 11% for commercial timber and 1% for fruit orchards. The slower growth rates in the drier parts of the region would need to be compensated for with lower population density. The urgency for developing renewable fuel supplies is such that raising fuelwood should be given priority over other forms of forestry.

#### Rural Household Energy Considerations

3.31 In addition to the relocation of some of the population and the promotion of tree, scrub fuelwood and grass planting by rural households, other energy-related measures are being promoted to arrest the erosion of the loess hills. These include increasing coal supplies to rural households, efforts to increase the efficiency of traditional cooking and heating practices, and popularization of parabolic dish type solar cookers. There have also been some efforts to promote household biogas generation, but because the cold winter limits the generation of gas through simple methods to only six months per year, the high capital costs of digestors and accessories will be difficult to justify in economic terms in all but exceptional cases.

3.32 Coal. Efforts to increase coal supplies to rural households have been a major aspect of the program to rationalize fuel supply and use, and given the size of reserves and relatively low costs of supply, there is little doubt that coal can play an increasingly significant role as a substitute for biomass fuel. Currently, coal accounts for some 10-15% of rural household fuel in the Dingxi region as a whole, but in areas of Zone I, where reserves are concentrated, and in the irrigated areas, coal apparently accounts for

some 30% of fuel use. Current efforts to increase supplies focus upon both increasing supplies of commercial coal (produced primarily in mines owned by the central or local governments) and increasing output from small, collectively or individually operated coal pits. In 1984, goals were outlined to increase supplies by 1986 to an average of one ton per household (about 35% of current household fuel use) in Zone I, and to an average of one-half ton per household (15-20% of current household fuel use) in Zones II and III.

3.33 Rural households directly purchase and transport coal if they live near enough to a small mine or pit; otherwise transportation to the local town is arranged by the county or township, and households will move the coal from there to the farm. Transport costs to the local town are fully subsidized by the Two Xis Commission; rural households pay only the ex-mine price.

3.34 Despite the potential, there are major constraints to increasing rural household coal use, including the availability of investment funds for state as well as small mine development, the underdevelopment of road transport, and perhaps most important, the inability of households to pay cash costs. Various county and village level reports almost universally portray the lack of cash to purchase coal as a critical constraint on expanding coal use. Recently, the Two Xis Commission has undertaken efforts to provide coal free of charge to households, contingent upon the planting of specified areas of uncultivated land to scrub fuel. Through such measures, it is hoped that pressure on uncultivated land to provide biomass supply for short-term needs can be sufficiently alleviated to enable more rational and ultimately more productive means of harnessing the hillsides to provide biomass products to take hold.

3.35 Viewing the longer term, the cash costs of increased coal supplies may be more than compensated by increased cash income from agricultural development resulting from changes in fuel supply patterns. One example could be the partial replacement of dung currently used as fuel for the kang with purchased coal and the use of dung as a fertilizer to increase crop yields. Another example could be an increase in coal supplies for cooking, allowing steep hillside land to be cultivated primarily for fodder to promote animal husbandry development.

3.36 Solar Cookers. Although there are problems of design and convenience with existing cookers, research suggests that use of solar energy for cooking could be competitive with other energy sources in many areas of Dingxi. As of mid-1985, about 29,000 parabolic-dish cookers had been disseminated in the Dingxi region, and 46,000 units had been popularized in Gansu province as a whole. Costs are quoted at Y 60-80 per unit, while fuel savings based on survey results are reported at 200-250 kgCE per family, representing about one quarter of cooking needs. (The average number of sunny days per year is estimated at 200, and even on sunny days solar cookers are used to meet only a portion of total cooking needs.) Households pay Y 10-20 per unit, while the balance of the cost of the units is subsidized by the Two Xis Commission.

3.37 The cookers currently in use consist of a cement parabolic shaped shell, coated with bitumen, onto which square glass mirrors are pressed and

focused upon the cooking pot, supported by an adjustable stand. The units are produced locally and weigh about 100 kg each. In addition to the excessive weight of the units, the chief technical problem encountered has been the deterioration of the glass mirrors due to inferior raw material. Although the cooker body may last for a long time, the glass must be replaced every three years, at a cost of some Y 15-20 per unit. Although most of the disseminated units are still in use, users have nevertheless found them to be inconvenient. Cooking must be done outdoors in the sunshine, even during winter, and often warmed water must be taken inside to complete cooking with the indoor stove. Solar cookers could be made more attractive to potential users by the use of different material (perhaps aluminum or aluminized plastic) and the availability of solar box-type cookers.

3.38 Improving Energy Efficiency. Improvements in the efficiency of household fuel use could generate fuel savings at a lower economic cost than any of the chief supply alternatives. The thermal efficiencies of traditional stoves in Dingxi are reported at 10, 15 and 18%, using crop by-products, fuelwood, and coal, respectively. "Improved stoves" are reported to have average thermal efficiencies of 20-30%, yielding a savings in fuel consumption for cooking of one-third to one-half when replacing traditional stoves.

3.39 In the Dingxi region, the improved stove program has focussed on completing retrofits to existing traditional cook stoves. An iron grate is installed in the combustion chamber and a brick chimney is added, apparently to improve the air flow and facilitate more complete combustion. As of mid-1985, such retrofits are reported to have been completed in virtually all of the one million households in Dingxi. Most of the retrofitting took place in 1984. Costs per retrofit are reported at Y 9-10, of which Y 4 is for the iron grate. Retrofits have been fully subsidized by the Two Xis Commission for about 70% of the households in the region; households which can afford retrofits themselves have purchased materials on their own and contracted for local technicians to do the work. Information regarding the actual results of efforts to date in terms of fuel savings is not available.

3.40 Experience in other countries suggests that, while major fuel savings can be achieved through an effective improved stoves program, lack of careful attention to critical details and the full range of consumer needs can result in failure. The designing of effective improved stoves has proved far more complex than originally thought. Parameters which need to be considered include convenience, smoke emissions, turndown capacity (ability to adjust the heat output rate), the types of foods being prepared, the types of fuel used, and possible indirect benefits from stove use, such as space heating. Methods of dissemination, and especially the degree of interaction between designers and users, have been found to be critical.

3.41 Judging from reports on areas where stove retrofits were completed in 1983, the improved stove program in the Dingxi region has suffered from the same implementation problems that have affected similar efforts in other countries. Local craftsmen often have had inadequate training and technical support, and stove designs have not been standardized, with the result that the quality and effectiveness of designs varies widely. In many cases, users apparently are unfamiliar with operation techniques. According to one report

from investigations of a village in northern Dingxi county, fuel use for cooking actually increased in some households after retrofits were completed. If not already initiated, an in-depth evaluation of actual results to date is strongly recommended, in order to pinpoint priorities for strengthening the program.

3.42 While cooking accounts for the larger portion of household energy use in most cases, fuel consumption for heating the household kang accounts for about 40-45% of the total. Chinese sources also emphasize the need to realize the potential for savings through improvements in the traditional kang, but while a program to disseminate improved kang is envisaged for the near future, work is still at an experimental stage. Potential fuel savings are believed to be on the order of one-third to one-half.

#### Institutional Arrangements

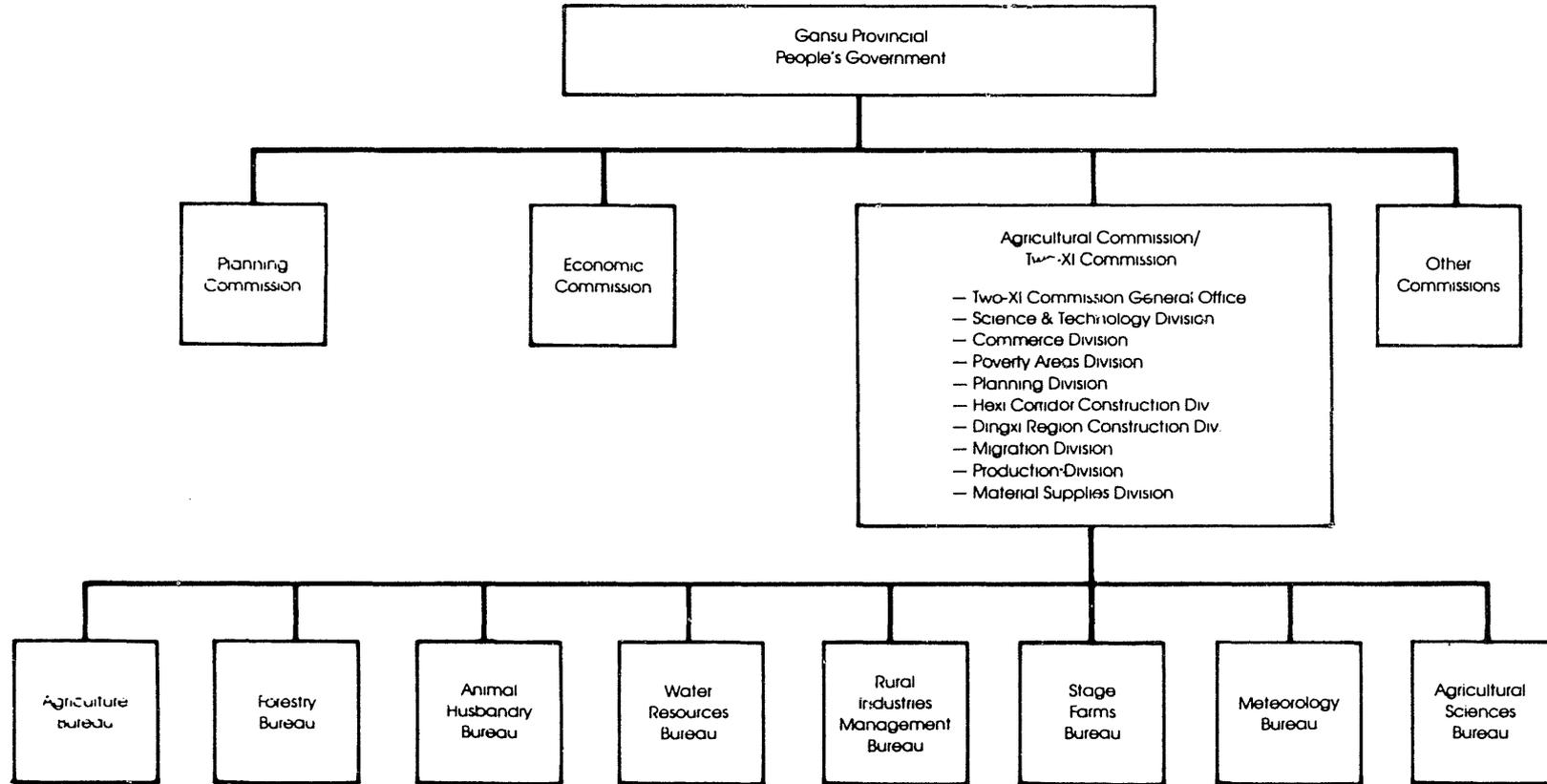
3.43 Past attempts to revegetate the eroded loess hills were made under the brigade system and involved mobilization of large teams of workers. This has changed recently with the introduction of the production responsibility system (PRS). Individual farmers are now invited to take up a temporary permit for as much of the steep hillside as they believe they can revegetate. They are also allotted lower land of milder slope suitable for annual cropping and are required to accept controls on the grazing of their animals, mainly sheep. On satisfactory completion of afforestation work, supervised by local technical staff, they receive a certificate of tenure which can be inherited by their children and grandchildren providing they continue to manage the area satisfactorily.

3.44 Overall responsibility for this work lies with the Two Xis Commission which executes programs through the provincial, prefecture, district and county agricultural and forestry staff (see Figure 3.1). This network is widespread and relatively effective, though levels of technical competence could doubtless be improved. Nevertheless, the positive impact of the PRS is apparent, indicating the acceptability of the systems employed to at least a proportion of the population involved. Thus, in the Dingxi area, afforestation has become more successful largely in response to the greater security of tenure offered by the PRS.

#### Financing Arrangements

3.45 The rehabilitation of the loess hills is financed partly through the Two Xis development budget. Farmers are paid according to the quantity of work performed both in their own agricultural areas and in the public land in the vicinity of their settlements. As the farmers themselves would enjoy the benefits of the rehabilitation, such payments are not intended to reflect the true costs of the investments. A scale of payments for satisfactorily completed works in various categories was promulgated in 1984 (see Table 3.2). Although these standard payments are used for programming and budgeting purposes at the provincial level, prefectural and county officials are at liberty to adjust the scale in accordance with local circumstances.

## Organizational Structure of the Gansu Provincial People's Government and the Agricultural and Two-Xis Commissions



Source: Two-Xis Commission.

Table 3.2: PAYMENTS FOR LAND REHABILITATION AND OTHER ACTIVITIES

---

	Payments
<hr/>	
Grass Planting	
Reverting sown land to pasture	10 yuan per mu
Planting grass on barren land	5
Incorporating grass in rotation	5
Forestry	
Planting trees and scrub	15
Establishing tree nurseries	30
Land Development	
Terracing slopes	20
Rehabilitating stone mulch	20
Constructing gully plugs	40
Treating basins	10,000 yuan per km
Water supply	
Constructing underground storage	1 yuan per mu
Rehabilitating storage ponds	300 yuan per unit
Rural Energy Resource Development	
Modernizing stoves	11 yuan per household
Transporting coal for household use	30-50 yuan per household
Constructing biogas pits	160 yuan per unit
Installing solar stoves	80 yuan per unit
Purchasing electrical appliances	80 yuan per household

---

Source: Two Xis Commission

3.46 Budgeted expenditure for these items was estimated at 65.4 million yuan for 1984 (see Table 3.3). The Hexi budget represents only 13% of the total for these categories, much of which is concentrated in counties adjacent to the Dingxi region where conditions and urgency for rehabilitation are similar to those in the Dingxi counties.

Table 3.3: PUBLIC EXPENDITURES ON LAND REHABILITATION, 1984

	Hexi	Dingxi	Total
	(million yuan)		
Grass Planting			
Reverting sown land	0.34	2.41	2.75
Planting barren areas	0.81	3.62	4.43
Incorporating grass	0.31	4.29	4.60
Forestry			
Planting trees	3.49	10.89	14.38
Establishing nurseries	1.29	1.32	2.61
Land Development			
Terracing	-	6.00	6.00
Mulching	0.04	2.40	2.44
Basin treatment	1.00	10.00	11.00
Rural Energy			
Converting stoves	0.38	6.26	6.64
Suppling coal	0.94	8.75	9.69
Purchasing appliances	-	0.07	0.07
Constructing biogas pits	-	0.42	0.42
Installing solar stoves	-	0.36	0.36
<u>Total</u>	<u>8.60</u>	<u>56.79</u>	<u>65.39</u>

Source: Two Xis Commission

3.47 Government investments in rehabilitation activities constitute a relatively small proportion of the full costs. Whereas the budget allocations and thereby the nominal costs are known and as given above, the true costs cannot be directly determined and therefore the contributions by the beneficiaries can only be roughly estimated. The construction of bench terraces can, however, serve as a basis for estimating the magnitude of such contributions. Bench terracing requires, for example, an average of 66 work-days per worker (990 workdays/ha), assuming a daily earth moving output as 3 m<sup>3</sup>. The daily wage rate is reported as Y 1.97, giving a total financial cost of Y 130 per worker, which is Y 110 above the government investment. The ratio of beneficiary to government contribution is approximately 5.5:1. Similarly, for tree and scrub planting on narrow negative-sloping terraces, the government's portion of investment (paid to beneficiaries) is Y 15/mu (Y 225/ha). An estimated 40 workdays would be required and the farmer has to supply the planting materials, at heavily subsidized costs of Y 0.1 per seedling. The farmers are responsible for gap-fill replanting to ensure a survival rate of 85% after the first year. The labor and material cost would be in the order of Y 60 per mu (Y 910/ha). In this case, the beneficiary to

government contribution ratio would be about 4:1. The rationale for such ratios is that the benefits would, over time, accrue to the farmers.

### Employment and Population Implications

3.48 In order to implement the proposed rehabilitation strategy it will be necessary to reduce population densities in some parts of the Dingxi region. The drier climate of Zone I (150-350 mm average annual rainfall) permits only very limited agricultural development. Crop production possibilities in a balanced cropping system suggest grain yields of around 650 kg/ha/year in an average rainfall year with the likelihood of one severe drought year in four. Fuelwood growth rates suggest that about 3.5 ha of fuelwood forest would be needed for a family to be self-sufficient. Given the normal distribution of land deemed suitable for cropping, forest and grassland, a typical farm family would require a total surface of around 14 ha of which, in addition to fuelwood forest, some 5.6 ha would be cropped and 4.9 ha would be grassland. At present, however, about 170,000 households are farming 1.2 million ha of land or about 7 ha per household (see Tables 3.4 and 3.5). Moreover, even after land rehabilitation, land availability will increase to no more than 1.8 million ha.<sup>10/</sup> Thus in this drier zone the relocation of part of the population (about 32,000 households or 180,000 people) would be essential before starting the rehabilitation process.

---

<sup>10/</sup> It should be noted that there appears to be considerable underestimation of the existing area under agriculture and much of the land designated as potentially suitable for farming may already be under some form of agriculture.

**Table 3.4: LAND USE IN THE DINGXI REGION BY COUNTY**  
(000 ha)

County	Gross area	Cultivated land	Forest	Pasture /a	Other land	(Of which suitable for agriculture)
Gulang	501.2	73.3	10.7	343.2	72.7	(40.0)
Jingtai	543.4	44.0	6.0	429.4	64.0	(11.3)
Jingyuan	759.8	97.3	8.7	298.5	355.3	(176.0)
Huining	565.3	154.7	23.3	52.0	335.3	(85.3)
Yongdeng	565.2	92.7	33.3	62.5	376.7	(322.0)
Gaolan	339.4	38.0	4.7	113.4	183.3	(0.0)
Yuzhong	324.6	79.3	31.3	78.7	135.3	(108.0)
Dingxi	365.0	130.0	24.0	101.7	109.3	(98.0)
Lintao	286.6	75.3	19.3	91.3	100.7	(100.7)
Tongwei	290.8	124.0	8.0	128.8	30.0	(16.0)
Longxi	240.5	82.7	12.7	117.1	28.0	(28.0)
Yongjing	189.5	23.3	7.3	54.2	104.7	(104.7)
Dongxiang	151.8	25.3	4.7	41.8	80.0	(60.0)
Jingning	219.9	102.7	14.7	71.8	30.7	(17.3)
Zhuanglang	152.1	64.7	70.7	38.0	28.7	(28.7)
Qinan	160.5	84.7	8.7	55.8	11.3	(11.3)
Huanxian	922.6	90.7	35.3	511.9	284.7	(211.3)
Huachi	383.5	26.7	69.3	72.8	214.7	(151.3)
<b>Total/b</b>	<b>6,961.6</b>	<b>1,395.3</b>	<b>344.0</b>	<b>2,678.3</b>	<b>2,544.0</b>	<b>(1,525.3)</b>

/a Residual

/b Figures do not add up exactly.

Source: Two Xis Commission and mission estimates.

**Table 3.5: DISTRIBUTION OF LAND AND POPULATION IN THE DINGXI REGION BY ZONE**

	Zone I	Zone II	Other Zones	Total
<u>Land Distribution ('000 ha)</u>				
Cultivated land	295	701	400	1,396
Forested land	65	118	161	344
Pasture	919	1,154	605	2,678
Barren land	905	1,020	619	2,544
(of which suitable)	652	447	426	1,525
<u>Total</u>	<u>2,184</u>	<u>2,993</u>	<u>1,785</u>	<u>6,962</u>
Of which actually suitable	1,279	1,973	1,166	4,418
Potentially suitable	1,931	2,420	1,592	5,943
<u>Population Distribution ('000)</u>				
Households	170	452	370	992
People	978	2,427	1,965	5,370
<u>Land Availability (ha/household)</u>				
Actual	7.5	4.4	3.2	4.5
Potential	11.4	5.4	4.3	6.0

Source: Two Xis Commission and mission estimates.

3.49 Zone II (350-450 mm average annual rainfall) has a substantially greater potential and a typical farm family would require a total surface area of around 7 ha. Substantial relocation of the population (about 106,000 households or 570,000 people) will also be necessary in this zone since current land availability per household is only a little more than 4 ha.

#### Economic and Financial Analysis

3.50 A complex system of rehabilitation measures has already been implemented at the Dingxi and Mizhi Experiment Stations. These rehabilitation measures include construction of terraced land for production of crops (wide terraces), tree and scrub fuelwood (narrow terraces), conversion of steeply sloped hillsides to unterraced grassland (for controlled grazing or cut-and-carry fodder production), and construction of soil dams, wells and roads. Since the economic viability of each of these measures differs by zone, and within each zone by slope, a complete economic analysis of the loess hills rehabilitation strategy would require an examination of a large array of

investment options. As a first step, therefore, several representative rehabilitation measures to be undertaken in Zone II of the Dingxi region have been analyzed.<sup>10/</sup>

3.51 The specific measures examined include: construction of wide terraces (7 m) on gently sloped hillsides for cropping, construction of narrow terraces (1.5 m) on gently and steeply sloped hillsides for production of trees and scrub fuelwood, and construction of small and large soil dams. Economic values were attributed to the investment and production costs and incremental benefits of each of these rehabilitation measures. In most cases the analysis is based on the assumption that the land is currently under some form of cultivation. Typical investment costs for each measure are summarized in Table 3.6; crop budgets at full development are presented in Table 3.7; and economic and financial prices for major products are detailed in Table 3.8. Based on data from experimental work by the Dingxi Station the following assumptions were adopted in the base case:

- (a) Crops: Yields would be 75% greater on more intensively farmed terraced fields relative to less intensively farmed untterraced fields (the Dingxi and Mizhi stations report incremental yields of at least 100%);
- (b) Trees and Scrub Fuelwood. Each mu of gently sloped terraced trees would yield 150 kg of scrub fuelwood in years 4 to 9, and 300 kg at harvest in year 10 (125 kg of scrub fuelwood in years 4 to 11 and at harvest in year 12 on steeply sloped land); each mu of scrub fuelwood would yield 150 kg of fuelwood beginning in year 2; the financial prices for 7 inch polewood (Y 5 per pole) and fuelwood (Y 0.10 per kg) were representative of their economic value; and the average worker would harvest 23 poles or 100 kg of scrub fuelwood per day; and
- (c) Soil Dams. A small soil dam (6 m wall) would silt up in year 4 producing 0.5 ha of dam land (0.25 ha of sloped land assumed lost to

---

<sup>10/</sup> The adoption of the various rehabilitation measures depends on the expected economic returns for those measures and on the resource endowment of the village concerned. Thus, in addition to zone and slope, the size of the village work force, the availability of barren land, the geology of the village gullies, and other natural factors will govern the selection of program components and the scheduling of the rehabilitation package. With a greater understanding of the resource endowments of the average village, it will be possible to design a representative package of rehabilitation measures and to estimate a rate of return for investment in the package for the typical village in each zone.

Table 3.6: LOESS HILLS REHABILITATION - INVESTMENT COSTS PER MU

Land class:	Gentle slope (15°)					Steep slope (25°)						Soil dams							
	Crops		Trees			Grass		Scrub fuelwood		Trees		Small			Large				
	Year:	1	2+	1	2-9	10+	1	2+	1	2+	1	2-11	12+	1	2-3	4+	1-2	3-9	10+
<b>Annual Labor (man-days)</b>																			
Terracing /a	92	-	25	-	-	-	-	25	-	25	-	-	-	-	-	-	-	-	-
Construction /b	-	-	-	-	-	-	-	-	-	-	-	-	2,460	-	-	-	12,500	-	-
Planting /c	-	-	45	-	-	5	-	7	-	45	-	-	-	-	-	-	-	-	-
Maintenance	-	5	-	10	5	-	3	-	5	-	10	5	-	49	49	-	-	500	500
Subtotal (man-days)	<u>92</u>	<u>5</u>	<u>70</u>	<u>10</u>	<u>5</u>	<u>5</u>	<u>3</u>	<u>32</u>	<u>5</u>	<u>70</u>	<u>10</u>	<u>5</u>	<u>2,460</u>	<u>49</u>	<u>49</u>	<u>12,500</u>	<u>500</u>	<u>500</u>	
Value /e	55	3	42	6	3	3	2	19	3	42	6	3	1,476	30	30	7,500	300	300	
<b>Materials (Yuan)</b>																			
Seeds and seedlings /f	-	-	50	3	-	-	-	4	-	50	3	-	-	-	-	-	-	-	-
Other /g	9	1	7	1	1	1	-	3	1	7	1	1	246	5	5	1,250	50	50	
<b>Total</b>	<u>64</u>	<u>4</u>	<u>99</u>	<u>10</u>	<u>4</u>	<u>4</u>	<u>2</u>	<u>26</u>	<u>4</u>	<u>99</u>	<u>10</u>	<u>4</u>	<u>1,722</u>	<u>34</u>	<u>34</u>	<u>8,750</u>	<u>350</u>	<u>350</u>	

/a Labor requirements for construction of 7 m wide terraces (for crops) calculated at 3.6 m<sup>3</sup> per work-day and 330 m<sup>3</sup> per mu and 1.5 m wide benches (for trees and scrub fuelwood) calculated at 3.6 m<sup>3</sup> per work-day and 90 m<sup>3</sup> per mu. Establishment of grassland does not require terracing.

/b Average labor requirements for construction of soil dams in Mizhi County, Shaanxi Province.

/c Includes transport of seed or seedlings, planting and first watering.

/d Includes replacement of trees (annual failure rate of 16% in years 1-3 annualized over years 2-9) and repair of terraces, grassland and dams.

/e Labor at Y 0.6 per work-day.

/f For trees, 500 seedlings at Y 0.1 each; for grass 6 kg of alfalfa seed at Y 0.44 per kg; and for scrub fuelwood, 0.5 kg of seed at Y 5 per kg.

/g Includes costs for equipment, tools and other materials.

Table 3.7: LOESS HILLS REHABILITATION - CROP BUDGET AT FULL DEVELOPMENT, ECONOMIC VALUES PER MU

	Unit	Unit price	Wheat				Potato		Millet	
			Zone II		Irrigated		Zone II		Zone II	
			Amt.	Value	Amt.	Value	Amt.	Value	Amt.	Value
<b>Without Project (Rainfed)</b>										
<u>Input Costs</u>										
<u>Materials</u>										
Seeds	kg	-	10.0	6	-	-	100.0	7	5.0	3
Chemical fertilizer	kg	0.28	7.0	2	-	-	14.3	4	14.0	4
Manure	kg	0.03	33.0	1	-	-	100.0	3	100.0	3
Agrochemicals	kg	-	-	0	-	-	-	1	-	1
Machinery	Y	-	-	2	-	-	-	3	-	2
<u>Labor</u>										
Human	work-day	0.60	11.8	7	-	-	15.3	9	9.3	6
Animal	work-day	2.20	2.5	6	-	-	3.0	7	2.0	4
Subtotal	Y			<u>24</u>		<u>-</u>		<u>33</u>		<u>21</u>
<u>Value of Output</u>										
Yield	kg	-	75	-	-	-	473	-	68	-
Price	Y/ton	-	-	843	-	-	-	72	-	519
Product value	Y			63		-		34		35
By-product value	Y			3		-		6		3
<u>Total Value</u>	Y			<u>66</u>		<u>-</u>		<u>40</u>		<u>38</u>
<u>Net Value</u>	Y			<u>42</u>		<u>-</u>		<u>7</u>		<u>16</u>
<b>With Project (Rainfed)</b>										
<u>Input Costs</u>										
<u>Materials</u>										
Seeds	kg	-	10.0	6	20.0	13	100.0	7	5.0	3
Chemical fertilizer	kg	0.28	15.0	4	57.0	16	28.5	8	22.5	6
Manure	kg	0.03	30.0	1	95.0	3	223.0	7	160.0	5
Agrochemicals	kg	-	-	4	-	10	-	1	-	1
Machinery	Y	-	-	2	-	9	-	3	-	2
<u>Labor</u>										
Human	work-day	0.60	13.0	8	26.0	16	16.5	10	10.5	6
Animal	work-day	2.20	2.5	6	3.5	8	3.0	7	2.0	4
Subtotal				<u>31</u>		<u>73</u>		<u>43</u>		<u>28</u>
<u>Value of Output</u>										
Yield	kg	-	131	-	300	-	827	-	118	-
Price	Y/ton	-	-	843	-	843	-	72	-	519
Product value	Y			110		253		60		61
By-product value	Y			5		9		10		4
<u>Total Value</u>	Y			<u>115</u>		<u>262</u>		<u>70</u>		<u>66</u>
<u>Net Value</u>	Y			<u>84</u>		<u>189</u>		<u>27</u>		<u>38</u>

Table 3.8: FARM-GATE PRICES FOR MAJOR PRODUCTS AND INPUTS /a

	<u>/b</u> Wheat	<u>/c</u> Sorghum	<u>/d</u> Maize	<u>/e</u> Urea	<u>/f</u> TSP	<u>/g</u> Potash
Net trade status	M	X	X	M	M	M
<u>1995 Prices (1983 US\$)</u>						
Import price (\$)	150	-	-	107	134	74
Ocean freight (\$) /h	46	-	-	46	46	46
CIF or FOB Shanghai (\$)	196	92	104	153	180	120
CIF or FOB Shanghai (Y) /i	725	339	365	506	665	444
Port charges and margin /j	90	-56	-58	76	85	65
Transport: Rail to project area /k	25	15	15	5	25	25
Transport: Truck to farm-gate /l	3	3	3	3	3	3
Price ex-mill	843	302	325	670	778	537
Milling adjustment	-	-	-	-	-	-
Milling cost less by-product value	-	-	-	-	-	-
Economic price (Y)	843	306	329	670	778	537
Financial price (Y)	640	300	500	-	-	-

/a World Bank projections for 1995 in 1986 constant dollars (EPD, "Half-Yearly Revision of Commodity Price Forecasts and Quarterly Review of Commodity Markets," Office Memorandum, August 1986).

/b Canadian No. 1 Western Red Spring (CWRS), in store, Thunder Bay.

/c US No. 2 grain sorghum, Milo yellow, FOB Gulf ports.

/d US No. 2 Yellow, FOB US Gulf Ports.

/e Bagged, FOB NW Europe, 46% N.

/f Bulk, FOB US Gulf, 46% P<sub>2</sub>O<sub>5</sub>.

/g Potassium chloride, bulk, FOB Vancouver, 60% K<sub>2</sub>O.

/h Estimated freight rate of bulk commodities from US Gulf to China ports.

/i Converted at the exchange rate of Y 3.70 = US\$1.00.

/j Port charges of Y 30 and 5% distribution margin.

/k Estimated rail freight rate for bulk commodities from China ports to project area.

/l Estimated truck freight rate for bulk commodities from railhead to farm-gate.

production beginning in year 1<sup>11/</sup>); a large soil dam (25 m wall) would silt up in year 10 producing 5 ha of dam land (2.5 ha of sloped land assumed lost to production beginning in year 1<sup>11/</sup>); and net benefits from crop production on dam land would be equivalent to the net benefits from Zone II wheat (small dams) and irrigated wheat (large dams).

3.52 A critical assumption concerns the economic value of labor which has been estimated at Y 0.60 per workday compared with the basic financial wage of Y 1.0-Y 2.0 per day. At the present time there is massive unemployment and underemployment in rural areas of Gansu and the marginal productivity of labor or its opportunity cost is effectively nil. At a minimum, however, the unemployed would be unwilling to work for less than the additional cost of food associated with a full day's work, and some additional allowance should be added to this. On this basis an economic wage has been estimated that takes account of additional energy requirements of employment and reflects the marginal disutility of labor.

3.53 Using these assumptions and discounting costs and benefits over the life of the rehabilitation measure (10, 12, or 30 years), the ERRs for the measures examined range from 13 to 40%. It should be emphasized that these ERRs do not account for the positive downstream effects of decreasing siltation in the Yellow River watershed. The high rates of return demonstrate the economic advantage of reduced cultivation of unterraced hillsides in favor of converting these lands to terraced crop and tree production and to dam land. Production of scrub fuelwood on previously cultivated hillsides appears to be the exception to this rule - net benefits are negative. Production of scrub fuelwood on previously barren land, on the other hand, has a high rate of return. (Since overgrazing and the removal of sod over many years has resulted in large tracts of barren land in the Dingxi area, the production of scrub fuelwood on this land represents a major development opportunity.) Terracing gently sloped land for crop and tree production also has a high rate of return. Terracing steeper slopes for tree production appears to be somewhat less remunerative. Because of their large investment costs and delayed benefits, soil dams are the least attractive of the rehabilitation measures examined. However, it should be noted that soil dams play a key role in soil conservation and so are associated with large but unquantified downstream benefits. Furthermore, the rate of return is higher for soil dams constructed in areas where little or no sloped land is lost to production (16% for both small and large dams where no sloped land is taken out of production).

3.54 Sensitivity of the ERR was tested to variation in investment costs, the economic value of labor, trees and scrub fuelwood, crop yields, and combinations of increased costs and decreased benefits. The results of the sensitivity analysis are summarized in Table 3.9. No single variant proved crucial to the economic viability of terracing gentle and steep slopes for

---

<sup>11/</sup> This is in the upper bound to the amount of sloped land lost to production. In many cases soil dams are constructed in areas where most or all of the land is too steep for successful crop production.

Table 3.9: SUMMARY OF LOESS HILLS (ZONE II) ECONOMIC ANALYSIS

	<u>Gentle slope</u>		<u>Steep slope</u>		<u>Soil dams</u>	
	<u>Crops</u>	<u>Trees</u>	<u>Fuelwood</u>	<u>Trees</u>	<u>Small</u>	<u>Large</u>
<u>Base Case /a</u>	27	26	40	19	13	13
<u>Variations</u>						
<u>Investment Costs up</u>						
+10%	25	25	35	18	10	13
+20%	23	24	31	18	9	12
+30%	21	23	28	17	7	11
<u>Economic Cost of Labor at</u>						
Y 0.7 per work-day	24	25	34	19	11	12
Y 0.8 per work-day	22	25	28	19	10	11
Y 1.0 per work-day	17	24	20	18	7	10
Y 1.2 per work-day	14	23	14	17	5	8
<u>Incremental Yield with Ter-</u> <u>racing at</u>						
50%	14	-	-	-	9	-
100%	41	-	-	-	16	-
<u>Economic Value of Trees Down</u>						
-10%	-	24	-	18	-	-
-25%	-	21	-	16	-	-
-50%	-	15	-	10	-	-
<u>Economic Value of Scrub</u> <u>Fuelwood Down</u>						
-10%	-	25	34	19	-	-
-20%	-	25	29	19	-	-
-30%	-	25	23	19	-	-
-50%	-	24	11	18	-	-
<u>Irrigated Wheat Yields Down</u>						
-10%	-	-	-	-	-	12
-20%	-	-	-	-	-	10
-30%	-	-	-	-	-	7
Combination 1 /b	18	22	22	17	6	10
Combination 2 /c	16	20	13	15	6	9

/a The without project situation assumes some cultivation in all cases except scrub fuelwood which is assumed to be on previously barren land. Net benefits are negative for scrub fuelwood produced on previously cultivated hillsides.

/b Combination of investment cost overrun (+25%) and an increase in the economic value of labor to Y 0.75 per work-day.

/c Combination 1 (footnote /c above) plus a 10% decrease in incremental yields (crops and small dams), value of trees (trees) and scrub fuelwood (fuelwood), and irrigated wheat yields (large dams).

crop, tree and scrub fuelwood production - the ERRs remained greater than the opportunity cost of capital in China (about 12%) in almost all cases. The return to investment in soil dams remained greater than 9% despite increases of 10 to 20% in investment costs or 10 to 20% decreases in expected benefits, but fell below 9% with greater changes in costs and benefits.

3.55 Financial Analysis. The rates of return for the several loess hills rehabilitation measures examined in this report are not greatly affected by valuing crops at financial prices since the lower financial prices diminish the net benefit from annual crop production in both the with and without project scenarios. Using financial crop prices diminishes the rate of return to 19% for conversion to terraced crop production (ERR = 27%) and to 7% and 10%, respectively, for, construction of small and large soil dams. The rate of return increases marginally in the case of conversion to terraced tree crop production. However, reflecting the labor-intensive nature of the rehabilitation measures, the FRR is more seriously compromised when labor is valued at the financial wage rate. Valuing labor at Y 1 per workday and using financial prices for crops, the FRRs for conversion to terraced crop production, planting scrub fuelwood on barren land, and construction of small and large soil dams are 10%, 20%, 2%, and 6%, respectively (ERRs = 27%, 40%, 13%, and 13%). It should be noted, however, that with the possible exception of large soil dams, individual households will be responsible for undertaking the rehabilitation measures on their own land. They will receive from the government some financial assistance but this will amount to much less than the daily wage equivalent.

#### Principal Issues

3.56 On the basis of the experimental work already undertaken, it seems clear that economically and financially viable rehabilitation measures can be developed for rainfed areas of Dingxi. But much further work is still required in developing specific packages of measures for different areas and in preparing an overall plan for implementation of loess hills rehabilitation. In this regard a number of important issues need to be addressed:

- (a) testing programs for different types of trees (including fuelwood) and grass species need to be strengthened and more account needs to be taken of similar work in other parts of China and other parts of the world;
- (b) there is scope for improving the productivity of proposed farming systems but this will involve more work on crop rotations and varieties, water use efficiency and fertilizer strategy;
- (c) livestock needs to be better integrated into proposed farming systems but this will depend crucially on the rate at which the use of fodder for fuel can be reduced;

- (d) there is great scope for expanding the use of coal and for improving the efficiency of energy use but this will depend on government financial, technical and institutional support including a continuation and expansion in the program for providing subsidized coal tied to progress in land rehabilitation; and
- (e) the task of surveying different watersheds and developing action programs is enormous and much more attention needs to be paid to the staff requirements and training implications.

#### IV. IRRIGATION DEVELOPMENT

4.01 The broad objectives for development of irrigation in Gansu in the medium-term may be summarized as follows:

- (a) To complete projects already under construction or at advanced stages of planning in the Dingxi and Hexi regions.
- (b) To strengthen water management and on-farm development activities so as to optimize economic and financial benefits from existing systems.
- (c) To facilitate the self reliance of farmers in carrying out minor water conservation activities.
- (d) To select projects for future development, consistent with the availability of funds, which would produce multipurpose benefits in the context of comprehensive river basin planning. The stated target of the Bureau of Water Conservancy is to increase the area under irrigation in the province by some 115,000 ha by 1990, and by 267,000 ha by the turn of the century.

Dingxi and Hexi are of key importance in the strategic planning of water conservancy activities.

4.02 Development of irrigation in the the two Xis is constrained less by the availability of suitable land than by other factors. These include the limited availability and location of water sources, which in turn impose technical limitations on methods of water conveyance, cost limitations on the distance to which it would be economic to convey it, and the cost of energy needed to operate high lift pumps and hence the height to which such water may have to be pumped to reach potential command areas.

4.03 The schemes which are the least costly and the most economic to develop, and which provide the greatest opportunities for local resettlement are either those with simple gravity diversions in the Hexi corridor, or those with relatively low pumping heads and short conveyance canals in the Dingxi region. The latter tend to be relatively small in size, thus minimizing the overall construction and on-farm development period. However such schemes have already been developed or will be completed in the near future. Future prospects therefore are for major projects with likely greater technical complexity, longer construction periods and large capital investment.

#### The Irrigation Program

4.04 Past and projected trends in cropped and irrigated area are summarized in Table 4.1. Total cropped area increased by 9% from about 3.45 million ha in 1950 to a peak of over 3.75 million ha in the late-1950s and has declined marginally since that time. Irrigated area, on the other hand, increased steadily from 0.34 million ha in 1950 to 0.89 million ha in 1984, or from less than 10% of total cultivated area to over 25% during the last 35

years. The expansion of the irrigated area in the Hexi corridor has accounted for more than 90% of the total.

Table 4.1: IRRIGATION DEVELOPMENT 1950-95  
(million ha)

Year	Total Cultivated Area	Irrigated Area	Share of Total (%)
1950	3.45	0.34	9.9%
1955	3.76	0.38	10.2%
1960	3.76	0.50	13.3%
1965	3.60	0.53	14.8%
1970	3.59	0.68	18.9%
1975	3.57	0.81	22.6%
1980	3.55	0.86	24.3%
1984	3.53	0.89	25.3%
1995 Target	3.50	1.15	32.9%

Source: Gansu Provincial Water Resources Bureau.

4.05 About 90% of the increase in irrigated area since 1950, almost 0.6 million ha, was achieved through 50 medium- to large-scale irrigation projects, each with an irrigation command area of at least 3,300 ha. The Provincial Water Resources Bureau has provided data indicating that, with the exception of a minor slow down during the 1960s, the pace of irrigation development in Gansu has been relatively steady both in terms of the number of projects completed and the expansion of irrigated area per decade. The average project has an irrigation command area of about 10,000 ha, but about two-thirds of the projects have command areas below this level (between 3,300 and 10,000 ha). Small sections of several of the largest projects (ranging between 25,000 to 30,000 ha) were completed in the late-1950s and then greatly expanded in subsequent decades. All but three of the projects employ gravity irrigation systems. The three lift irrigation systems were completed in the 1970s (two projects) and 1980s (one project) and have lifts of 445, 511, and 534 meters and a total command area of 35,300 ha. Many of the small-scale irrigation schemes in Gansu, i.e., those with command areas of less than 3,300 ha, employ lift irrigation systems; however, lift irrigation accounts for less than 5% of the total irrigated area in Gansu at present.

4.06 Current plans call for the expansion of Gansu's irrigated area to 1.15 million ha by 1995. The bulk of this expansion would be achieved with the completion of twelve irrigation projects, including Jingtai II (33,300 ha), Yindaruqin (57,300 ha), the Linding Scheme (22,000 ha), the Shule River System (43,300 ha), the Yinli Scheme (50,000 ha) and seven projects with command areas of less than 10,000 ha each.

4.07 The Jingtai Phase II project is to irrigate, through pumping from the Yellow River, some 32,800 ha in Jingtai and Gulang counties about 200 km north of Lanzhou. Average lift is about 460 meters with a design flow of 18 m<sup>3</sup> per second. The Phase I project was completed in 1974 and currently irrigates some 19,800 ha under wheat (60%), maize, fruits and vegetables at moderate yield levels. Wheat yields about 3.8 tons/ha. Average annual rainfall of less than 200 mm precludes most annual cropping without irrigation. Topography is quite flat and soil quality appears to be better than either Jingtai Phase I or Yindaruqin. The rail line traversing the project area provides good communication and market access to Lanzhou. The trunk canal is about 100 km long; secondary canals total 340 km. Twenty-eight pumping stations are planned with a 174,000 kw power installation. Construction of the project began in 1976 but was suspended shortly thereafter until 1983 for lack of funds. Capital expenditure through 1984 was about Y 40 million (\$14.3 million). Another Y 41 million were to be spent in 1985 and an additional Y 216-256 million (\$77-91 million) may be required to complete the investment.

4.08 Provincial planners have proposed an ambitious agricultural diversification program on project lands centered on wheat (45% of the area) but including a substantial area of sugar beets as well as livestock, forestry and agroindustrial activities. The project area, at elevations between 1596 and 1906 m on the southern edge of the Tenggelii Desert, receives an average annual rainfall of 185 mm. It is sparsely populated and has been designated to absorb at minimally adequate income levels an additional 150,000 people at the proposed irrigated land allocation of about 0.17 ha of irrigated land per individual. Success in diversification and the economic cost of electricity for pumping are critical determinants of the project's economic rate of return (see para. 4.40).

4.09 The Yindaruqin Project, begun in the late 1970s, is to divert water from the Datong River at a design flow of 32 m<sup>3</sup> per second to irrigate through gravity flow some 57,300 ha in the Qinwangchuan area some 60 km north of Lanzhou city. The command area is at an average elevation of 2,000 m with an average annual rainfall of 290 mm. Physical works would include the main conveyance system (90 km in length), secondary canals about 1,050 km, 39 tunnels totalling about 75 km (of which five shorter ones have been completed and another three are more than five km each in length), 13 aqueducts, two inverted siphons and other smaller structures. In November 1985 negotiations were completed for foreign contractors to complete one of the longer tunnels (15 km) over a five year contract period. Topography is level to undulating. Soil quality is generally good, but with some indication of salinity in areas which have been partially irrigated in the past. The growing season is in the range of 165 days. Much of the area now grows one crop of wheat annually, largely under rainfed conditions and at low yields (about 500 kg/ha). Provincial authorities propose an eight year investment program involving the completion of civil works and rapid diversification of agriculture to include higher value crops, animal husbandry, forestry and agro-processing. Overall wheat yields at full development would average about 4.5 tons/ha, as compared with about 5.2 tons/ha now realized under irrigation on a small part of the project area with very good soils. Projected crop yields seem reasonable, but agricultural diversification plans are ambitious

and would require strengthened programs in adaptive agricultural research and extension. At full development, Yindaruqin is expected to absorb another 120,000 people in addition to the existing population. Most of the new settlers would be drawn from the two counties in which the project is located (Gaolan and Yong Deng). Total investment costs (1980 prices) to complete the project are estimated at Y 560 million. This should be increased by at least 15% to convert to 1985 prices.

4.10 A feasibility study of the proposed Linding Project in Dingxi prefecture is scheduled to be completed in 1986 and design options are still being explored. It is estimated that an initial 20,000 ha could be irrigated in the scheme. Present plans are to develop this site as a pumping scheme (10 cu m/sec) by high lift pumps through a head of 460 m. The proposed 78 km conveyance canal would entail construction of 32 km of tunnels. However, a gravity flow system from a reservoir also has been considered. Investment costs have been provisionally estimated at about Y 9,000/ha. The project is of continued interest to provincial authorities because of the large amount of good quality water available from the Tao River and the proximity of the site to severely depressed areas in Dingxi from which it is planned some 30,000 migrants could be drawn.

4.11 Other irrigation possibilities including the Yinli and Shule schemes are in the Hexi Corridor to the northwest of Lanzhou. They are viewed as major potential receiving areas for settlers from the poorest parts of the Dingxi region. Eleven irrigation projects in Hexi listed by the Resettlement Division of the Two Xis Commission are scheduled to receive a total of 170,000 migrants between 1987 and 1991. Details of projects are sketchy and only one, the Changma which would provide for migration of 23,000 people, is targeted to receive more than 15,000, and of that total no more than 3,000 are expected to be settled by 1992.

4.12 As presently planned, work on many of these schemes would proceed in parallel. The Yinli scheme, however, faces a serious riparian rights issue which will almost certainly delay and possibly limit development of the command area. In addition, more work is needed on the economic as well as the financial viability of different schemes and on the appropriate phasing of schemes to derive maximum economic returns.

#### Types of Development

4.13 All irrigation projects in the Two Xis have conventional gravity type distribution systems apart from a small experimental area (360 ha) of sprinkler irrigation in Jingtai county. Canals are designed to run continuously down to, and often including, the tertiary level with distribution to field plots on a 20 day rotational basis.

4.14 Differences between projects arise from the method of conveying water from the source to the service area. The principal types encountered are either high lift pump or gravity diversion, dictated by the topographical features of the area and location of the water source. Both types usually entail construction of long conveyance canals, and include aqueducts, siphons and tunnels.

4.15 The Yellow River is the principal source of water for projects in much of the Dingxi area. As the river runs in a defile far below the general level of those terraced lands which can be adapted to irrigation development, high lift pumps (215m to 554m heads) are an essential feature of projects using this water source. The volume of water flowing in the Yellow River (27.7 billion m<sup>3</sup> per year) and the control exercised by the Liujiaxia Hydro-power reservoir upstream (4.15 billion m<sup>3</sup> available storage capacity) ensure an adequate supply of water consistent with the irrigation demand pattern. However the high silt content of the Yellow River (3.12 kg/m<sup>3</sup> on average) necessitates replacement of impellers every fifteen months.

4.16 Sources of water for projects in the Hexi corridor are streams flowing from the Qi Lian mountain range, whose water is obtained partly from snow melt and glaciers. As water availability from these streams does not exactly correspond with the extent and timing of irrigation crop water requirements, reservoir storage facilities have to be constructed if optimum use is to be made of restricted water sources.

#### Design of Irrigation Systems

4.17 The climatic conditions in Gansu are such that they call for systems that are almost totally unique to the province. Perhaps the most significant feature is the application of winter irrigation (net 1,500 m<sup>3</sup>/ha) supplied during October and the first half of November to serve several purposes: leaching and loosening the soil texture through subsequent freezing to a depth of about one meter and therefore cracking the soil to facilitate aeration. The practice also acts to eradicate soil borne fungus diseases which would otherwise be rife under the conditions of significant wheat monocropping that characterizes most irrigated plots. Finally, and very important, the practice ensures an early supply of soil moisture in the spring, thus facilitating crop germination in March to give a longer growing period than could otherwise reliably be achieved, since irrigation water cannot be applied via the system so early in the year due to the danger of damage to concrete structures from sporadic ice formation.

4.18 Thereafter, the main irrigation supply during the cropping season is based on three applications at 20 day intervals during May, June and July. However, these applications, typically at 900, 1,050 and 900 m<sup>3</sup>/ha, respectively, are slightly less than estimates of crop evapo-transpiration for wheat, the principal crop. This appears to be particularly relevant to projects in the driest areas such as Jingtai and Hexi which experience high evaporation and windspeeds, although the latter factor can be, and has been ameliorated on many of the more mature schemes by the almost universal practice of tree planting for use as building poles, which incidentally serve as wind breaks prior to their harvest.

4.19 Systems typically have canals constructed to the tertiary level (at two or three m<sup>3</sup>/s) with irrigation water rotated at the quaternary level. Night irrigation is common practice with no problems reported. Water supply is designed to meet the water requirements of grain crops, principally wheat, a feature that would require modification to meet the demands of alternative crops.

4.20 On-farm development costs in Gansu, and especially on land that has been previously farmed under rainfed conditions, are affected by the need to remove the stone and gravel mulch applied by farmers to reduce evaporation in such cases. Further, loess soils consolidate and settle unevenly after initial applications of irrigation water. As a result land levelling is required over two or three successive seasons, and permanent quarternary and field structures can only be installed after the soils have finally consolidated. In addition to these costs, crop yields rarely stabilize at their full potential until five years after irrigation water is first applied.

#### Irrigated Crop Production Systems

4.21 Irrigated production in Gansu should be examined in terms of three areas. The Dingxi region and the Hexi corridor are somewhat different in terms of irrigation systems and production possibilities. In Dingxi existing irrigation systems tend to cover comparatively small areas that are intricately involved with the rainfed agriculture of the surrounding loess hills. Irrigation command areas in Hexi on the other hand are larger and more self-contained except to the limited extent that sheep flocks jointly use the residues of the irrigated areas and the sparse and irregular vegetation on the surrounding desert areas. However, a significant third type is emerging. The Jingtai Phase I irrigation area, the small existing development within the proposed Yindarqin command area and the Xicha scheme are the beginning of what will ultimately amount to about 200,000 ha of irrigated land. This complex together with the Jingtai Phase II project resembles the Hexi corridor situation except that geographically it is located comparatively close to the large urban center of Lanzhou which provides important opportunities for the production of perishable products for sale into that market.

4.22 Irrigation is necessary to make maximum use of the six to seven months when temperatures are high enough to permit plant growth. Consequently it is difficult to grow more than one crop a year in Gansu due to the long period of low temperatures. The average growing period for major crops and possible alternatives under irrigation is illustrated in Figure 4.1.

4.23 Production patterns in the Dingxi, Hexi and Yindariqin areas are similar. Wheat is the most important crop since it is the staple grain and because it makes good use of the restricted growing season. It currently occupies 70-80% of the irrigated cropping area with oil seeds, principally linseed, and the summer cereals, mainly millet, each occupying 5-10%. The remaining 10% is made up of a variety of crops. In the Hexi corridor these are dominated by sugar beets and melons; whereas potatoes, broad beans, medicinal crops, melons, vegetables, some fruit trees and roses for oil appear in the other areas.

4.24 Two factors suggest the desirability of reducing the proportion of the area planted to wheat. Having 70-80% of the area in wheat does not allow for satisfactory crop rotation and the biological and economic benefits that could otherwise be attained. There are perceived financial advantages for farmers from growing cash crops although the net benefits from the alternatives have yet to be fully investigated. Diversifying the cropping pattern

# Crop Calendar

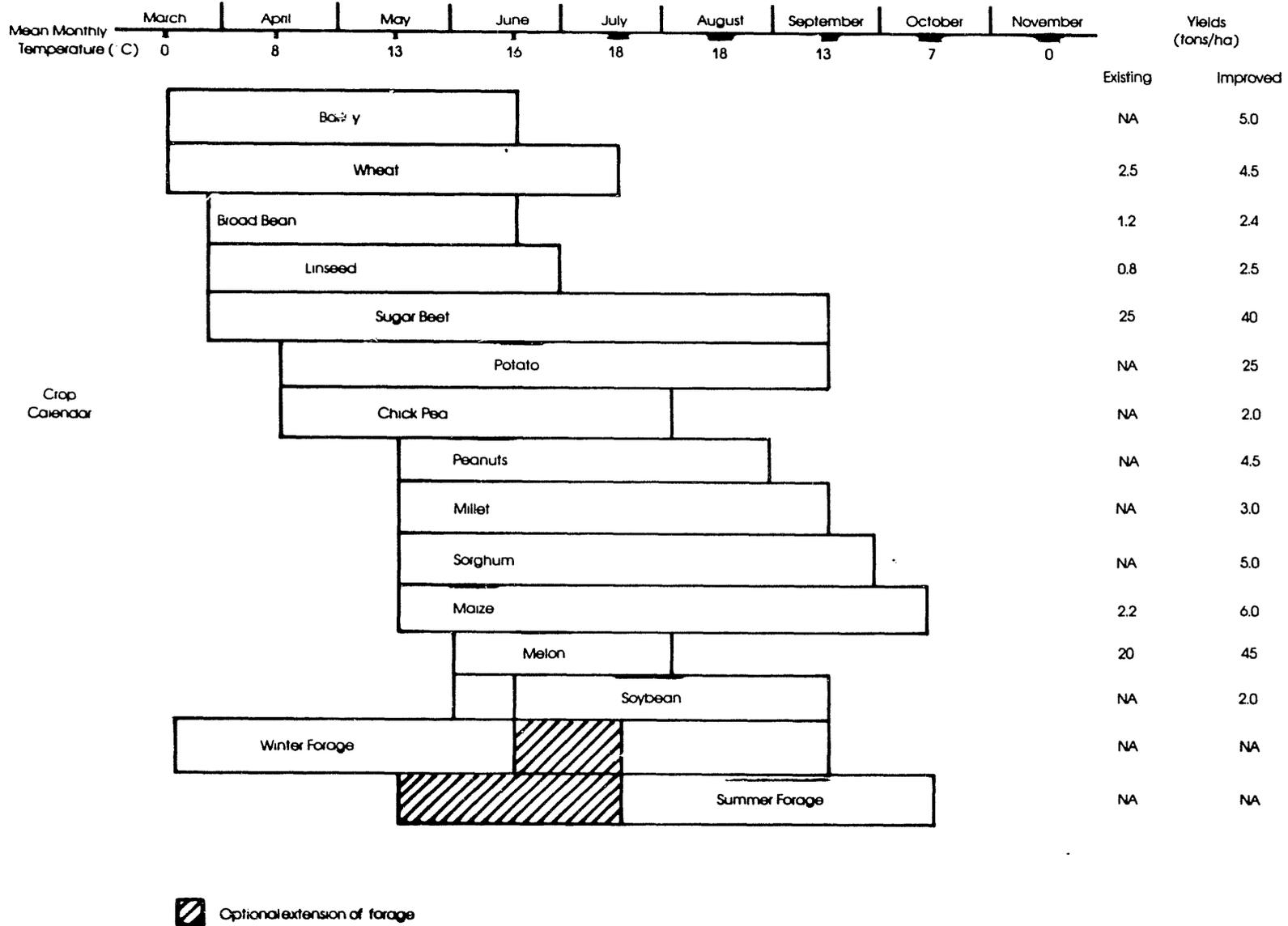


Figure 4.1

would have important advantages in spreading and increasing labor requirements. It would, however, require modification to the pattern of irrigation since this was developed mainly for wheat.

4.25 At present there is very little double cropping. Nevertheless, there are some exceptions that have a substantial local impact on overall farm production and income. In the irrigated areas of the Zhuang Lang river basin which forms part of the proposed Yindaruqin command area, farmers grow a vegetable crop immediately following wheat. Further south and at lower elevations (1,600 m), the follow-on crop is potato. In the northern areas, elevation rises, cabbage replaces potato and at very high elevations, as the growing season becomes shorter, garlic takes over at about 1,900 m. Above 2,000 meters no follow-on crop is possible. In several command areas in the Hexi corridor, a short season summer fodder crop, predominately hairy vetch (*vicia villosa*) is planted immediately after the wheat is harvested and is itself cut some 70-80 days from planting. The green fodder is conserved as a high protein winter feed for pigs. At the same time the legume crop contributes to soil fertility restoration.

4.26 Alternate Crops. Sugar beets are already grown extensively in the Hexi corridor where processing facilities exist. Total area of sugar beets in Gansu is misleading as an unspecified portion is grown for animal feed. In terms of the present farm gate price for beets, its production is lucrative to the farmer but expansion of area for sugar production is questionable on economic grounds in view of current and projected world prices. Black melon seed is currently attractive in financial terms and both planners and farmers intend to extend the area planted, though the extent of the market is not clear. However, unlike sugar beet production, no high cost processing facilities are required, the area can be regulated annually in response to market forces, and there are no alternative supplies readily available. Medicinal crops have high net benefits but the restricted market seems to already have confined their production in Gansu to small areas and specialized growers. Roses for oil are profitable but the crop is restricted to elevations between 1,600-1,900 meters and will most likely be contained within the Yindaruqin command area. At present expansion is limited by processing capacity. Deciduous fruit trees such as apple, pear, and peach appear attractive. Production prospects are good and market potential warrants examination within Gansu and outside the province.

4.27 Production of vegetables and soft fruit such as strawberries are attractive alternatives for the Yindaruqin irrigation project, particularly given its close proximity to Lanzhou. The same logic may apply to Jingtai Phase I and II command areas since both are located adjacent to a main railway. Similarly, leaf vegetables that can be transported have already become established in Hexi corridor irrigation cropping systems.

4.28 Market study and technology research are essential to narrow the long list of vegetables and other alternative high value crops and thereafter to establish the most appropriate and sound production technology. At present the market is good for fresh vegetables with demand exceeding supply. The production expansion possible when Yindaruqin, Xicha and Jingtai are fully developed calls for careful study of existing and new markets plus

investigation of processing possibilities at an early date. However, the alternatives to the field crops that have already demonstrated high net benefits or that appear to offer good opportunities are unlikely to occupy a very large portion of the irrigated area expected to be available by the year 2000. The major source of improved production and income by and large is likely to be via animal production based on irrigated feed, fodder or forage crops.

4.29 An indicative cropping system that integrates these opportunities is as follows:

Annual Cropping 90-95% of area		Perennial cropping 5-10% of area
Year 1	<p><u>Winter Cereal</u> Followed when feasible mainly wheat, substitute part of area with oil seed or early season potato</p> <p>Followed when feasible by short season fodder or later season vegetable.</p>	<p>fruit trees roses strawberries alfalfa</p>
Year 2	<p>Preceded when feasible by short-season winter fodder or grain legume</p> <p><u>Summer Cereal</u> mainly millet, maize or sorghum, substitute with melons or vegetables</p>	

Role of Forestry and Livestock

4.30 Forestry. In contrast to deciduous fruit trees considered above as no more than potentially alternative crops, tree production, almost entirely poplars, is an established enterprise in irrigated areas. They are usually grown as two to three meter strips on the edges of fields or irrigated blocks. Most are planted on irrigation ditches achieving rapid growth rates for sale as building poles after a five to eight year growth period. Market demand is strong and likely to remain so in the foreseeable future.

4.31 Livestock production in irrigated areas is poorly developed, and in the short to medium term there are good grounds for introducing and sustaining a higher proportion of feed grains and fodder crops, including beets, to improve its efficiency. Integration of livestock with crop production in irrigation systems offers considerable opportunity for added income as well as bestowing crop rotation advantages. At present, livestock in irrigation areas subsist on crop residues or, in the case of sheep and goats, almost entirely graze outside the irrigated area. In addition to enhancing the efficiency of animal traction, major opportunities exist for fattening the progeny of sheep flocks based on adjacent rainfed areas thus reducing grazing pressures in

winter as well as increasing incomes of both graziers and farmers in irrigated areas. Opportunities also exist for increasing pig and poultry offtake via additional feed grain production, provided that steps are taken to remove the present subsidy on prepared livestock feeds which currently cost less than farmgate prices of feed grains in the province. A strong demand exists for dairy products in the Lanzhou area. The question of the economics of dairy production in irrigation schemes comparatively close to Lanzhou, such as Yindaruqin warrants further consideration. .

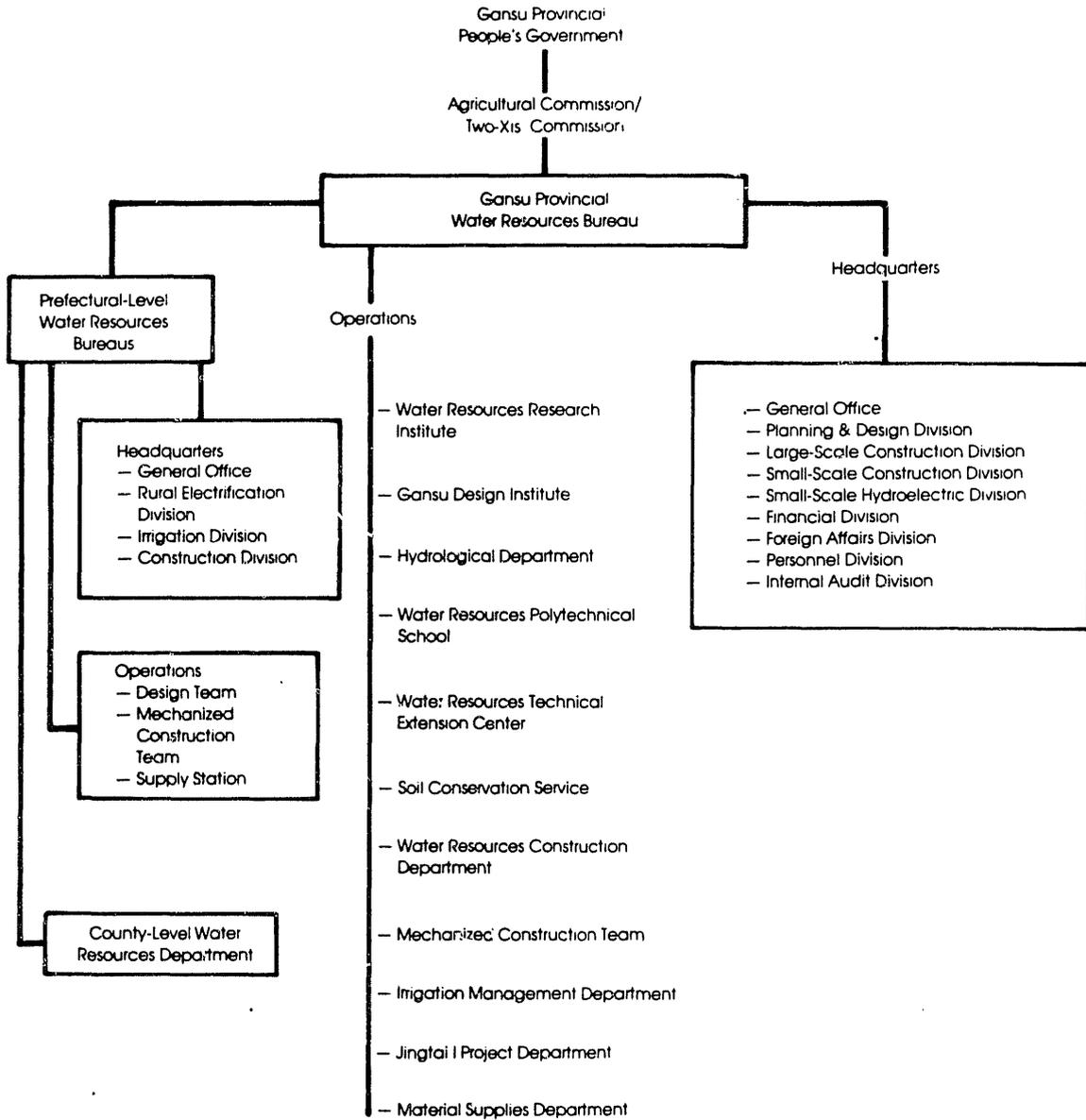
#### Organization and Management

4.32 The Provincial Water Resources Bureau (PWRB) of the Provincial Agricultural Commission has had primary responsibility for planning, design, and implementation of Gansu's irrigation development program since 1949 in collaboration with the Provincial Planning and Economic Commissions. The organizational structure of the PWRB and its position in the Gansu Provincial People's Government is illustrated in Figure 4.2. The professional and support staff at the PWRB's Headquarters in Lanzhou currently number 130, but this number is expected to be reduced to between 80 to 90 through staff retirement and the elimination of the Small-Scale Hydroelectric Division. The PWRB's professional and support staff in Operations total over 4,200. This includes about 2,300 staff in the Water Resources Construction Department and about 1,600 in the Gansu Design Institute. The Design Institute is responsible for irrigation development feasibility studies and contracts out its professional staff to other provinces in northwest China. A separate Department was established in the 1970s to implement and manage the Jingtai Phase I Irrigation Project. The PWRB is represented at the prefectural-level by 10 prefectural WRBs. These prefectural WRBs, each having 10 to 50 staff depending upon the scale of local irrigation and water resources activities, supervise the activities of county-level WRBs. Each of Gansu's counties has a WRB, but in counties where irrigated agriculture is not significant these bureaus may have only one to three staff.

4.33 Responsibility for operation and maintenance of schemes is generally in the hands of county or prefecture officials, with technical guidance from PWRB engineering staff. Such activities tend to be operated as maintenance units operating with direct labor and responsible for operation and maintenance of pumps and main conveyances down to the tertiary level. Quaternary canals and field channels are the responsibility of the local township served by them acting on the instructions of the Scheme Administrative Unit which also supplies required materials. The quality of system maintenance leaves something to be desired, blamed usually on shortage of funds, but also due perhaps to lower numbers and levels of competence of supervisory staff, failure to comprehend the agricultural importance of efficient operation and maintenance, and unwillingness of local people, not fully appreciating the implications of the PRS, to accept fully their role in this area.

4.34 Recognizing the changes in organization that have come about in the past five years or so, there appear to be grounds for more active involvement by local officials in the formation of, for example, water user associations. At the same time there is an urgent need for strengthening of middle and lower level technical staff, with systematic training in operation and maintenance

Figure 4.2  
**Organizational Structure  
of the Gansu Provincial Water Resources Bureau**



Source: Gansu Provincial Water Resources Bureau

including the importance of agricultural considerations and in extending, especially to new irrigated farmers, approved methods of on-farm water management.

4.35 There is also an urgent need for substantial strengthening of lower level agricultural personnel at the system level. This strengthening of services should be complemented by such measures as enhanced adaptive research work, improved seed production and distribution systems, the development and testing of improved production practices, especially for crops other than wheat, and dissemination of technical information to farmers. While these observations are true of all irrigation systems in the province, the need is particularly pressing in new schemes where the farmers themselves are generally unfamiliar with the particular skills needed to make the most efficient use of the land and water resources with which they are provided. Improved research and extension will be essential if migrants from areas of rainfed agriculture are to become efficient managers of more complex irrigated farming operations.

4.36 Since its establishment in 1980, the Two-Xis Commission has assumed a growing role in the coordination of Gansu's irrigation development program. Within its headquarters in Lanzhou, the Commission has established several specialized divisions for coordinating irrigation development in the Dingxi region and the Hexi corridor with resettlement, land rehabilitation and soil conservation activities. These divisions are primarily responsible for reviewing feasibility studies prepared by the Gansu Design Institute of the PWRB, prefectural-level commissions, and other organizations for a variety of irrigation, land rehabilitation and soil conservation, rural industry, and other projects. Outside consultants are contracted to review large-scale projects with capital construction costs of Y 100 million or more. The Commission is represented at the prefecture level by Agricultural Development Corporations (ADCs) and at the county level by Agricultural Development Offices (ADOs). The typical ADC has a staff of 20 to 30 and, in addition to a General Office, has Planning, Resettlement, Rural Energy, Capital Construction, and other offices as appropriate. The ADOs generally have a smaller staff and differ in their organizational structure according to local circumstances.

#### Financing Arrangements

4.37 At present, the bulk of the funding for irrigation development in Gansu is provided by the Commission from its annual budget of about Y 215 million. This budget is guaranteed at the current level for the rest of the century and is supplied by the central government from three sources: Y 165 million from the Three-Xis Commission's annual budget of Y 200 million; Y 35 million from the Government's annual allocation of Y 55 million for aid to backward areas; and Y 15 million specifically earmarked for capital construction in Gansu. The central government allows the Two Xis Commission to carry over unused funds for use in the next year or to borrow up to Y 30 million from next year's budget for use in the current year. This is important since actual disbursement of these funds is dependent upon the implementation schedules of a number of irrigation and other projects. Over 40% of the annual budget, or about Y 90 million, has been committed on a long-

term basis to irrigation development. Disbursement against large-scale projects, such as Yindaruqin and Jingtai Phase II, must receive the prior approval of the Three-Xi Commission and the State Planning Commission. Prior approval is not required for small and medium-scale projects, such as Xingbuzichuan and Xicha, with capital construction costs below Y 100 million.

4.38 The provincial government provides the remainder of the funding for irrigation development. In 1984, total disbursement was more than Y 60 million, including at least Y 20 million for capital construction and about Y 40 million for recurrent costs (including irrigation system maintenance costs not covered by user fees and other miscellaneous expenses). Unlike the funds from the Commission, these funds do not represent a constant share of the provincial budget since they vary from year to year in accordance with the annual investment requirements of a number of irrigation projects. The provincial government does stand ready, however, to guarantee matching funds for irrigation projects receiving bilateral and international assistance.

4.39 Farmers themselves also help finance the development of irrigation projects. In the case of Jingtai II, for example, some 25% overall of the Y 95 million capital investments now proposed, will be met by project beneficiaries, mostly in the form of labor. The percentages of itemized investment components derived from beneficiaries will vary, apparently with the labor content. Thus, farmer contributions to on-farm development are in the order of 45% due to their heavy involvement in these activities. In recent years farmers have also begun to pay for irrigation maintenance costs (estimated in 1983 at rather less than 2% of total fixed investments, other than on-farm works) through the imposition of water charges.

#### Economic and Financial Returns

4.40 In order to better assess the economic returns to further irrigation development in Gansu, preliminary analyses of the Yindaruqin and Jingtai Phase II projects have been undertaken. Both projects are ongoing and civil works undertaken prior to end-1986 have been treated as sunk costs and excluded from the base case. Economic values, converted to local currency at the official exchange rate of Y 3.70 = US\$1.00, were attributed where possible to project costs and benefits (see economic prices in Table 3.8). Project investment costs include construction of the central conveyance systems and distribution canals (including pumps and pumping stations for Jingtai), land leveling and field preparation, and first year resettlement costs (estimated at Y 200 per settler). Nonenergy operation and maintenance costs have been estimated at Y 135 per ha (plus, in the case of Jingtai, costs for replacement of pump impellers and ball bearings every fifth year). Annual energy operating costs for Jingtai have been estimated at 500 million kWh valued at Y 0.05 per kWh.<sup>12/</sup> Labor has been valued at Y 0.6 per workday (see para. 3.51 for further discussion of the economic value of labor). Project benefits include net benefits from incremental output of field and tree crops and animal

---

<sup>12/</sup> See Annex B, Appendix 3 for a full discussion of the economic costs of electric power generation in Gansu.

products. Major crops include wheat, maize, oilseeds, vegetables and melons, poplar poles, and apples. Selected crop budgets for the Yindaruqin area are presented in Table 4.2.

4.41 Using these assumptions and discounting costs and benefits over 35 years, the economic rates of return (ERR) are 12% for Yindaruqin and 13% for Jingtai. The ERRs were tested for sensitivity to variations in investment costs, the economic value of labor and electric power, projected yields and prices for crops and animal products, a one year lag in project benefits, and a combination of a 10% increase in investment costs and a 10% reduction in yields (summarized in Table 4.5). The sensitivity analysis indicates that likely levels of change in any single variant would leave the economic viability of the projects intact. However, a combination of cost overruns and decreased yields would decrease the ERRs to 10% or below.

4.42 On the basis of the preliminary analysis of these two projects, it appears that the returns to further major irrigation development in Gansu are not very high and careful analysis needs to be undertaken before any new projects are initiated. The returns to new high lift irrigation schemes are particularly suspect since, unlike Jingtai Phase II, future high lift projects will not benefit from large sunk costs. Including sunk costs to the analysis for Jingtai lowers the ERR to 9%; it is unlikely that the returns to any future high lift irrigation scheme would exceed this level. The analysis also indicates the economic importance of avoiding delays in project completion. Due to financial constraints, for example, the original plans for Yindaruqin called for a 10 year construction period that would have delayed full development by several years. The economic effect of this extended construction period would be to lower the estimated ERR for Yindaruqin to less than 11%.

#### Principal Issues

4.44 Gansu has successfully undertaken an irrigation development program which has more than doubled irrigated area since 1950. Plans for additional irrigation development over the next 15 years have been drawn up and tentative steps have been made to coordinate these plans with land rehabilitation and soil conservation and population resettlement targets. However, due to problems with the program's design and implementation, the social benefits from Gansu's investments in irrigation development have not always been optimal. Several of the more important problems include:

- (a) available investment resources spread over too many projects. This approach has prolonged project implementation, delayed the onset of project benefits, and thus reduced the irrigation development program's rate of return;
- (b) program focus on getting water to a command area without devoting adequate attention to the suitability of the land or to optimizing agricultural production on the newly irrigated areas; and

Table 4.2: IRRIGATION - CROP BUDGET AT FULL DEVELOPMENT,  
ECONOMIC VALUES PER HECTARE

	Unit	Unit price	Wheat		Grain Legume		Oilseed	
			Amt.	Value	Amt.	Value	Amt.	Value
<u>Without Project (Rainfed)</u>								
<u>Input Costs</u>								
<u>Materials</u>								
Seeds	kg	-	200	161	150	60	105	105
Chemical fertilizer	kg	0.87	75	65	40	35	25	22
Manure	ton	2.00	30	60	30	60	30	60
Agrochemicals	kg	-	-	3	-	-	-	-
Machinery	Y	80.00	-	-	-	-	-	-
<u>Labor</u>								
Human	work-days	0.60	105	63	120	72	75	45
Animal	Y	2.00	45	90	60	120	40	80
Subtotal	Y			<u>442</u>		<u>347</u>		<u>312</u>
<u>Value of Output</u>								
Yield	ton	-	0.80	-	0.45	-	0.70	-
Price	Y/ton	-	-	843	-	400	-	1,000
Product value	Y	-	-	674	-	180	-	700
<u>Net Value</u>	Y			<u>232</u>		<u>-167</u>		<u>338</u>
<u>With Project (Irrigated)</u>								
<u>Input Costs</u>								
<u>Materials</u>								
Seeds	kg	-	300	241	180	72	90	90
Chemical fertilizer	kg	0.87	450	390	375	325	375	325
Manure	ton	2.00	60	120	45	90	60	120
Agrochemicals	kg	-	-	63	-	8	-	5
Machinery	Y	80.00	1	72	1	72	1	72
<u>Labor</u>								
Human	work-days	0.60	145	87	112	67	120	72
Animal	Y	2.00	30	60	15	30	30	60
Subtotal	Y			<u>1,033</u>		<u>664</u>		<u>744</u>
<u>Value of Output</u>								
Yield	ton	-	4.50	-	3.00	-	2.25	-
Price	Y/ton	-	-	843	-	400	-	1,000
Product value	Y	-	-	3,794	-	1,200	-	2,250
<u>Net Value</u>	Y			<u>2,761</u>		<u>536</u>		<u>1,506</u>

**Table 4.3: Yindaruqin - SUMMARY OF ECONOMIC BENEFITS AND COSTS**  
(Y million)

Year	Project costs			Project benefits				Total net benefits	
	Investment	O&M	Total	Net benefits from:			Total benefits	Without project	With project
				Field crops	Perennial crops	Animal products			
1985	20.0	-	20.0	-	-	-	-	-	-20.0
1986	20.0	-	20.0	-	-	-	-	-	-20.0
1987	71.2	0.2	71.8	-	-	-	-	-	-71.8
1988	146.6	1.7	148.3	1.7	-0.5	-0.2	1.0	0.3	-147.6
1989	189.7	3.1	192.8	12.8	-3.3	-1.1	8.4	1.8	-186.2
1990	189.7	4.6	194.2	28.1	-4.1	0.3	24.3	3.3	-173.3
1991	153.8	6.0	159.8	45.6	-4.8	1.6	42.4	4.9	-122.3
1992	124.1	7.7	131.8	64.9	-3.8	3.0	64.2	6.4	-74.0
1993	-	7.7	7.7	86.7	2.9	4.6	94.3	8.4	78.2
1994	-	7.7	7.7	97.5	9.6	8.2	115.3	8.4	99.2
1995	-	7.7	7.7	102.9	15.9	8.7	127.5	8.4	111.4
1996	-	7.7	7.7	106.1	23.1	9.1	138.3	8.4	122.2
1997	-	7.7	7.7	107.1	34.6	9.7	151.4	8.4	135.3
1998	-	7.7	7.7	107.2	46.8	9.7	163.7	8.4	147.6
1999	-	7.7	7.7	107.2	51.0	9.7	167.9	8.4	151.8
2000	-	7.7	7.7	107.2	52.4	9.7	169.3	8.4	153.2
2001	-	7.7	7.7	107.2	52.4	9.7	169.3	8.4	153.2
2002	-	7.7	7.7	107.2	61.3	9.7	178.2	8.4	162.1
2003	-	7.7	7.7	107.2	67.3	9.7	184.3	8.4	168.2
2004	-	7.7	7.7	107.2	67.3	9.7	184.3	8.4	168.2
2005	-	7.7	7.7	107.2	67.3	9.7	184.3	8.4	168.2
2006	-	7.7	7.7	107.2	67.3	9.7	184.3	8.4	168.2
2007	-	7.7	7.7	107.2	74.8	9.7	191.7	8.4	175.6
2008	-	7.7	7.7	107.2	41.8	9.7	158.7	8.4	142.6
2009	-	7.7	7.7	107.2	41.8	9.7	158.7	8.4	142.6
2010	-	7.7	7.7	107.2	41.8	9.7	158.7	8.4	142.6
2011	-	7.7	7.7	107.2	41.8	9.7	158.7	8.4	142.6
2012	-	7.7	7.7	107.2	46.2	9.7	163.1	8.4	147.0
2013	-	7.7	7.7	107.2	52.4	9.7	169.3	8.4	153.2
2014	-	7.7	7.7	107.2	52.4	9.7	169.3	8.4	153.2
2015	-	7.7	7.7	107.2	52.4	9.7	169.3	8.4	153.7
2016	-	7.7	7.7	107.2	52.4	9.7	169.3	8.4	153.3
2017	-	7.7	7.7	107.2	61.8	9.7	178.8	8.4	162.7
2018	-	7.7	7.7	107.2	70.5	9.7	187.4	8.4	171.3
2019	-	7.7	7.7	107.2	70.5	9.7	187.4	8.4	171.3
2020	-	7.7	7.7	107.2	70.6	9.7	187.5	8.4	171.4
2021	-	7.7	7.7	107.2	70.6	9.7	187.5	8.4	171.4

Table 4.4: Jingtai - SUMMARY OF ECONOMIC BENEFITS AND COSTS  
(Yuan million)

Year	Project costs			Project benefits				Total net benefits
	Invest- ment	O&M	Total	Net benefits from:			Total benefits	
				Field crops	Tree crops	Animal products		
1983	20.0	-	20.0	-	-	-	-	-20.0
1984	20.0	-	20.0	-	-	-	-	-20.0
1985	20.0	-	20.0	-	-	-	-	-20.0
1986	20.0	-	20.0	-	-	-	-	-20.0
1987	44.0	0.5	44.5	-	-1.0	-0.5	-1.5	-46.0
1988	63.3	1.8	65.0	0.9	-3.3	-0.6	-3.0	-68.0
1989	75.1	3.1	78.2	4.1	-5.8	0.4	-1.4	-79.6
1990	66.2	4.4	70.6	8.8	-8.2	1.7	2.4	-68.3
1991	24.4	4.4	28.8	14.9	-6.1	4.6	13.4	-15.4
1992	-	4.4	4.4	19.9	-2.1	5.0	22.8	18.4
1993	-	5.6	5.6	22.7	2.0	5.6	30.2	24.7
1994	-	4.4	4.4	25.2	8.0	5.6	38.7	34.3
1995	-	4.4	4.4	25.4	10.1	5.6	41.0	36.6
1996	-	4.4	4.4	25.5	18.0	5.6	49.0	44.6
1997	-	4.4	4.4	25.5	24.0	5.6	55.0	50.6
1998	-	5.6	5.6	25.5	24.7	5.6	55.7	50.2
1999	-	4.4	4.4	25.5	24.9	5.6	55.9	51.5
2000	-	4.4	4.4	25.5	15.7	5.6	46.8	42.3
2001	-	4.4	4.4	25.5	22.5	5.6	53.5	49.1
2002	-	4.4	4.4	25.5	30.9	5.6	62.0	57.5
2003	-	5.6	5.6	25.5	32.3	5.6	63.3	57.8
2004	-	4.4	4.4	25.5	32.6	5.6	63.6	59.2
2005	-	4.4	4.4	25.5	15.7	5.6	46.8	42.3
2006	-	4.4	4.4	25.5	17.2	5.6	48.3	43.9
2007	-	4.4	4.4	25.5	19.1	5.6	50.2	45.7
2008	-	5.6	5.6	25.5	19.4	5.6	50.5	44.9
2009	-	4.4	4.4	25.5	19.5	5.6	50.5	46.1
2010	-	4.4	4.4	25.5	15.7	5.6	46.8	42.3
2011	-	4.4	4.4	25.5	19.4	5.6	50.4	46.0
2012	-	4.4	4.4	25.5	24.0	5.6	55.0	50.6
2013	-	5.6	5.6	25.5	24.7	5.6	55.7	50.2
2014	-	4.4	4.4	25.5	24.9	5.6	55.9	51.5
2015	-	4.4	4.4	25.5	15.7	5.6	46.8	42.3
2016	-	4.4	4.4	25.5	15.7	5.6	46.8	42.3
2017	-	4.4	4.4	25.5	16.1	5.6	47.1	42.7
2018	-	5.6	5.6	25.5	17.0	5.6	48.0	42.4
2019	-	4.4	4.4	25.5	17.9	5.6	48.9	44.5
2020	-	4.4	4.4	25.5	18.8	5.6	49.9	45.5
2021	-	4.4	4.4	25.5	18.8	5.6	49.9	45.5

Table 4.5: SENSITIVITY ANALYSIS

	ERR (%)	
	YDRQ	Jingtai
<u>Base Case</u>	12.2	12.8
<u>Variations</u>		
<u>Investment costs up:</u>		
+10%	11.5	12.1
+20%	10.8	11.4
<u>Economic cost of labor at:</u>		
Y 1.2 per workday	11.4	11.0
Y 0.8 per workday	11.9	12.2
<u>Economic cost of energy at:</u>		
Y 0.02 per kWh <u>/a</u>	<u>/b</u>	17.8
Y 0.04 per kWh	<u>/b</u>	14.5
Y 0.06 per kWh	<u>/b</u>	11.1
<u>Yields down 10%:</u>		
Field crops	11.2	10.6
Tree crops	12.0	12.3
Animal products	12.1	12.5
All yields	10.9	9.7
<u>Prices down 10%:</u>		
Field crops	11.5	10.7
Tree crops	11.9	12.7
Animal products	12.1	12.5
All prices	11.0	10.3
<u>Project benefits:</u>		
Delayed one year	11.1	11.6
<u>Combination:</u>		
10% cost overrun plus 10% decline in yields	10.2	9.1

/a The current financial price for energy in Jingtai Phase I is Y 0.01 per kWh.

/b Energy costs represent only a small portion of YDRQ's operating costs.

- (c) plans for irrigation development over the next 15 years which call for the expansion of economically inviable lift irrigation systems. Specifically, completion of the Jingtai II, Linding, Xingbuzichuan, and Xicha schemes would more than double the command area of Gansu's lift irrigation systems from less than 5% at present to more than 10% of the total irrigated area by 1995. The rate of return to further investment in the Jingtai II, Xingbuzichuan, and Xicha is acceptable since they are at least partially completed. However, new lift irrigation schemes such as Linding, where there are no appreciable sunk costs, would not be economic. Such schemes appear attractive in financial terms because of the extremely low financial price of power in Gansu ( Y0.01 per kWh).

4.45 Gansu's planners have to some extent already recognized these problems with program design and implementation. By expediting the implementation of Yindaruqin and at least temporarily delaying the Linding scheme, the province has moved to concentrate its funds on fewer projects and to reduce plans to expand lift irrigation systems. The provincial authorities also appear interested in pilot operations designed to optimize agricultural production in newly irrigated areas such as Jingtai I. However, further efforts must be made to improve the objectivity of irrigation development feasibility studies. Most importantly, Gansu's planners should realize that, because of the low returns to irrigation development in Gansu, the expansion of irrigated area should be motivated by and coordinated with targets for land rehabilitation and soil conservation and population resettlement targets.

## V. RESETTLEMENT

5.01 Resettlement is the third element of the provincial government's strategy for development of the Two Xis. Without removal of excess population from the overcrowded loess hills it will be impossible to sustain their present populations, to begin to redress the serious environmental damage already incurred in the hills themselves, or to protect downstream users from the heavy silt loads derived from the massive ongoing erosion of the hills. There are thus substantial economic and environmental reasons for resettlement to be part of Gansu's strategy for rural development. There are also compelling social reasons for alleviating the severe poverty of the majority of the hill dwellers by providing opportunities for at least some people to settle in new irrigation schemes and encouraging those remaining in the loess hills to follow proven, sustainable and income enhancing agricultural practices.

### Methodology and Schedule of Resettlement

5.02 The Two Xis Commission estimates that 600,000 inhabitants of the Dingxi region, or slightly more than 10% of the total population, should be relocated to irrigated areas within Dingxi and the Hexi corridor by 2000. This figure has been derived from the difference between estimates of the subsistence requirements of the current population and the carrying capacity of the Dingxi region in terms both of agriculture and of rural industry. More specifically, per capita subsistence requirements for food, fuel, and clothing have been compared with local land, water, and energy resources, soil conservation priorities, and potential for employment in rural industry. Details of these calculations for each of the Dingxi region's 18 counties are presented in Table 5.1. They are broadly consistent with the estimates of required resettlement made in Chapter 3, but it should be noted that they take no account of natural population growth.

5.03 About 52,000 settlers have already relocated and an additional 28,000 are expected to relocate by the end of 1986. Resettlement plans for 1987-2000 call for 350,000 settlers to relocate to irrigated areas within Dingxi and the remaining 170,000 to resettle in the Hexi corridor. Relocation to other provinces is also under consideration, but is acknowledged to involve greater resettlement costs and management problems and greater adjustment difficulties for the settlers. About 80% of the settlers are expected to be engaged in agriculture and the rest employed in rural industry. Another 300,000 settlers, half of the total, are scheduled to relocate during the period 1987-91 and the remaining 220,000 during 1992-2000. Details of the schedule of resettlement and resettlement sites are presented in Table 5.2.

5.04 In Dingxi, assuming financial resources are assured, the settlement programs for much of the Jingyuan Irrigation Area (consisting of the Zhingbaoze, Zhechuan, Liuchuan and Sanyangyuan Projects) and for part of the Huining Irrigation Area (composed mainly of the Baicaoyuan Project) could be largely completed by 1990, in tandem with the progress of land leveling on newly constructed irrigation projects. However, these areas have the capacity for settling only 112,500 people while an additional 407,500 would have to

Table 5.1: CURRENT POPULATION, CARRYING CAPACITY, AND RESETTLEMENT PLANS FOR THE DINGXI REGION  
(Population in '000s)

County	Current population	Carrying capacity			Population to be resettled /a	Schedule of resettlement					
		Agri culture	Rural industry	Total		1987-1991			1992-2000		
						Within Dingxi	Within Hexi	Sub-total	Within Dingxi	Within Hexi	Sub-total
Gulang	288.1	200.0	8.1	208.1	80	80	-	80	-	-	-
Jingtai	160.0	85.0	5.0	90.0	70	50	-	50	20	-	20
Jingyuan	392.7	355.0	7.7	362.7	30	20	-	20	10	-	10
Huining	420.9	380.0	5.9	385.9	35	10	15	25	10	-	10
Yongdeng	381.3	245.0	16.3	261.3	120	30	-	30	90	-	90
Gaolan	179.3	160.0	19.3	179.3	0	-	-	-	-	-	-
Yuzhong	356.6	330.0	16.6	346.6	10	-	-	-	-	10	10
Dingxi	339.0	300.0	9.0	309.0	30	10	-	10	20	-	20
Lintao	407.9	330.0	77.9	407.9	0	-	-	-	-	-	-
Tongwei	347.8	310.0	7.8	317.8	30	-	20	20	-	10	10
Longxi	346.6	290.0	46.6	336.6	10	-	10	10	-	-	-
Yongjing	152.4	120.0	32.4	152.4	0	-	-	-	-	-	-
Dongxiang	193.2	160.0	23.2	183.2	10	-	-	-	-	10	10
Jingning	370.4	340.0	15.4	355.4	15	-	15	15	-	-	-
Zhuangland	329.7	240.0	19.7	259.7	70	-	40	40	-	30	30
Qinan	439.4	340.0	89.4	429.4	10	-	-	-	-	10	10
Huanxian	242.4	240.0	2.4	242.4	0	-	-	-	-	-	-
Huachi	86.5	80.0	6.5	86.5	0	-	-	-	-	-	-
<u>Total</u>	<u>5,434.2</u>	<u>4,505.0</u>	<u>409.2</u>	<u>4,914.2</u>	<u>520</u>	<u>200</u>	<u>100</u>	<u>300</u>	<u>150</u>	<u>70</u>	<u>220</u>

/a Difference between current population and estimated carrying capacity.

Source: Resettlement Division of the Two-xi Commission.

Table 5.2: LOCATION OF SITES AND SCHEDULE OF RESETTLEMENT FOR THE TWO-XI REGION  
(Population in '000s)

Resettlement	Associated Irrigation Project	Population to be resettled /a	Schedule of resettlement					Subtotal	1992-2000 Subtotal
			1987-91						
			1987	1988	1989	1990	1991		
<u>Dingxi Region</u>									
Gulang	Jingtai II	80	-	10.0	10.0	30.0	30.0	80	-
Jingtai	Jingtai II	70	5.0	5.0	10.0	15.0	15.0	50	20
Jingyuan	Jingyuan	30	4.0	4.0	4.0	4.0	4.0	20	10
Huining	Huining	20	2.0	2.0	2.0	2.0	2.0	10	10
Yongdeng	Yindarugin	120	-	-	-	15.0	15.0	30	90
Dingxi	Linding	30	-	-	-	5.0	5.0	10	20
	Subtotal	350	11.0	21.0	26.0	71.0	71.0	200	150
<u>Hexi Region /b</u>									
<u>Large Group</u>									
Dunhuang	Danghe	1	1.0	-	-	-	-	1	-
Anxi	Shuangtabao	17	-	1.0	2.0	3.0	1.0	7	10
Yumen City	Huanghua	10	-	1.0	3.0	4.0	2.0	10	-
Yumen	Changea	3	1.0	1.0	1.0	-	-	3	-
Yumen	Changma	20	-	-	-	-	-	0	20
Jinta	Dadunmen	10	-	1.0	2.0	4.0	3.0	10	-
Jiuquan	Shanzi	2	-	-	-	-	-	0	2
Zhangye	Heihe West	15	1.0	2.0	2.0	3.0	2.0	10	5
Zhangye	Gaopai	8	0.5	0.5	0.5	1.0	0.5	3	5
Linze	Yinggeju	9	1.0	1.0	1.0	2.0	1.0	6	3
Linze	Yingli	5	-	-	-	-	-	0	5
Minle	Quzhai	10	1.0	4.0	5.0	-	-	10	-
	Subtotal	110	5.5	11.5	16.5	17.0	9.5	60	50
<u>Small Group &amp; Household</u>									
Dunhuang		2	0.5	0.5	0.5	0.5	-	2	-
Anxi		15	2.0	2.0	2.0	2.0	2.0	10	5
Yumen City		12	1.5	2.0	1.5	1.0	1.0	7	5
Jinta		21	2.5	2.5	2.5	2.5	1.0	11	10
Jiuquan City		2	0.5	0.5	0.5	0.5	-	2	-
Zhangye City		1	0.2	0.2	0.2	0.2	0.2	1	-
Gaotai		2	0.5	0.5	0.5	0.5	-	2	-
Linze		2	0.5	0.5	0.5	0.5	-	2	-
Minle		3	0.6	0.6	0.6	0.6	0.6	3	-
	Subtotal	60	8.8	9.3	8.8	8.3	4.8	40	20
	<u>Total</u>	<u>520</u>	<u>25.3</u>	<u>41.8</u>	<u>51.3</u>	<u>.3</u>	<u>85.3</u>	<u>300</u>	<u>220</u>
	<u>Cost (Y million) /c</u>	<u>155</u>	<u>9.0</u>	<u>15.0</u>	<u>18.0</u>	<u>27.0</u>	<u>21.0</u>	<u>90</u>	<u>65</u>

/a Difference between current population and estimated carrying capacity (see Table 5.1).

/b Resettlement to the Hexi Region takes forms: (a) large groups relocating to newly developed irrigated areas and (b) small groups and individual households relocating to existing or very small-scale new irrigation areas.

/c Assuming Y 200 and Y 500 per settler for relocation within Dingxi and to Hexi respectively.

Source: Resettlement Division of the Two-Xi Commission.

depend on the progress of the Yindaruqin, Jingtai Phase II and Linding projects.

5.05 Government programs for sponsoring movement to Hexi depend not only on budget availability; they are also strongly conditioned by job opportunities at the destinations. During 1983-85 about 21,000 migrants resettled in Hexi under formal programs; an additional 100,000 people are scheduled to resettle by 1991 and 70,000 more by the year 2000. This includes large groups which will move to new irrigation schemes and smaller groups which will move to already settled areas or to new small-scale irrigation schemes.

#### Organization and Management

5.06 Gansu's resettlement program is organized and supervised by the Resettlement Division of the Two Xis Commission. The Resettlement Division's four full-time staff members have overall responsibility for program design and coordinate the activities of prefectural and county-level resettlement offices in the Dingxi region and the Hexi corridor. Resettlement field officers have been designated for each of the 18 counties in the Dingxi region and, in order to facilitate ongoing resettlement activities, four of these counties (viz., Huining, Jingyuan, Tongwei, and Zhuanglang) have already established resettlement offices. In the Hexi corridor, resettlement activities are coordinated by three prefectural (viz., Jiuquan, Zhangye, and Wuwei) "Agricultural Development Corporations." These corporations were recently established by the Two Xis Commission in order to coordinate water resource development, agricultural, and resettlement activities in the Hexi corridor. Hence, while they have some overlapping responsibilities with the Bureaus of Agriculture and of Water Conservancy in these prefectures, the corporations have primary responsibility for the resettlement program. The companies coordinate the activities of county-level resettlement field offices. Reflecting their earlier experiences with resettlement programs in the Hexi corridor, most of these counties have existing resettlement field offices.

5.07 It is in the settlement of newly developed irrigated areas that the government plays a significant role which includes planning and execution. This is the dominant form of relocating population from the vulnerable loess hills. The first step in resettlement is the estimation of the absorptive capacity of individual irrigation tracts. On the basis of allocating 2 mu (0.13 ha) of irrigated land per capita (the absolute minimum area per settler), the number of settlers can be assessed directly. Potential settlers are then organized to work alongside the local population in such tasks as land levelling and construction of on-farm irrigation works. During this time they typically maintain their original residence, and other family members cultivate their existing land. The county authorities organize the new settlements: allocating house plots, providing building materials for houses, constructing clinics, schools and shops, organizing domestic water supply and establishing electricity connections.

### Financing Arrangements

5.08 The Two Xis Commission provides individual migrants with subsidies for travel as well as building materials; occasionally where large numbers are settled in a particular locality, a special grant is given to the local authorities at the destination, to supplement the basic amenities. As an example, the total investment cost for the relocation of 13,200 migrant households in Jingyuan county has been estimated to be approximately Y 7.4 million, or Y 560 per household. Approximately half of this amount would be for supplying one cubic meter of construction timber for initial settler housing.

### Principal Issues

5.09 The provincial resettlement program is a necessary step to reducing poverty and achieving ecological stabilization in Dingxi and has been carefully and adequately designed. However, through discussions with resettlement officials and with migrants, it is apparent that the social benefits of the program could be further enhanced by:

- (a) placing greater emphasis on training settlers in irrigated farming techniques. This is an important area for improvement since the loess hills farmers have had no previous experience with irrigated farming; and
- (b) better coordinating the schedule of resettlement with both the implementation of land rehabilitation measures in Dingxi and the development of irrigated cropland in Hexi. Specifically, it was evident that communication between the Migration and the Soil Conservation Divisions of the Two Xis Commission was lacking and that plans to coordinate resettlement with land rehabilitation had not been devised. Although resettlement officers in Hexi are well aware of the planned schedule of resettlement in their areas, existing plans for the development of irrigated areas for these settlers are not well thought out or realistic in all cases. By comparison, coordinated plans for the timely development of irrigated areas within Dingxi are well advanced.

5.10 It should be noted that while the importance and logic of the resettlement program is clear in the current context of poverty and ecological degradation in Dingxi, this context is expected to change rapidly in upcoming years and may necessitate changes in the pace and scope of resettlement in the 1990s. In particular, following completion of Yindaruqin, Jingtai Phase II, and other irrigation schemes in the early-1990s, it will be necessary to review the progress of and future need for resettlement. Such a review would take into account changes in per capita income in Dingxi, amelioration of the soil erosion problem, and the growth and expected further growth of employment in rural industry.

## VI. AN INTEGRATED DEVELOPMENT PROGRAM FOR THE TWO XIS

6.01 Preceding chapters have sought to describe both potential opportunities and growth constraints in the agricultural sector in Gansu province, particularly in the Dingxi and Hexi areas. The natural resource endowment, including the location of human resources, clearly circumscribes the development options. The impact of current production practices on the loess hills has serious consequences for the national economy. At the same time, within the province, the failure to optimize such development opportunities as do exist is resulting in a rapidly deteriorating resource base on the loess hills and an intensification of the abject poverty of much of the rural population. These facts are recognized by both the national and provincial governments which are attempting to remedy the situation through the development strategy outlined in Chapter II, and through the provision of substantial recurrent subsidies in grain, energy and water supply to alleviate the lot of those most seriously affected in the province.

6.02 Redressing this situation requires an integrated approach involving the resettlement of rural populations from the overcrowded and degraded loess hills and the rehabilitation of the hills to improve agricultural productivity and simultaneously preventing them from causing massive and continuous downstream costs to the national economy. Some of the people to be resettled may move to new irrigation schemes. But the very high costs and low returns to such irrigation development suggests that alternative resettlement opportunities also need to be considered. These alternatives are discussed in detail in other annexes and in the main report.

### Loess Hills Rehabilitation

6.03 With some exceptions, proven techniques for diagnosing and remedying the technical problems of the loess hills have been established. However, the province still lacks the technical and possibly the financial resources to put such remedies into effect at the required rate or to refine them, taking into account experience gained elsewhere. The rate at which implementation of these measures can proceed is also governed by the factors influencing resettlement on newly developed irrigated areas and elsewhere.

6.04 Preliminary economic analysis of the rehabilitation program presented in Chapter III suggests that the overall viability of various components ranges from 13 to 40%. The techniques proposed are, to a large extent, familiar to the technical staff concerned, and more importantly are welcomed by the hill population. However, it would be naive to assume that they could be introduced on the scale required without substantially increasing the number of technical staff who supervise the construction of land protection measures and disseminate new information. Farmers also need to be trained in the modified farming practices that will be at the core of the new programs.

6.05 The pool of information collected by the Dingxi Loess Plateau Comprehensive Control Experiment Station in its short life is impressive but needs to be much enlarged. This can be achieved in part by testing and

adapting the results of other agencies such as the Shaanxi (Mizhi) Comprehensive Control Experiment Station of the Loess Plateau. It also requires more comprehensive field testing in Dingxi in such fields as appropriate fertilizer strategies for field crops, experimentation with alternative timber, fuelwood, and stock feeds, investigations of alternative integrated cropping and live-stock production systems and the means of disseminating such knowledge and required support services to the farm population. Required also is further investigation and development followed by dissemination of knowledge on alternative sources of energy for heating and cooking, such as solar power plus work on efficient utilization of all energy sources, both conventional and innovative.

### Irrigation Development

6.06 As indicated in Chapter IV, irrigation development faces formidable costs in the provision and conveyance of water to suitable irrigable areas. Preliminary analysis of the economics of two large projects, Yindaruqin and Jingtai Phase II, for which detailed feasibility studies are available and which are accorded the highest priority by provincial officials, shows rates of return of about 12 and 13%, respectively. Application of more diversified agriculture, including livestock, would probably improve the rates of return slightly, although this would require significant strengthening of research and extension efforts. Relatively low returns reflect the distance (both vertical and horizontal) of water sources from command areas requiring expensive civil works, and the limitations on cropping imposed by the climate. However, the incremental production of the principal grain crop, wheat, with the proposed cropping systems would help to reduce the annual grain subsidy to the province. In addition, irrigation development would help some of the settlers who need to move from poverty stricken, eroded hill areas and provide them with acceptable incomes and living standards.

### Resettlement

6.07 Careful and imaginatively planned resettlement of excess population from the crowded loess hills is the third and integral element of the proposed program. Without resettlement the hills cannot be rehabilitated. This is certainly a most demanding task but some experience has already been gained, and provincial and local officials are aware of the many problems involved.

6.08 Chapter V indicates that a total of some 520,000 people are to be resettled by the year 2000 in order to achieve the population balance estimated to be needed for loess hill rehabilitation and poverty alleviation and that most will settle in new irrigation schemes. While the absolute numbers to be moved and their resettlement options require further investigation and analysis, it is unlikely that they will be less than those quoted. The evidence suggests that no difficulties will be encountered in persuading people to move. Rather, the problem will be to ensure that population movement takes place in an orderly manner and that, where necessary, locations have been prepared adequately to receive settlers. In the case of new irrigation schemes, this will require that the people and officials of receiving sites have been conditioned for the influx, that the very basic social services that settlers might expect are in place, and that the facilities and services needed to start a new and productive life are ready and functioning.

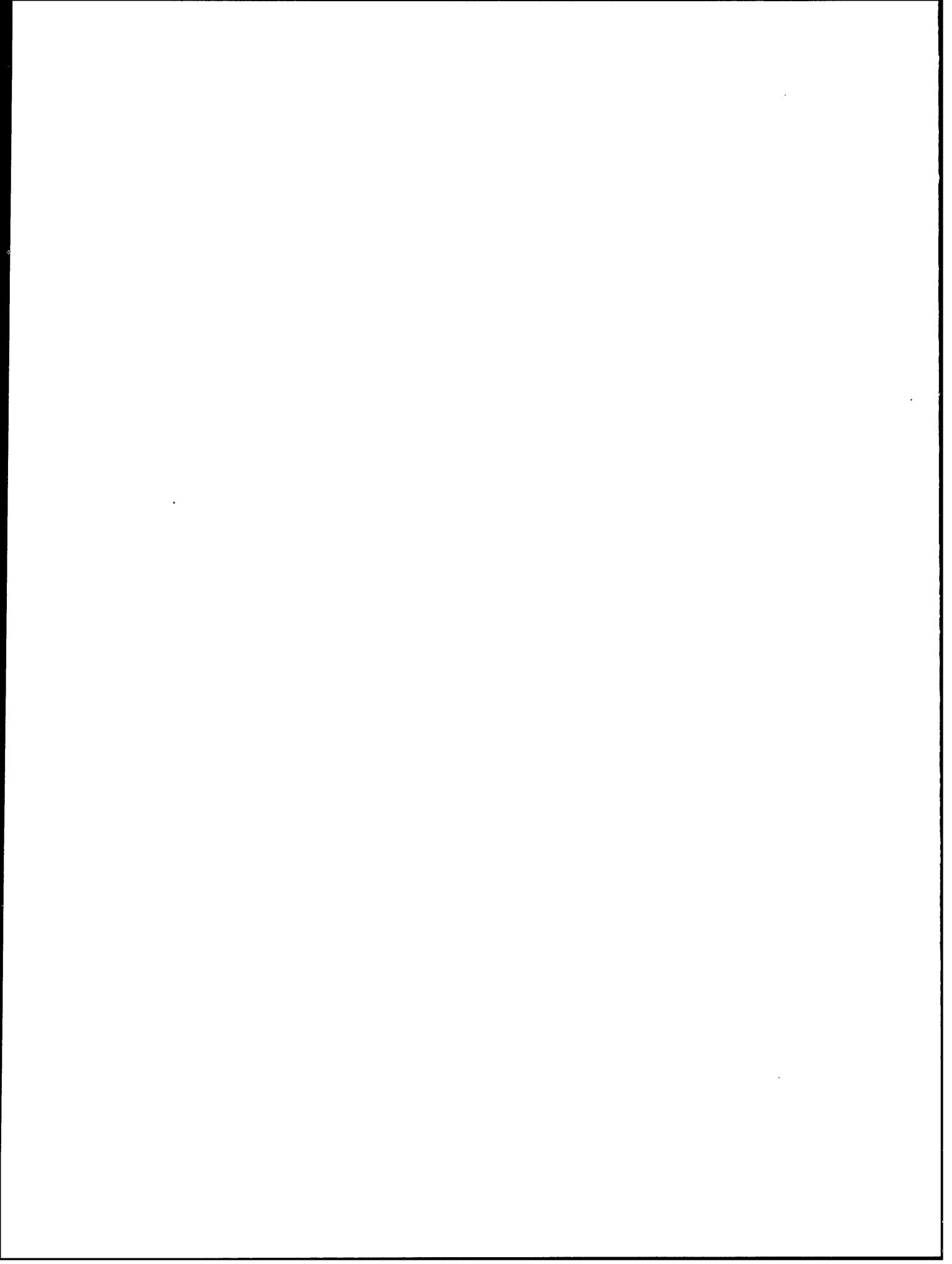
6.09 The coordination of resettlement programs requires a unique linkage between the organizations and individuals who manage outmigration and those who manage the settlement process. Often these entities are located many miles apart. Provincial authorities have recognized this need for close cooperation and have established basic procedures to address it. But the required expansion will need careful and flexible planning by specialized staff, particularly at the receiving end, and close coordination with local authorities and technical personnel. That there will be cases of hardship is inevitable and it will be the task of those responsible for this segment of the program to ensure that they are minimized.

6.10 Major elements will comprise the strengthening of the institutions concerned with establishment and provision of relocation grants, the arrangement and provision of transport, the planning of reception areas within irrigation schemes consonant with areas of origin, and provision of basic building materials, principally timber as the framework for settlers' predominantly mud houses. Potable water supplies and foodstuffs to carry settlers over their first growing season are essential. The pattern of settlement however, whereby typically one or two family members arrive to perform the pioneering role, means that additional amenities such as schools and other community buildings are not needed until the second or third year after arrival. By this time settlers have begun to establish themselves on their farms, have extended their initial houses, and can afford to send for their spouses and school age children.

#### Planning and Implementation

6.11 There is already in place in Gansu an authority responsible for and capable of directing a program of the type proposed. The Two Xis Commission coordinates the work of the Provincial Water Resources and Agricultural Bureaus and the ancilliary provincial institutions concerned with all aspects of the program. Answering to the deputy governor responsible for agricultural affairs, and liaising closely with appropriate planning and financing authorities at the national and provincial levels, the Commission also has close links with prefecture, county and district level officials charged with local planning and implementation. Because the program is seen to be central to provincial--and indeed national--agricultural development strategy for the area it has powerful political support. But the Commission still requires further strengthening, especially in the fields of economic evaluation and project planning.

6.12 In the coming months and years it will be important that the provincial government in general and the Two Xis Commission in particular review in detail how best to integrate the three major elements of the program and link them to developments in other sectors including industry and services. It will also be important that they consider carefully both the institutional and financial requirements of such a major program. There are opportunities for reducing poverty and raising incomes on the Loess Plateau; but realizing these opportunities remains a most difficult task.



Annex B: Industrial Development Issues in Gansu

Table of Contents

	<u>Page No</u>
I. <u>INDUSTRIAL DEVELOPMENT AND STRUCTURE</u> .....	209
Building Basic Industries, 1949-1979.....	211
Adjustment and Reform, 1979-1984.....	213
Ownership Structure.....	216
Employment and Wages.....	219
Industrial Efficiency.....	222
II. <u>RURAL INDUSTRY</u> .....	228
Rural Industry Development, Past and Present.....	228
Rural Nonagricultural Development - the Asian Experience.....	232
Prospects for Rural Industry and Services in Gansu.....	238
Development Issues.....	244
III. <u>URBAN INDUSTRY</u> .....	248
Ownership and Control.....	248
Heavy Industry.....	250
Light Industry.....	255
Development Issues.....	257
IV. <u>PROSPECTS AND POLICY OPTIONS</u> .....	260
Creating Productive Employment.....	260
Wage Flexibility.....	262
Investment Decisions and Financing.....	265
Technology Transfer and Development.....	268
Institutional Support.....	271

TABLES IN TEXT

1.1	Gansu: Sectoral Composition of Output and Employment, 1982 .....	210
1.2	Gross Industrial Output Value (GVIO), 1949-84.....	212
1.3	Share of Light Industry in Capital Construction of State-Owned Enterprises, 1979-84.....	215
1.4	Total Investment by State Enterprises, 1983.....	216
1.5	Gross Industrial Output (GVIO) by Ownership, 1979-83.....	218
1.6	Sectoral Composition of Employment, 1982.....	219
1.7	Value-Added per Employee Ratio by Sector.....	220
1.8	Urban Wages and Rural Incomes, 1978-84.....	221
1.9	Wages by Type of Enterprise, 1983.....	222
1.10	Gross Fixed Assets per Employee by Type of Enterprise, 1983.....	223
1.11	Productivity Indices of State Enterprises in Gansu, 1975-82.....	224
1.12	Total Factor Productivity Growth.....	226
2.1	Employment and Output Growth of Commune and Brigade Enterprises (CBEs).....	231
2.2	Percentage of Rural Labor Force with Primary Employment in Non-Farm Activities.....	234
2.3	Shares of Off-Farm Income and Nonfarm Income in Total Farm Household Income, Asia.....	235
2.4	Composition of Rural Off-farm Employment.....	240
2.5	Composition of Industrial Township and Village Enterprise Output.....	241
4.1	Employment Projections, 1982-2000.....	261

APPENDICES

1.	Conditions and Prospects for Selected Agroindustries.....	274
2.	Institutional Support for Rural Industries.....	286
3.	Costs of Electric Power Generation in Gansu .....	292
4.	Profiles of Selected Enterprises in Gansu.....	301
5.	Selected Industrial Statistics.....	324

TABLES IN APPENDICES

3.1	Costs of Electric Power Generation for the Daxia Hydropower Station in Gansu .....	295
3.2	Costs of Electric Power Generation for a Thermal (Coal) Power at a Coastal Location (Beilungang Project) .....	296
3.3	Costs of Electric Power Generation from Gansu to Beijing/Tianjin .....	297
3.4	Gansu Electric Power Statistics, 1984.....	298
3.5	Gansu: Five Year Average Hydrological Data for the Liujiaxia Reservoir, 1980-84.....	299
5.1	Gross Value of Industrial Output .....	325
5.2	Gansu: Gross Industrial Output Value (GVIO).....	326
5.3	Jiangsu: Gross Industrial Output Value (GVIO).....	327
5.4	China: Gross Industrial Output Value (GVIO).....	328
5.5	Gross Value of Industrial Output by Industrial Subsector, 1983.....	329
5.6	Growth of Gross Value of Industrial Output (GVIO), 1949-84 .....	330

5.7 Industrial Output by Ownership (including Village Enterprise Industrial Output), 1979-83.....	331
5.8 Industrial Structure .....	332
5.9 Investment in Capital Construction by Broad Industrial Subsector ....	333
5.10 Investment in Capital Construction and Technical Renovation in State Enterprises, 1983 .....	334
5.11 Fixed Assets by Industrial Subsector at Original Cost, 1983 .....	335
5.12 Ratio of Fixed Assets at Original Value and Employment by Industrial Subsector, 1983 .....	336
5.13 Gansu: Industrial Employment, 1980-84 .....	337
5.14 Jiangsu: Industrial Employment, 1980-83 .....	338
5.15 China: Industrial Employment, 1980-84 .....	339
5.16 Total Factor Productivity of State Enterprises .....	340
5.17 Township and Village Enterprise (TVEs) - All Sectors .....	341
5.18 Industrial Township and Village Enterprises (ITVEs) .....	342
5.19 Number of Township and Village Enterprises (TVEs).....	343
5.20 Employment of Township and Village Enterprises (TVEs) .....	344
5.21 Gross Output of Township and Village Enterprises (TVEs) .....	345



## I. INDUSTRIAL DEVELOPMENT AND STRUCTURE

1.01 By historical or international standards, Gansu province has experienced rapid economic growth during the past five years. However, compared to the national average, economic growth in Gansu has fallen behind. Provincial net material product per capita in 1984 was only 79% of the national average, compared with 85% in 1980. This decline occurred despite favorable weather and above-average growth of agricultural production. The reason for the below-average performance of the provincial economy was the lagging growth of industrial production in the state sector and the slow emergence of smaller collective industrial enterprises under village, township, or county-level ownership and control. Efficient industrial development is the key to stopping or reversing further slippage in relative economic performance, creating sufficient numbers of nonagricultural activities and narrowing the widening gap between incomes in Gansu and those in more advanced coastal provinces. The objective of this Annex is to analyze the conditions and prospects for efficient industrial development in Gansu and to discuss policy options at both the national and provincial levels. This chapter will review developments in the industrial sector in Gansu in the light of national and international experience on the basis of available quantitative data. To illustrate how Gansu compares with China's more developed coastal provinces, Jiangsu province is frequently used as a comparator.

1.02 Unfortunately, published historical statistics for Gansu province and China are limited to only a few major indicators. National income accounts are available for Material Product System (MPS) concepts only and are limited to net material product (NMP) at current prices for five broad sectors (agriculture, industry, construction, transport, commerce) and two expenditure categories (consumption and accumulation). This considerably limits international comparison, as the large majority of developing and industrialized countries use the broader gross domestic product (GDP) concept of the United Nations System of National Accounts (U.N. SNA). Furthermore, China's sectoral classification is different from the U.N. Standard Industrial Classification which is commonly used in other countries. More detailed statistics of industrial production are available only in terms of gross output value -- entailing different (and changing) degrees of double counting between different sectors and regions, or over time. Comparison across sectors and regions or over time is therefore tenuous, even within China. For these reasons, tables in this chapter are presented according to U.N. SNA concepts wherever feasible (i.e., including nonmaterial services, and avoiding double-counting of production).

1.03 Table 1.1 presents four different ways to look at the role of industry in Gansu's economy. The first three are different ways to measure economic activity (output) and the fourth shows the share of industry in total employment. According to the first, and in China most frequently cited measure, the gross value of agricultural and industrial output (GVIAO), the industrial sector is indeed very important to Gansu's economy: 72% of GVIAO originates in the industrial sector. However, as the next columns show, this measure is highly misleading on two counts: it excludes a substantial part of

the economy, and it involves a lot of double counting, especially in the industrial sector. Using the Chinese national income concept (net material product: NMP), the importance of industry in Gansu decreases sharply to about 45% as material service sectors (construction, transport, commerce) are included, and double counting of production is eliminated. The share of agriculture increases, despite the addition of other sectors, due to the smaller extent of double counting in agriculture. The NMP measure is already a very significant improvement over GVIAO. Unfortunately, virtually all detailed production statistics are only available in terms of GVIAO. If the gross domestic product (GDP) measure of national income is used (i.e., including the output of nonmaterial service sectors such as banks, research institutions, public administration, etc.), and some hidden service sector employment in industrial enterprises is reclassified as "services", the share of the services sector (excluding construction) increases from 16% to 23%.

1.04 By international standards, the share of industry in Gansu is still very large (52% of GDP, including construction). Among developing countries, only a few countries with very large mining or petroleum extraction sectors (Congo and Algeria) have a similarly large share of industry. Among industrialized economies only a few socialist countries have a similar (or slightly higher) share of industry in GDP. Looking at employment however, the situation changes dramatically: only 11% of Gansu's labor force is employed in industry, while in most other countries the shares in output (GDP) and employment are much closer, and in industrialized countries are almost identical. The reason for this unusual relation between output and employment in Gansu is the low productivity of agriculture (employing 76% of the labor force) and the high concentration of industry in the provincial capital.

Table 1.1: GANSU: SECTORAL COMPOSITION OF OUTPUT AND EMPLOYMENT, 1982 (%)

	GVIAO	NMP	GDP /a	Employment /b
Agriculture	28	32	26	76
Industry	72	45	44	11
Construction	-	7	7	2
Transport	-	5	4	2
Commerce	-	11	9	3
Nonmaterial services	-	-	10	6
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

/a Main Report, Appendix A, Table 9.

/b Adjusted for part-time agricultural workers.

Source: Provincial statistics, 1982 Population Census.

### Building Basic Industries, 1949-1979

1.05 Industry in Gansu has progressed remarkably over the past three decades. The gross value of industrial output (GVIO) in 1979 was Y 8,279 million, or about 80 times that of 1949 (both at 1980 prices), compared with a roughly 40-fold increase in industrial production nationwide. This rapid real growth at nearly 16% p.a. was mostly due to the tremendous expansion of heavy industry,<sup>1/</sup> increasing at about 21% p.a., compared with 16% p.a. nationwide. Light industry grew more slowly at 10% p.a., slightly below the national average of 11% p.a. As a result, per capita GVIO (in 1980 prices) increased from about Y 10 in 1949 to Y 437 in 1979, or 93% of the national average, from less than 50% in 1949. Per capita industrial output in one of the most developed coastal provinces, Jiangsu, was nearly three times that of Gansu in 1949, but only 40% higher in 1979.

1.06 These dramatic changes in China's industrial landscape were the conscious result of central planning. The industrial development of the provinces in the remote and undeveloped Northwest was an important element of China's socialist development strategy, geared towards rapid development of heavy industry and equalization of regional and other income differentials.

1.07 The rich mineral resource endowment of Gansu with nonferrous metal ores, petroleum, coal and hydropower provided the logical starting point for the central planners. The First Five-Year Plan (1952-57) included a large refinery in Lanzhou, and a petroleum equipment and machinery plant to exploit the Yumen oilfield near Jiuquan, which was the largest oilfield in China at that time. Later, a large petrochemicals complex was built in Lanzhou to complement the refinery. Other major undertakings included a copper smelter in Lanzhou and a nickle mine and smelter in Jinchuan. The Liujiaxia hydro-power station with 1,160 MW was completed in 1969 and meets a large share of the power requirements for these energy-intensive heavy industries. As a result of these and other major heavy industry projects, the share of heavy industry in Gansu increased from 22% in 1949 to 82% of GVIO in 1979, far above the national average of 47% (Table 1.2).

---

<sup>1/</sup> Chinese statistics differentiate between heavy and light industry according to the use of products. Light industries produce primarily consumer goods, heavy industries producer goods. For multiproduct enterprises the entire production is assigned to either light or heavy industry according to the type of its principal products. Unfortunately, the breakdown of industrial statistics into heavy and light industry is not available in all cases. For this reason a broader sectoral classification of "heavy" (metallurgy, power, coal, petroleum, chemicals, machinery, and building materials) and "light" industry (wood, food, textiles, clothing, leather, and textiles) is sometimes used.

Table 1.2: GROSS INDUSTRIAL OUTPUT VALUE (GVIO), 1949-84

	Composition (%) /a				Growth (% p.a.) /b			
	1949	1979	1984	1985	1949-79	1979-82	1983	1984
<u>Gansu</u>								
Light	78	18	23	25	10.0	8.5	7.3	12.7
Heavy	22	82	77	75	21.3	-3.1	9.7	10.8
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>15.7</u>	<u>-0.8</u>	<u>9.1</u>	<u>11.2</u>
<u>Jiangsu</u>								
Light	94	53	59		11.1	15.4	12.1	17.6
Heavy	6	47	41		80.8	6.5	14.8	22.1
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>		<u>13.2</u>	<u>11.5</u>	<u>13.2</u>	<u>19.4</u>
<u>China</u>								
Light	74	43	50		11.0	13.2	8.7	13.0
Heavy	26	57	50		16.5	2.0	12.4	14.2
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>		<u>13.3</u>	<u>5.0</u>	<u>10.5</u>	<u>14.0</u>

/a 1949 at 1952 prices; 1979 and 1984/85 at 1980 prices.

/b At 1980 prices.

Sources: Statistical Yearbooks of China; Almanac of China's Economy;  
Provincial data.

1.08 Although these achievements are impressive, the emphasis on heavy industry was not without problems. Many heavy industry projects were well conceived, exploiting Gansu's mineral resource endowment to provide a comparative advantage over other locations with better transport facilities, better trained labor and direct access to markets, but some of the projects were not so well conceived. For example, several iron and steel plants were built with little regard for technical and economic efficiency. One plant was built in Jiuquan in northwest Gansu near iron ore and coal deposits to produce only pig iron, while another plant was built 1,000 km away in Lanzhou to produce only steel but no pig iron. The first plant was under national government control and the other was provincially owned and controlled. With separate planning and material allocation systems, lack of coordination in investment planning was carried over into lack of coordination in operating the plants. This lack of coordination along with the construction of several other uneconomical small plants, led to heavy financial losses in the iron and steel industry in Gansu Province, and economic losses were even larger.

1.09 Another problem of the heavy industry strategy is the excessive spatial concentration of industry and the lack of linkages with other indus-

trial subsectors and with agriculture. The provincial capital, Lanzhou, accounts for over 50% of provincial gross industrial output, compared with only 15% for Nanjing, the capital of Jiangsu. In other words, industrial output per capita in Lanzhou is very close to that of Nanjing but industrial production per capita outside the provincial capital in Gansu is only about one-quarter of that in the rest of Jiangsu. While the heavy industry strategy of the past three decades has helped to move Lanzhou toward the level of coastal cities, it has failed to do so for the rest of the province, where over 90% of the population live. Lanzhou has remained an industrial enclave within a poor and predominantly agricultural province.

1.10 Another legacy of the heavy industry strategy is the unbalanced sectoral composition in Gansu. Heavy industry accounts for a very large share of total output (Table 1.2) and is dominated by metallurgy, power and petroleum, while chemicals, machinery and building materials have sectoral shares close to the national average (Appendix 5, Table 5). Among light industries, textiles and clothing are particularly underrepresented, followed by food processing, while the share of leather goods is close to the national average due to the presence of a substantial livestock industry in Gansu and the Northwest.

#### Adjustment and Reform, 1979-84

1.11 By 1979, the basic flaws of the past industrialization strategy had been recognized by China's leaders and a period of "readjustment, restructuring, consolidation and improvement" was inaugurated to redress the imbalances. Previous policies were now being criticized as having overemphasized heavy industry and "production for production's sake" at the expense of attention to the needs being served. Production had remained divorced from customers' needs. As a result, living standards were hurt, and the economy suffered from shortages of consumer goods, building materials, electricity, spare parts and other items. Deliveries of goods and materials under the state plan were not dependable. Construction capacity was overextended and too many projects were started, particularly in heavy industry, so that investments took much too long to complete. Meanwhile, a significant fraction of the goods produced could not be used and instead were stockpiled in state warehouses.

1.12 A related criticism was that not enough attention had been given, particularly in 1966-78, to the efficient use of resources. Thus, inefficient enterprises, once established, were allowed to make losses and use excessive quantities of energy and materials. Too much emphasis was placed on industrial self-sufficiency within each region and organizational unit. Both small and large plants were built to be "complete," based on a high degree of vertical integration, while opportunities were neglected for creating an efficient division of labor through specialization. Industrialization programs put too much emphasis on immediate gains in production; investments in support of industry were neglected, notably in mining, transport, communications and power. Particular excesses occurred by "taking steel as the key link" and overinvesting in metallurgical industry. Meanwhile, light industry was badly neglected, along with agriculture and the so-called nonproductive investments such as housing, education and cultural facilities.

1.13 In Gansu, these problems were particularly evident. While only 11% of industrial capital construction <sup>2/</sup> during the preceding 25 years were for light industry nationwide, in Gansu it was even less at 4%. Using a broader (sectoral) definition of "light" industries <sup>3/</sup> the figures are similar: "light" industry, thus defined, accounts for only 5% of industrial fixed assets <sup>4/</sup> in Gansu compared with 15% nationwide.

1.14 The new policy framework first announced in early 1979 was designed to counteract and gradually overcome these problems. The Government decided to reduce aggregate pressures on the national economy by slowing the rate of growth, particularly in heavy industry, by cutting back capital construction. At the same time, efforts were made to correct the imbalances, relieving shortages and removing bottlenecks. Within industry, light industries and a few bottleneck sectors were given much higher priority in investment allocation. Other industries were given new goals, including adjusting output to customer needs, advancing technology, beginning restructuring and creating a wider division of labor, for example, through subcontracting. Throughout industry, steps were taken to economize on raw materials and energy, and on working capital. There were also experimental reforms designed to give enterprises greater autonomy, including gradual relaxation of the rigid state material allocation system, new types of contracts, some competition among enterprises, especially in consumer goods industries, and the beginning of an officially condoned parallel market in producer goods that had previously been available only through plan allocation.<sup>5/</sup>

1.15 In Gansu these reforms did not go as far as elsewhere, but at the same time the burden of the adjustments was felt more in Gansu than elsewhere, due to the predominance of heavy industry and a large number of inefficient state enterprises that had to be restructured or closed down. Gross industrial output declined by 10% between 1979 and 1981 in Gansu but increased by 13% nationwide, as heavy industry production was cut back by 16% in Gansu during 1979-81 and only 3% nationwide. Only in 1983 and 1984 did industrial growth resume in Gansu at a rate close to the national average (Table 1.2). Similarly, more advanced provinces, like Jiangsu, were quick to shift investment towards more profitable and employment-generating light industries, while the traditional investment pattern, dominated by heavy industry, continued

---

<sup>2/</sup> Investment in capacity expansion, excluding technical renovation of existing plants.

<sup>3/</sup> Wood, food, textile, leather, paper and miscellaneous industries; see footnote 1.

<sup>4/</sup> At original values (excluding depreciation).

<sup>5/</sup> For example, until 1982, 100% of the output of major machine tool manufacturing plants was subject to plan allocation. By 1985, the share of plan allocation had declined to about 50% for a sample of 45 major machine tool plants in Shanghai.

unchanged in Gansu (Table 1.3). The investment shares given in Table 1.3 include only capital construction investment, that is, new plants and capacity expansion, and exclude technical renovation investments, due to data availability for earlier years. Technical renovation investments have become much more significant in recent years and are more evenly divided between heavy and light industry (see below).

Table 1.3: SHARE OF LIGHT INDUSTRY IN CAPITAL CONSTRUCTION OF STATE-OWNED ENTERPRISES, 1979-84  
(% of industry total)

	1980	1981	1982	1983	1984	1985
Gansu	...	...	11	9	7	7
Jiangsu	...	...	22	37	37	21
China	12	18	20	18	14	12

Source: Provincial data; Statistical Yearbook of China, 1981-85.

1.16 The differences shown in Table 1.3 are even more dramatic if investment of collectively owned units in urban and rural areas are added. In Jiangsu, investment of collective enterprises in cities and towns in 1983 was of the same magnitude as that of state enterprises.<sup>6/</sup> In Gansu, capital construction investment of collective enterprises was only equivalent to about 10% of that of state enterprises. Even in Gansu, investment of collective enterprises is more balanced, with about one half in "light" industries.<sup>7/</sup> Adding collective enterprises thus increases the share of "light" industries in total industrial capital construction in 1983 to about 11% in Gansu,<sup>8/</sup> and to 43% in Jiangsu. Adding technical renovation funds increases the share of "light" industries in total industrial investment in Gansu further to about 12% in 1983 and 17% in 1984. The increase in 1984 is entirely due to an increased allocation of technical renovation funds to "light" industries (28% in 1984, up from 20% in 1983). "Heavy" industry still accounted for over 92% of capital construction of state enterprises, and basic metal industries alone for 34%. For the more narrowly defined manufacturing sector (i.e., excluding mining and power), the share of "light" industries in state enterprise capital construction was 9% in 1983 (compared with 23% nationwide). Table 1.4 gives the distribution of total investment (capital construction plus technical

6/ Excluding village and other (e.g., private) enterprises.

7/ Defined again on a subsectoral basis (wood, food, textiles, etc.).

8/ Assuming (conservatively) that "light" collective industries in Jiangsu account for the same share of collective industry investment as in Gansu.

renovation) of state enterprises in 1983 for the broadly defined industrial sector and for the manufacturing sector. "Heavy" and "light" industries are again defined on a sectoral basis, rather than by type of product, due to data availability.

Table 1.4: TOTAL INVESTMENT BY STATE ENTERPRISES, 1983

	Industrial Sector (% of industry)		Manufacturing Sector (% of manufacturing)	
	Gansu 1983	China 1983	Gansu 1983	China 1983
"Heavy" industries (of which: metallurgy)	89 (27)	68 (11)	85 (41)	59 (13)
"Light" industries	11	32	15	41
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
(Y million)	(822)	(64,011)	(639)	(50,662)

Note: Includes capital construction plus technical renovation.

Source: Provincial data; Statistical Yearbook of China, 1984.

1.17 The share of investment in light manufacturing industries in China in 1983 shown in Table 1.4 are quite "normal" by international standards. It is interesting to note that total manufacturing investment of state enterprises in Gansu today is still more biased towards heavy industry (85%) than it was on average in China during the past three decades of heavy industry development (75%). Today it is widely accepted in China that past industrial investments were too heavily biased in favor of heavy industries.

#### Ownership Structure

1.18 Continued predominance of heavy industry in investment allocation is one major reason for the slow growth of industrial production in Gansu over the past five years. Continued dominance of state enterprises and the slow

emergence of collective enterprises <sup>9/</sup> is another and closely related factor. In the more advanced coastal provinces, counties and townships in urban and rural areas have been quick to take advantage of the relaxation of the material allocation system and the emergence of parallel markets for nearly every imaginable product. In Jiangsu for example, the output of rural township and village enterprises increased by over 30% p.a. during 1976-79 and over 20% p.a. during 1979-83 and now accounts for about one quarter of industrial production. Larger urban collectives also grew rapidly. By contrast, development of rural and urban collective enterprises in Gansu has been slow. During 1979-82, gross output of commune and brigade enterprises, now renamed township and village enterprises (TVEs) increased by only 1.5% p.a., and employment actually declined with the closing of some of the small and inefficient "five small industries" enterprises which had been promoted during the Cultural Revolution to advance industrial self-sufficiency in rural areas. Significant growth of rural enterprise output and employment did not return until 1983, with recent growth rates (1984 and 1985) close to the national average. In 1984, gross output growth of industrial township and village enterprises sharply accelerated to 27% in Gansu and 39% in China, while employment growth increased to 20 and 18% respectively (from 3-4% in the preceding years). Provisional data for 1985 indicate similarly rapid growth (Chapter 2).

1.19 The share of urban and rural collective enterprises in total industrial output in Gansu is still very small (7-8%), especially if compared with an advanced coastal province such as Jiangsu, where collective enterprises account for 40-45% of industrial output. Table 1.5 gives the composition of

---

<sup>9/</sup> Most collective enterprises are owned and operated by local governments. They fall into two categories: rural enterprises (township and village enterprises, formerly called commune and brigade enterprises) and urban collectives. Small urban collectives are run by the neighborhood (jiedao) which is of the same administrative level as the township. These small rural and urban collectives have full responsibility for profit and loss and are required to pay taxes. Large collectives are administered by provincial, prefectural (municipal) or county (district) industrial bureaus depending on size and sectoral characteristics. These industrial bureaus are also in charge of state enterprises and in practice there is very little difference between these larger collectives and state enterprises. However, investment funds are not fungible between state and collective enterprises. Unfortunately, statistics on collective enterprises are published in separate, and partly overlapping, sources. The State Statistical Bureau data on industrial output and collective enterprises exclude industrial village enterprises, while the Ministry of Agriculture, Animal Husbandry and Fisheries publishes data on township and village enterprises excluding urban and county level rural collectives. While a breakdown into industrial and other enterprises is available for township and village enterprises together, it is not available separately for village enterprises. These categories are presently being revised.

gross value of industrial output<sup>10/</sup> (GVIO) by type of enterprise ownership and control. The GVIO figures given in Table 1.5 probably underestimate the contribution (in terms of net output, or value added) of TVEs. The available financial data indicate that the ratio of net-to-gross output for TVEs is 0.53, but only 0.35 for state enterprises in Gansu (and 0.32 and 0.26, respectively, in Jiangsu). On a net output (value-added) basis, the share of TVEs in industrial output in Gansu is about 4-5%, compared with 27-28% in Jiangsu, and the share of state enterprises is about 91% in Gansu and 50% in Jiangsu.

Table 1.5: GROSS INDUSTRIAL OUTPUT (GVIO) BY OWNERSHIP, 1979-83

	<u>Real Growth 1979-83 (% p.a.)</u>			<u>Share in GVIO 1983 (%)</u>		
	<u>Gansu</u>	<u>Jiangsu</u>	<u>China</u>	<u>Gansu</u>	<u>Jiangsu</u>	<u>China</u>
State enterprises	1.4	8.7	6.1	93	55	74
Large urban collectives	4.4	12.0	10.8	4	19	14
Township and village enterprises	3.8	21.9	16.0	3	24	11
Other	-	74.8	44.9	0.1	2	1
<u>Total</u>	<u>1.6</u>	<u>12.4</u>	<u>7.9</u>	<u>100</u>	<u>100</u>	<u>100</u>
(Y billion)	-	-	-	8.9	61.1	640.9
GVIO per capita (Y)				447	996	625

Note: GVIO has been adjusted to include industrial village (brigade) enterprise output.

Source: Statistical Yearbook of China; Agricultural Yearbook; Provincial data.

1.20 The high net-to-gross output ratio for township and village enterprises in Gansu is due to the prevalence of labor-intensive sectors and production processes among TVEs and the still rather underdeveloped commercial relations among all types of enterprises. This appears to hold true even if adjustments are made for the different sectoral composition of output. Differences in per capita net industrial output between Gansu and Jiangsu (1:1.7) are thus less than per capita gross output ratios (1:2.2) appear to indicate. This shows the limitations of the gross output concept even for comparison within China.

<sup>10/</sup> Adjusted to include industrial village enterprise output.

Employment and Wages

1.21 Despite massive investments over the past three decades, the industrial sector has generated little employment in Gansu. Today, industry still accounts for about 50% of total fixed investment in Gansu (and 60% of state sector investment) but for only 8% of employment. Over 80% of the labor force is still in agriculture -- not much less than three decades ago. From an employment perspective, the industrialization strategy of the past three decades has clearly failed. By comparison, Jiangsu was much more successful in industrial employment creation (Table 1.6) because a larger share of investment was allocated to light industries (Table 1.3) and higher agricultural incomes provided the basis for a more diversified household consumption pattern. What is also striking in international perspective is the low share of service sector employment in Gansu. One of the major features of industrialization in other developing countries has been the rapid increase in service sector employment. In South Korea, for example, the share of industrial employment increased from 10% in 1965 to 23% in 1983, while service sector employment (including construction) increased from 31% to 46%.

Table 1.6: SECTORAL COMPOSITION OF EMPLOYMENT, 1982 (%)

	Gansu 1982	Jiangsu 1982	China 1982	South Korea	
				1965	1983
Agriculture	81	66	74	59	30
Industry	8	21	14	10	24
Manufacturing	(7)	(20)	(12)	(9)	23
Services /a	11	13	12	31	46
Construction	(2)	(3)	(2)	(3)	(6)
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

/a Including construction; usual World Bank practice is to include construction in industry.

Sources: 1982 Population Census; Korea: Economic Statistics Yearbook.

1.22 This indirect pattern of employment shifting from agriculture to services in the process of industrialization, rather than directly into industry, is quite typical for other developing countries, and especially for rapidly developing semi-industrialized countries. For 50 middle-income countries together, the share of industry (including construction) increased from 15% to 21% of total employment between 1960 and 1980, while services (excluding construction) increased from 23% to 34%. Among low-income

countries <sup>11/</sup> the share of industry expanded from 7% to 11% over the same period, and service employment rose from 11% to 16%.

1.23 Another striking difference between Gansu and the rest of the world is the large difference in labor productivity between agriculture and industry -- and to a slightly lesser degree between agriculture and services. Net output (value added) per employee in Gansu's industry is about 14 times that in agriculture, compared with a factor of 6 for China, 4 for India, and only 2.5 for other low-income countries. In rapidly developing countries such as South Korea or Brazil, the labor productivity differential between agriculture and industry has sharply narrowed over the past two decades (from 4.1 to 2.4 in South Korea, and from 7.5 to 3.3 in Brazil), as a substantial part of the labor force shifted from agriculture to industry and, even more important, to services (Table 1.6). In industrialized countries, intersectoral labor productivity differentials are even smaller. The remaining labor productivity differential between industry and agriculture of 2:1 reflects the lower capital-intensity of agriculture. It is interesting to note that labor productivity differentials between industry and services are small in most countries and even turn in favor of the service sector in industrialized countries, reflecting a larger share of highly educated workers in services than in industry or agriculture (Table 1.7).

Table 1.7: VALUE-ADDED PER EMPLOYEE RATIO BY SECTOR  
(Total = 100)

	Gansu 1982	China 1982	India 1981	South Korea		Industrialized countries, 1981
				1960	1982	
Agriculture	33	47	54	56	54	50
Industry <sup>/a</sup>	459	281	200	222	128	95
Services	301	200	206	172	113	109
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

<sup>/a</sup> Including construction.

Source: Provincial data; 1982 Population Census; World Bank, World Development Report.

1.24 The huge labor productivity differential between agriculture and industry in Gansu of 1:14 (Table 1.7) is almost without parallel in the world and reflects two factors, namely, the high capital-intensity of industry in Gansu and the absence of any direct relationship between rural incomes and

<sup>11/</sup> Excluding China and India.

urban wages (Table 1.8). Urban wages in Gansu are some 10-20% higher than elsewhere in China, but rural incomes are 40-50% lower. As a result, urban wages in Gansu are now about three times the rural income per worker, whereas for China as a whole, urban wages are only 30-40% higher than rural incomes.<sup>12/</sup> The rural reforms have narrowed the urban/rural income gap, but the gap in Gansu is still larger than it was in the rest of China even before the start of rural reforms.

Table 1.8: URBAN WAGES AND RURAL INCOMES, 1978-84

	Gansu			China		
	1978	1981	1984	1978	1981	1984
----- Y/year -----						
Urban wages						
(all sectors) /a	...	945	1,200	614	779	974
Industry	760	985	1,358	...	800	988
Rural income /b	...	317	442	267	620	711
----- as % of rural income/worker -----						
Urban wages						
(all sectors) /a	...	298	271	230	130	137
Industry	...	311	307	...	134	139

/a State and urban collective enterprises.

/b Rural income per worker estimated assuming two workers per household.

Source: Provincial data; Statistical Yearbook of China.

1.25 In most other countries, such a large urban/rural income gap would have led to massive rural-urban migration, as peasants would have streamed into the cities in pursuit of better income opportunities. This did not happen in Gansu, or elsewhere in China, due to stringent restrictions on migration. The policies of the past have kept rural incomes far below what they could have been, if peasants had been encouraged to engage in nonagricul-

<sup>12/</sup> In terms of marginal labor productivity this gap is even larger, as rural incomes per worker include a return on land and capital, but urban wages do not. But on the other hand, urban wages in China have no direct relationship to marginal labor productivity since there is virtually no labor market -- in contrast to market economies and even most other socialist countries.

tural activities or permitted to migrate to other locations. Far smaller income differentials have led elsewhere to massive rural-urban migration and rapid and efficient industrialization. For example, in South Korea rural household income in 1965 was actually some 20% higher than urban household income (reflecting nevertheless a somewhat lower marginal productivity of labor in rural areas), but rural-urban migration was equivalent to about 10% of the total population during 1965-75.

1.26 Unlike state workers who are paid wages according to a unified scale over the whole country (with a hardship allowance for workers in cold and remote provinces like Gansu), collectives are, in theory, responsible for their own profit and losses and pay varies from one unit to another. In Gansu, wages in urban collectives are about one quarter lower than in state enterprises, but this is in part due to the higher share of light industry among collective enterprises. In other parts of China, wages of urban collectives are in general about 15% lower than those of state enterprises (Table 1.9). Given the low agricultural productivity and low rural incomes in Gansu, it is rather astonishing that wages of rural collective enterprises are some 20% higher than in the more advanced coastal provinces. It is not clear what has led to this pattern of wage setting. High state enterprise and urban collective wages appear to exert a strong influence on wages in rural township and village enterprises, although other factors, such as the prevalence of difficult and dangerous jobs (e.g., coal mining or construction) would also be reflected in the high average wages of rural collectives in Gansu. With these high wages it will be very difficult to create a large number of rural non-agricultural jobs, given Gansu's disadvantages of remote location and poor agricultural resource endowment.

Table 1.9: WAGES BY TYPE OF ENTERPRISE, 1983

	Gansu	Jiangsu	China	Gansu	Jiangsu	China
	-----	Y/year	-----	% of state enterprises		
State enterprises	973	768	865	100	100	100
Urban collectives	702	643	698	72	84	81
Rural collectives	641	525	544	66	68	63

Source: Statistical Yearbook of China, 1984.

### Industrial Efficiency

1.27 Industry in Gansu is very capital intensive. Moreover, the capital intensity of industry in Gansu cannot be fully explained by the large share of capital-intensive heavy industry in total industrial output. It also appears that capital is used much less efficiently in Gansu's industry than elsewhere in China. Fixed assets per employee in state enterprises in Gansu are nearly twice the average for China, and about two and one-half times that of state enterprises in Jiangsu. To some extent this high figure can be explained by

the higher share of capital-intensive heavy industries in Gansu's industrial output. For the broad (sectoral) definition of heavy industry for which provincial data are available, gross fixed assets per employee are about 2.7 times that of light industry (Table 1.10). For China as a whole, fixed asset statistics are also available using the more narrow (producer goods) definition of heavy industry. Under this definition, heavy industry is about eight times more capital intensive than light industry (Y 40,000 vs. Y 5,000 per employee). But if adjustment is made for the larger share of heavy industry in Gansu, fixed assets per employee are still about 70-100% higher than in Jiangsu (Table 1.10). This also holds for further disaggregation. In light industry subsectors, fixed assets per employee are 24% (food industry) to 100% (clothing) higher than the average for China, while output per employee is at best about equal to the rest of China. Only for township and village enterprises (TVEs) is the (low) capital intensity on par with other areas in China. Gross output per employee in industrial TVEs is considerably lower than elsewhere in China, but net output appears to be similar, indicating a much better use of scarce resources in small-scale rural enterprises than in the state sector.

**Table 1.10: GROSS FIXED ASSETS PER EMPLOYEE BY TYPE OF ENTERPRISE, 1983**  
(Y per employee)

	Total <u>/b</u>	Heavy <u>/c</u>	Light <u>/d</u>
<u>Gansu</u>			
State enterprises <u>/a</u>	20,570	26,920	10,470
TVEs	1,360	3,140	2,980
<u>Jiangsu</u>			
State enterprises	10,030	12,740	6,250
TVEs	1,320	...	...
<u>China</u>			
State enterprises	13,420	18,690	7,030
TVEs	1,420	...	...

/a Including large urban collectives.

/b For state enterprises, the total includes only industrial enterprises; for TVEs, the total includes all types of enterprises (agriculture, industry, construction, commerce).

/c Metallurgy, power, coal, petroleum, chemicals, machinery, and building materials.

/d Wood, food, textiles, clothing, leather, paper.

Source: Statistical Yearbook of China, 1984; Provincial data.

1.28 Sufficient data to make productivity comparisons with other parts of China are available only for state enterprises for 1975-82. For Gansu, state enterprises account for over 90% of total industrial output and these statistics are therefore representative for the whole industrial sector. While

output increased by only 10.6% during these seven years, employment and the capital stock increased much faster (by 28.6 and 43.5%, respectively), resulting in a decline of both labor and capital productivity (Table 1.11).

Table 1.11: PRODUCTIVITY INDICES OF STATE ENTERPRISES IN GANSU, 1975-82

	1975	1982	Change 1975-82 (% p.a.)
1. Net output	100.0	110.6	+1.4
2. Labor input	100.0	128.6	+3.7
3. Capital input	100.0	143.5	+5.3
4. <u>Total factor inputs /a</u>	<u>100.0</u>	<u>139.7</u>	<u>+4.9</u>
5. Labor productivity (1÷2)	100.0	86.0	-2.1
6. Capital productivity (1÷3)	100.0	77.1	-3.7
7. <u>Total factor productivity (1÷4)</u>	<u>100.0</u>	<u>79.2</u>	<u>-3.3</u>

/a Net output (at constant prices) is assumed to have grown at the same rate as gross output. This is a conservative assumption as the net/gross output ratio has probably declined slightly during the period. Capital inputs are defined as fixed assets (net of depreciation) plus circulating capital. Total factor inputs are the weighted average of labor and capital inputs, assuming a "normal" average rate of return to capital of 15% p.a (see Appendix 5, Table 16 for details). Due to the extremely high capital-intensity of state enterprises in Gansu, the share of capital inputs is rather high (75%).

Source: Appendix 5, Table 16.

1.29 While the measure for labor productivity is usually a robust and useful indicator, the simple measure for capital productivity could be misleading as it simply measures the increased capital intensity of production (as a decline in capital productivity). It is thus useful to calculate total factor productivity, that is, the increase in net output divided by a weighted index of total inputs (capital and labor). Total factor productivity, thus defined, measures technical progress resulting from improvements in managerial practices as well as technical progress in the more narrow technological sense.

1.30 Table 1.12 gives total factor productivity growth in state enterprises in Gansu, Jiangsu and China for 1975-82 and a comparison with total

factor productivity growth in the industrial sector <sup>13/</sup> of South Korea during 1971-84, using a range of assumptions about the "normal" rate of return to capital <sup>14/</sup> to determine the shares of labor and capital in total factor inputs. Total factor productivity growth in state enterprises in Gansu has been negative during this period, even at very low rates of return to capital. State enterprises elsewhere in China also show low total factor productivity growth if compared, for example, with the industrial sector of South Korea. Unfortunately, data for rural and urban enterprises are insufficient to enable us to calculate total factor productivity for the entire industrial sector, that is, including urban and rural collective enterprises. In Jiangsu province which has a large and growing share of rural collective enterprises, much lower capital requirements (Table 1.10) and rapidly increasing labor productivity (para. 2.13), total factor productivity growth for the entire industrial sector has probably been quite respectable in recent years, while these effects have not yet been felt in Gansu due to the low share of rural collective enterprises in total output (Table 1.5) and their slow growth until very recently.

---

<sup>13/</sup> Using Chinese definitions of the industrial sector, that is, mining, manufacturing and electric power.

<sup>14/</sup> Econometric studies in rapidly growing developing countries show that average rates of return to capital are typically in the range of 15-25% p.a. Average rates of return to capital in industrialized countries have fallen in recent years to 10% or less. Marginal rates of return to capital (opportunity costs of capital) in other developing countries are usually in the range of 10-15% p.a.

Table 1.12: TOTAL FACTOR PRODUCTIVITY GROWTH  
(% p.a.)

	<u>State enterprises 1975-82</u>			<u>Industrial sector 1971-84</u>
	<u>Gansu</u>	<u>Jiangsu</u>	<u>China</u>	<u>South Korea /a</u>
Assuming an average return on total capital of: 10%	-3.2	+0.3	+1.1	+3.1
15%	-3.3	+0.1	+0.8	+2.5
20%	-3.4	-0.1	+0.6	+2.1

/a For the more narrowly defined manufacturing sector (that is, excluding mining and electric power), the differences in total factor productivity growth between China and South Korea would be even larger than those shown. During 1971-84, the share of electric power total investments in industry in South Korea increased from 29% to 37% due to a large (and capital-intensive) nuclear power program whose economic returns have so far been low. For the manufacturing sector alone, total factor productivity growth was about 3-4% p.a. For Gansu, total factor productivity growth of the manufacturing and industry sectors is nearly identical as the share of electric power investments has remained small (14% of total industrial investment during 1971-82) and has changed very little.

Source: Appendix 5, Table 16.

1.31 A better interpretation of Table 1.12 is probably that technical progress in state enterprises in China has been low and capital has been used inefficiently. This is particularly true for Gansu, where total factor productivity growth is negative, even at a zero rate of return on capital. This stems in part from the lack of incentives to economize on capital inputs in the past. Investment funds were provided by the budget at no cost to the enterprise and working capital loans carried very low interest rates. Enterprise managers had very little incentive to economize on capital and this, together with the isolation from technical progress made abroad, resulted in very low and even negative total productivity growth in state enterprises.

1.32 The decline of total factor productivity in Gansu naturally also reflects the structural adjustments made during 1979-82, including closure of many inefficient heavy industrial plants. If these calculations could be made for a longer period, they would probably still show zero or negative total factor productivity growth for state enterprises in Gansu, indicating that the return on these massive investments has been close to zero on average. This is also true for state enterprises elsewhere in China. Similar calculations

made in the recent World Bank economic report <sup>15/</sup> show that total factor productivity in state enterprises declined during 1957-82. For recent years, the results presented in Table 1.12 are more favorable than those in the economic report, because they are based on total capital, including circulating capital, whereas the total factor productivity calculations in the economic report were based on fixed capital only, due to limited data availability for earlier years. During 1975-82, most state enterprises in China economized on physical stocks, and consequently, circulating capital expanded less rapidly than output or fixed assets, except in Gansu (Appendix 5, Table 16). However, by international standards, physical stocks are still rather high (4.9 months of gross output in Gansu, 2.6 months in Jiangsu, and 3.4 months in China in 1982, compared with about 2 months in South Korea).

1.33 Prices of many industrial goods are distorted in China and do not fully reflect the costs of production, although this probably does not affect results significantly. Prices for raw materials (e.g., crude oil, metal ores) are often below production costs, but the primary processing of these raw materials (e.g., oil refining, nonferrous metal smelting and refining) is often very profitable. For the entire economy, these price distortions cancel out. This is probably also true for broad sectors, such as industry, or industrial state enterprises. Price distortions in China are mostly due to price rigidity. For many products, prices have not been adjusted, sometimes for 20 years or more, while production costs have increased or decreased.

1.34 Another source of price distortions is insufficient allowance for the cost of capital. As a result, products of capital-intensive industries are often underpriced, particularly in sectors with low productivity growth (e.g., coal mining). However, in other capital-intensive industries, technical progress has been substantial (at least abroad), and Chinese prices are not significantly different from international prices as, for example, in the case of most nonferrous metals (with the exception of tin). It is thus not at all clear whether heavy industry goods are systematically underpriced compared to light industry goods. If this were the case, the results for total factor productivity growth in Gansu (Tables 1.11 and 1.12) would still be the same, but the rate of return on invested capital could be slightly higher than zero. (para 1.31). But it is unlikely that these price distortions change the results significantly, or even measurably.

---

<sup>15/</sup> World Bank, China: Long-Term Development Issues and Options, Johns Hopkins University Press: Baltimore, 1985, Chapter 7, Table 7.1.

## II. RURAL INDUSTRY

2.01 One of the most significant differences between Gansu and other more developed provinces in China is the extent to which nonagricultural activities have been developed in rural areas. In the more advanced coastal areas, commune and brigade enterprises (CBEs), now renamed township and village enterprises (TVEs), have developed very rapidly over the past 5-10 years while the development of rural industry and services in Gansu and other poor provinces has been slow, at least until 1982. Since 1984, the development of rural industries and services in Gansu has accelerated, and growth of employment and output are now close to the high rates that prevailed in some of the more developed coastal provinces during the past 5-10 years. However, the recent rapid growth rates of TVE employment and output are from a very low base.

2.02 If the experience of the more developed provinces and of other developing economies in East Asia and elsewhere is a guide, rural industry and service employment can be expected to account for a significant and rising share of industrial output, employment and rural cash income in Gansu. Their continued expansion can be expected as a logical part of the transformation in the rural economy arising out of current policy reform, aimed at increased production and higher rural incomes. This chapter first reviews the past and present development of rural industry (and services) in Gansu and elsewhere in China; then gives a short overview of the experience with rural nonagricultural development elsewhere in Asia; and finally discusses the prospects for development of rural industry and services in Gansu, and the policy options that could be pursued to promote rapid development of rural nonagricultural activities.

### Rural Industry Development, Past and Present

2.03 Policies towards rural industry development have changed several times in rather fundamental ways during the past 35 years. Rural industry originated in village handicraft and small workshops in traditional Chinese society. These activities declined in the mid-1950s when agricultural and other raw materials began to be procured and allocated by the state. Artisans in many of these workshops were organized into cooperatives. With the formation of people's communes and the call for communes to actively develop industries during the Great Leap Forward (1958-60), many of these cooperatives were absorbed by communes. In addition, some state enterprises were transferred to commune ownership, and new enterprises were set up with funds and labor contributed by commune members.

2.04 Disruption by the Great Leap Forward and natural disasters forced sweeping cutbacks in commune and brigade enterprises in the early 1960s. In addition to widespread technical and economic problems, severe shortages of raw materials and food forced closure of many CBEs and the recall of workers to concentrate their efforts in agriculture. CBEs began to revive in the mid-1960s. Their growth was sharply accelerated by the Cultural Revolution (1966-76), when communes and brigades were once again called upon to tap local initiative and use local resources to run enterprises that would aid the agricultural mechanization effort. Other rural enterprises promoted during the

Cultural Revolution were the "five small industries": iron and steel, fertilizer, cement, coal and hydroelectric power, and machine building. Most of these were county level, state or collective enterprises, rather than commune and brigade enterprises. However, many enterprises in the five small industries were launched with little regard for technical and economic efficiency and were not viable.

2.05 A major turning point for rural nonagricultural development came in December 1978 when the Third Plenary Session of the 11th Central Committee of the Chinese Communist Party adopted "The Decisions on Some Questions Concerning the Acceleration of Agricultural Development." Three of the decisions were aimed at (i) permitting more diversified agriculture; (ii) allowing the individual economy greater flexibility to develop in rural areas; and (iii) promoting the vigorous and systematic development of CBEs. Grossly inefficient enterprises in the five small industries were to "close down, suspend operation, merge, or shift to other work." Expansion of rural industry was to be encouraged not only to help improve agricultural production and people's livelihood but also to meet the needs of large-scale urban industry and to increase exports. Rural industries targeted for development included agroprocessing, manufacturing and repair of farm tools and spare parts, small hydro- and thermal-power stations, subcontracting for large enterprises, construction, transportation, and selected services (sewing, repair, hotels, and restaurants).

2.06 The Government took several steps to implement the new policies. A Commune and Brigade Enterprise Bureau was established in the Ministry of Agriculture to provide guidance and institutional support and to administer the funds, materials, and equipment allocated by the State Planning Commission and the State Bureau of Supplies. Local governments were directed to strengthen their institutional support for CBEs and to take a more active role in CBE development. Although most CBE development was to be financed internally from retained earnings or from reserve funds of communes and brigades, some efforts received state funds. The Agricultural Bank of China was directed to allocate a proportion of its annual agricultural loans to support CBEs.

2.07 Urban industries were directed to "radiate" production to rural areas by subcontracting to CBEs whenever possible. Urban enterprises were also urged to provide CBEs with technical advice and to transfer specialized equipment to rural areas at fixed prices. Government departments involved in industry, transportation, credit, construction and marketing were all directed to support CBE development and to help CBEs to improve their products, planning, and management. Most important, the state sector was asked not to set up "new factories to produce products which can be produced by commune- and brigade-run industries." Nationalization of CBEs was forbidden and those nationalized earlier were to be returned to the communes and brigades. To expand the marketing channels for CBEs, supply and marketing corporations were established at the county level.

2.08 Several tax concessions were also offered to qualified CBEs. CBEs directly serving agriculture or people's livelihood could apply to have specific products and services exempt from income taxes. Small iron mines, coal mines, power stations, and cement plants were exempt from industrial,

commercial, and income taxes for three years. New CBEs experiencing start-up difficulties could apply for exemption from industrial, commercial, and income taxes for two to three years.

2.09 There were attempts to consolidate and rationalize the five small industries and to encourage and give new direction to CBEs. Of the five small industries developed in the 1960s and 1970s, the local small iron and steel and machine-building industries were apparently the least efficient. Beginning in 1978, many of these were closed, merged, or forced to change their output mix. In the farm machinery industry, small local plants producing hand tractors and diesel engines were reorganized under provincial direction and switched to producing components and parts as subcontractors to large enterprises. Some of the effects of the restructuring of the five small industries can be gleaned from county level data of industrial output. For example, gross industrial output in Dingxi county in Gansu declined by 18% during the adjustment period of 1979-81, mostly due to a 70% reduction of machine building, reflecting the reorganization and closure of small-scale farming machinery plants.<sup>1/</sup>

2.10 Areas adjacent to major industrial centers and those closer to market opportunities have generally responded to the reforms more easily. In the coastal provinces, many CBEs have become subcontractors to larger enterprises. A large number of processing, assembly and compensation trade contracts have been signed between CBEs and state enterprises and even between CBEs and foreign firms. In less developed areas, CBEs have generally turned to agricultural processing, manufacture of light industrial goods for local consumption and the production of building materials, but growth has been less rapid than in coastal areas. In Jiangsu, for example, employment in CBEs increased by 9% p.a. during 1979-82, and output by 22% p.a., while in Gansu CBE employment actually declined by 3% p.a. during this period, and output increased by only 1-2% p.a.

2.11 While consolidation and adjustment reduced the number of CBEs nationwide from 1.5 million in 1979 to 1.3 million in 1983, the reduction in Gansu was far more pronounced: the number of CBEs declined by nearly 40% from 20,000 in 1979 to 12,200 in 1983. Elsewhere, virtually all reduction was in agricultural enterprises, with household sideline activities replacing agricultural CBEs. In Gansu, the reduction of CBEs affected both agricultural and nonagricultural enterprises, and among the latter mostly industrial enterprises.

2.12 A dramatic change in the prospects and performance of rural industries in poor and remote areas occurred during 1984 when the State Council adopted new policies permitting rural households to engage in small-scale private industrial and commercial activities including road transport. The policy reforms also provided CBEs and specialized households with greater access to railway transport. Local governments were urged to support small private undertakings with credits, tax concessions, technical assistance and

---

<sup>1/</sup> As well as the reorganization of dispersed defense industries.

favorable prices to ease start-up difficulties. The Government also permitted producers to negotiate prices (within a range stipulated by state ordinances) of goods sold by private traders.

2.13 As a result of the reforms in 1984, development of rural industries in Gansu accelerated dramatically in 1984 and 1985, substantially exceeding the growth rates in more developed areas in China, although this growth started from a relatively low level (Table 2.1). During 1984 and 1985 employment creation in collectively owned township and village enterprises alone increased to 90,000 p.a. compared to only 20,000 p.a. in 1982 and 1983, and virtual stagnation in the preceding five years. Recently, private nonagricultural employment creation (i.e., by specialized households) was also very rapid and possibly of the same order of magnitude as nonagricultural employment creation by TVEs. Unfortunately, statistics for recent years are not available. While TVE employment generation was initially concentrated in construction and since 1985 in industry (Appendix 5, Table 20) private nonagricultural employment generation was probably more concentrated in services, particularly transport and commerce.

Table 2.1: EMPLOYMENT AND OUTPUT GROWTH OF COMMUNE AND BRIGADE ENTERPRISES (CBEs)

	Employment growth (% p.a.)				Gross output growth (% p.a.)			
	1979-82	1983	1984	1985	1979-82	1983	1984	1985
<u>All CBEs</u>								
Gansu	-3.5	8.1	37.4	25.2	1.5	15.3	72.8	64.5
Jiangsu	8.6	6.9	..	..	21.7	25.3	..	..
China	2.3	3.9	19.0	..	16.3	20.3	36.6	38.0
<u>Industrial CBEs</u>								
Gansu	..	2.6	20.6	30.9	..	10.2	32.0	57.8
Jiangsu	..	7.6	..	..	..	25.7	..	..
China	4.5	4.6	17.6	..	15.7	19.0	38.9	..

Source: Provincial data; Agricultural Yearbook of China.

2.14 Table 2.1 also suggests that during 1979-84, township and village enterprises have become more productive and profitable. Gross output per employee has grown by about 7-8% p.a. in Gansu and 13-14% in Jiangsu. Factors that have contributed to this improvement include: closure of the most inefficient CBEs, the shift in production from low-price to higher-price goods with larger profit margins, and the introduction of the "responsibility system," with a wage system that ties rewards more closely to productivity.

The differences between Gansu and Jiangsu are partly due to more rapidly increasing commercial exchanges in Jiangsu (probably entailing a more rapid lowering of net-to-gross output ratios) but nevertheless, productivity appears to have increased more rapidly in the coastal areas during the early years of reform (1979-83). In 1984 and 1985, gross output per employee appears to have increased more rapidly in Gansu than elsewhere in China, as many township enterprises increased output very rapidly and shifted to higher value products.

2.15 One reason for the slower development of rural industries in areas with a poor agricultural resource base, like Gansu, is the low level of agricultural incomes and the limited diversification of agriculture that constrain possibilities for rural agroprocessing industries. Development of local industries and services is also hindered by limited or very expensive transport. Food processing accounts for only 3% of the total output of rural industrial enterprises in Jiangsu, while "footloose" industries that depend mostly on cheap labor account for the dominant part of rural industry in Jiangsu (machinery accounts for 27%, textiles and leather products account for 26%). It is difficult to ascertain precisely what share of the output of these footloose industries is for local consumption.

2.16 The gradual implementation of reforms that makes China a partially reformed economy -- part centrally planned, part market economy -- is probably the main reason for the slower development of rural industries in remote areas like Gansu. Rural industries have been the most dynamic sector of the emerging market economy in China. However, an efficiently functioning market economy requires the existence of and access to a service infrastructure, including transport, commerce and other services. The physical facilities necessary for rural industry development do exist but serve primarily the planned state sector; access to CBEs is limited. Under these conditions, rural industries in remote areas are at a disadvantage. Rural enterprises near urban centers or special economic zones have more easily overcome their limited access to rail transport and other services because of their physical proximity to urban markets. Rural enterprises in coastal areas, especially those close to special economic zones and open cities, have had more business opportunities, due to rapid economic growth in their vicinity.

2.17 Partial reforms have also led to distorted prices and incentives that have at times given the wrong signals, leading to "blind" expansion of rural industries without sufficient attention to economic effectiveness, market size, and availability of resources. Limited availability and mobility of competent managers and technical personnel have also contributed to poor results. In response to these problems, the Government has moved to tighten its control of CBE development and revise some of the incentives introduced to CBEs only a few years earlier. The primary control used by the Government to regulate CBE development is its power to approve or refuse applications to establish CBEs.

#### Rural Nonagricultural Development -- The Asian Experience 2/

2.18 Interest in rural nonagricultural development has been growing among policymakers and development economists. One reason for this attention is

that economic development based on large-scale, urban-concentrated, and capital-intensive industries has not had the desired impact on employment and equity. A related reason is the realization that in many developing countries in Asia, there are severe limitations on the capacity of the agricultural sector to absorb the existing supply of rural labor and to satisfy even minimum subsistence requirements of a large proportion of the rural population. Increasingly, policymakers are realizing that their original hope for the "Green Revolution" (that is, biological-chemical innovations) to solve both production and employment problems in rural areas (as it did in rural Japan) is no longer tenable. Given agriculture's limited capacity to absorb labor, rural nonfarm activity assumes increased importance as an alternative or supplementary source of rural employment and income. Another reason for the current interest is the realization that in many parts of the world, rural nonfarm activities are surprisingly important and dynamic. Given their importance and their apparent responsiveness to economic opportunities, rural nonfarm activities merit special attention in the design of rural -- and also of urban -- development strategies.

2.19 Employment and income from rural nonagricultural activities. Rural nonfarm activities are an important component of the rural economy in other Asian countries. In nearly all the areas listed, one fifth or more of the rural labor force is engaged primarily in nonagricultural activities. If the definition of "rural" is broadened to include market towns (as it does in China), the shares of rural nonagricultural employment are much larger, ranging between 25% and 45%. Table 2.2 does not include workers (mostly members of farm households) who participate in rural nonagricultural activities as a secondary occupation on a part-time or seasonal basis. This underestimation may be substantial. Available evidence suggests that 10-20% of the rural male labor force participate in nonfarm work as a secondary occupation. Because of the seasonal nature of agricultural activity, part-time nonfarm work varies significantly throughout the year. The proportion of Gansu's rural labor force that is engaged primarily in nonagricultural activities was 3-5% in 1982, significantly below the 20-40% found in most other parts of Asia.

---

2/ For a more detailed treatment see S. Ho, The Asian Experience in Rural Nonagricultural Development and Its Relevance for China, World Bank Staff Working Paper No. 757, 1985.

**Table 2.2: PERCENTAGE OF RURAL LABOR FORCE WITH PRIMARY EMPLOYMENT IN NONFARM ACTIVITIES**

Country or area	Year	Percentage in rural nonfarm activities
<u>Rural</u>		
India	1966	20
South Korea	1970	19
West Malaysia	1970	32
Philippines	1970	28
<u>Rural, Including Rural Towns</u>		
India	1966	24
South Korea	1970	25
West Malaysia	1970	37
Philippines	1970	40
Gansu	1982	5 /a
Jiangsu	1982	25 /a
China	1982	12

/a Estimated.

Source: Ho, op. cit., Table 1; 1982 Population Census.

2.20 Surveys of farm households can tell us more precisely the degree to which farm households are involved in nonagricultural work, by measuring either the employment time allocated to nonfarm activities or the income earned from nonfarm work. Farm household surveys usually divide farm household income into on-farm income and off-farm income. On-farm income is defined as the net earnings from crop and livestock production on a family's own farm. Off-farm income refers to income received from sources other than a family's own farm, and is composed of off-farm agricultural income (earnings from work on another farm, such as earnings of hired-out family labor, draft animals, and agricultural assets such as machinery) and nonfarm income.

2.21 In other parts of Asia, nonfarm income makes up between 25% and 70% of total farm household income. Except for Korea, where transfer income, mostly remittances from farm household members working in urban areas, accounted for about 20% of total farm household income in 1981, transfer income appears to be relatively unimportant. Once transfer income is taken into account, the relative importance of gainful earnings from nonagricultural activities for farm households in Asia range from a low of 13% to a high of over 70%. Farm households in Japan have exceptionally high shares of income from nonagricultural sources, while in most areas, this share ranges from 20 to 30%.

**Table 2.3: SHARES OF OFF-FARM INCOME AND NONFARM INCOME IN TOTAL FARM HOUSEHOLD INCOME, ASIA**

Country	Year	Percentage of off-farm income in total farm household income
Japan	1978	73
Thailand	1978	43
South Korea /a	1981	33

/a Nonfarm income.

Source: Ho, op cit, Table 2, Provincial data; Statistical Yearbook of China.

2.22 A few aggregate time series data available suggest that the percentage of the rural labor force engaged in gainful nonagricultural work has increased over time. Cross-sectional evidence also suggests a positive relationship between the share of the rural labor force engaged in nonagricultural work and the level of per capita income. How farm households' involvement in nonagricultural activities has changed over several decades can be documented only for parts of Asia. In many countries, farm households have become increasingly involved in nonagricultural activities. For example, in Japan, off-farm income as a share of total farm household income increased from 12% in 1921 to nearly 80% in 1980. Indeed, in Japan, farming has become a part-time activity for an increasing number of farm households, and this is also true for some other rapidly developing economies in East Asia. However, in South Korea, even though economic development has also been very rapid, farm households have not significantly increased their involvement in nonagricultural activities. In fact, since the early 1960s, the share of gainful earnings from nonagricultural activities has remained nearly constant in South Korea at 12-13%. This raises two questions: why farm households in some countries, such as South Korea, have not become as involved in nonagricultural activities as elsewhere; and more generally, what determines the level of rural nonagricultural activities.

2.23 Types of rural nonagricultural activities. Agriculture and rural nonagricultural activities are intimately related. Agriculture is related to rural nonagricultural activities directly through its forward and backward production linkages, and indirectly through the consumption demands of farm households. The weight of empirical evidence suggests that agriculture's forward linkages are quite important. Because agriculture is a spatially dispersed activity, because crops are generally bulky and heavy, because some crops are highly perishable, and because there is usually considerable reduction in weight and volume during processing, transport costs can be greatly reduced if agricultural processing is done close to the source of supply. For this reason, most agricultural processing activities are dispersed in rural areas. Agriculture also provides strong forward linkages to rural transport and rural marketing activities.

2.24 The available evidence suggests that backward linkages may be important in some instances. In many countries, traditional tools and farm equipment are usually made by rural craftsmen. Some modern farm implements (pumps and motors) are also produced in rural towns. Many modern agricultural inputs, such as chemical fertilizers and tractors, are either imported or produced by urban-based industries, but even for these, distribution and servicing may create rural nonagricultural employment opportunities.

2.25 Perhaps the most important linkage between agriculture and rural nonagricultural activities is consumer demand. In developing countries, farm households spend about 30-40% of their incomes on nonfood items and around 10-15% on foods requiring substantial processing. It is not fully known to what extent the rural demand for nonfood goods and services results in rural nonagricultural activities, but there are good reasons to believe that this demand contributes significantly to rural nonagricultural activities. For many nonfood goods, the transport and marketing costs between urban and rural areas are high (though falling) in many developing countries, so that local manufacturing on a small scale may be more efficient than large-scale production in urban centers. Finally, service activities (transport, trade, construction, and personal services) are, by their nature, linked to local markets.

2.26 Rural nonagricultural activities also exist to serve external (both foreign and domestic) markets. In some economies, a substantial proportion of the commodities produced in rural areas is for urban and international markets; for example handicrafts, such as carpets in Gansu. There are also production linkages between urban industries and rural nonagricultural activities. The most important linkage is the subcontracting arrangement between manufacturers and individual households and cottage enterprises in both rural and urban areas. Many of these activities are footloose, that is they depend on lower wages (and real estate prices or rents) than in urban areas. Because farming usually generates a reasonable average return to land and labor, but low marginal returns to labor, rural households often prefer to stay in rural areas rather than to migrate to cities, with one family member tending the farm and others working in rural industries and services, at a lower wage than they would be willing to accept in urban areas. This wage advantage can often compensate for higher transport costs and other disadvantages of a rural location.

2.27 The general composition of rural nonagricultural employment is about one third in manufacturing and the remaining two thirds in services of all types. Within manufacturing, most rural employment is accounted for by four broad groups of activities: food processing; textiles and wearing apparel; wood, including sawmilling, furnituremaking, and general carpentry; and metal working, including blacksmithing, welding, fabrication and assembly work for buildings, machines, tools and equipment. All four categories appear to have retained their importance in countries which have reached a variety of levels of development. In construction, half of the employment is typically in the construction of dwellings and farm buildings; the remainder is largely in roads and civil works. In commerce, retail trade accounts for three quarters of total employment; the other quarter is in trade and financial services.

2.28 Some of these rural nonagricultural activities involve more than just traditional skills and rudimentary cottage manufacturing. Factories, shops and offices (such as government offices) located near villages offer year-round, urban-type employment on a regular basis. In Japan and the Indian Punjab, an increasing number of industrial enterprises has appeared in rural areas alongside the main railroads and highways, and apparently a significant proportion of their work force comes from rural households. These factories can be identified as rural because they provide employment and income to rural households, but in operation they are urban and more capital-intensive than other small-scale rural industrial enterprises. In many cases, these modern rural enterprises employ similar technology (and capital intensity) to light industry in urban areas. Sometimes farm household members commute to jobs in urban areas. The very rapid growth in farm household income in Japan can be attributed largely to the increased involvement of farm households in these types of employment.

2.29 The extent of rural involvement in nonagricultural activities elsewhere is determined by a combination of "push" and "pull" factors. The most important push factor is the limited capacity of agriculture to absorb labor with a given amount of arable land. The pull factors are related to the availability of attractive, nonagricultural job opportunities. The relative importance of these two sets of factors depends on the stage of economic development, the intensity of population pressure, and government policies, including attitudes towards rural-urban migration. In the early stage of development, the rural sector is essentially a self-contained, closed economy. Once the economy progresses beyond the subsistence stage, the demand or pull factors become more important in determining the extent of rural involvement in nonagricultural activities. Because of the many direct and indirect linkages between agriculture and rural nonagriculture activities (discussed in the previous section), the development of nonagriculture activities is closely related to agricultural development, because agricultural growth and rising farm incomes create a favorable demand environment for development of rural nonagricultural activities, particularly if urban industry has not yet developed very far, as was the case during the early stages of rural industrialization in other parts of Asia. Agricultural growth and rising farm household income are likely to generate considerable demand for nonagricultural goods and services in rural areas.

2.30 Despite its importance, agricultural development itself does not explain why rural involvement in nonagricultural activities continues to rise in some parts of Asia. Indeed, one would expect rural nonagricultural activities to be adversely affected by continued economic development and increased domestic and international trade. New products, introduced to the countryside by urban-rural trade, frequently replace traditional products produced in rural areas. In time and with continued development, the transport and the marketing costs of many goods declined to the point where small local manufacturers no longer have a cost advantage in competing with imports and the larger urban-based industries. When this occurs, some traditional manufacturing activities in rural areas decline and others disappear. Thus, as an economy becomes more developed and industrialized, rural nonagricultural development will continue only if rural nonagricultural activities diversify, by becoming less dependent on agriculture-related employment and more dependent on urban-type jobs.

2.31 Proximity to urban areas is an important determinant of both the extent and quality of rural involvement in nonagricultural activities. Although a remote location does not significantly reduce the share of off-farm income, it does lower the absolute level of off-farm income. In other words, the quality of rural involvement in off-farm activities appears to be higher in villages closer to urban areas. In remote villages in Japan, for example, 64-80% of family heads involved in off-farm activities were either self-employed or employed as unskilled laborers, but in villages close to urban areas, 53-73% held jobs as professional, clerical, or skilled workers and only 33-47% were self-employed or employed in unskilled jobs.

2.32 In South Korea the spatial concentration of urbanization and industrialization appears to be a major reason that rural involvement in nonagricultural activities has remained essentially unchanged since the early 1960s, even though the pace of agricultural development and industrialization has been rapid. In contrast, decentralization of industry and development of roads and public transportation explain the extremely high involvement of farm households in nonagricultural activities in Japan and some other rapidly developing economies in East Asia. Footloose or urban-type employment accounts in some cases for one-half of total rural nonagricultural employment in industrialized and some rapidly developing economies alike.

2.33 Another factor often cited as a determinant of rural involvement in off-farm employment is education, since education not only improves an individual's qualifications for nonagricultural jobs, but also increases a person's ability to allocate worktime efficiently among income-producing activities. Studies of the impact of education on off-farm employment in developed countries have shown that farm household members who participate in off-farm work are generally those with higher education. The studies also reveal that farmers with more education tend to reallocate their labor from farming to off-farm employment faster than those with less education.

#### Prospects for Rural Industry and Services in Gansu

2.34 In view of the difficult agricultural conditions in Gansu (see Annex A), rural prosperity cannot be achieved on the basis of agriculture alone. Nor is it likely that a continued emphasis on heavy industry development will create productive jobs for more than a small and privileged urban minority. If incomes of the large majority of Gansu's rural population are to increase in line with incomes in the more advanced coastal areas, a substantial share of its rural population will need to move from less productive agricultural activities to more productive industrial and service jobs. This could be achieved through either substantial rural-urban migration or the creation of nonagricultural employment in rural areas. Most likely some combination of these two options would be most effective in raising productivity and income standards of Gansu's poor rural population. The benefits of permitting more rural-urban mobility within and outside the province is discussed elsewhere (Main Report, Chapter I). This section discusses only the second of these options -- creating nonagricultural jobs in rural areas in Gansu. Although this Annex deals mainly with the industrial sector, it needs

to be recognized that industrial and service sector activities are closely linked. One cannot develop efficiently without the other.

2.35 International experience, summarized above, suggests that the transition from a low-income to a middle-income country is accompanied by a shift in the sectoral composition of employment away from agriculture toward nonagricultural activities, particularly services. This shift is usually accompanied by significant population movements from rural areas to cities so that a strong relationship exists between economic development and urbanization. For various reasons, however, Chinese leaders are reluctant to permit the same degree of urbanization to occur in China as it develops from a low-income to a middle-income country. While migration to small market towns is now permitted, migration to larger cities or from one province to another is still quite restricted. This places areas with poor agricultural resource endowment, such as Gansu, at a distinct disadvantage. Rural nonagricultural development has thus become a central component of China's development strategy. This objective is expressed by the government's slogan: "leave the land but not the countryside, enter the factory but not the city." Township and village enterprises will thus play a key role in development of rural economies.

2.36 International experience suggests that rural nonagricultural development is closely related to the pace of agricultural development, the pattern of industrialization, the extent of internal and external trade, and the spatial pattern of small town and urban development. Because of this interdependence, projecting rural nonagricultural development is fraught with difficulties. Activities that serve local needs or produce nontraded goods, such as construction, commerce, services, and some local industries such as agro-processing, are obvious candidates for dispersed location, and are therefore likely to play an important role in rural nonagricultural development. With the government now encouraging commodity production and the formation of specialized households in rural areas the demand for these nontraded goods is bound to rise rapidly. Comprehensive statistics of rural employment are not available, but township and village enterprise employment provides a reasonable proxy as it accounts for about three quarters of rural nonagricultural employment. By international standards, rural nonagricultural employment is very low in China, and even more so in Gansu, accounting for only about 5% of the rural labor force, compared with 20-40% in other Asian developing countries, including some similarly low income countries or areas (Table 2.2).

2.37 Most striking is the near absence of any service sector employment in rural Gansu, if construction is excluded.<sup>3/</sup> In other countries, services account for one-third to three-quarters of total rural nonagricultural employment. The other outstanding feature is the large share of construction employment. This is due not to a large rural construction sector, but rather to the underdevelopment of manufacturing and services. Industrial TVE employment (mining, manufacturing and electric power) accounts for only 1-1.5% of

---

<sup>3/</sup> Elsewhere, construction is usually regarded as an industrial sector, together with mining, manufacturing, and electric power, gas and water.

the rural labor force, compared with about 15% in Jiangsu, still low by the standards of other developing countries in Asia (15-30%).

Table 2.4: COMPOSITION OF RURAL OFF-FARM EMPLOYMENT

	Township and Village Enterprise Employment			Total Rural Off-farm Employment	
	Gansu	Jiangsu	China	China 1982	Asian LDCs 1970
Agriculture	8	2	10	-	-
Industry	44	80	67	45	15-39
Transport	4	4	3	5	5-10
Construction	41	12	15	9	4-14
Other	3	2	5	41	37-76
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
(% of rural labor force)	3	19	9	12	20-40

Source: Agricultural Yearbook; 1982 Population Census; World Bank.

2.38 The pace of rural nonagricultural development will also depend on the ability of rural areas to attract manufacturing industries. The two most important factors influencing the location of manufacturing industries are transport cost and technology. Weight-reducing, resource-using production processes (for instance, metallurgy, wood products, and agricultural processing) are usually dispersed throughout the economy so as to be near the resources. Industries that produce bulky or heavy products that are costly to transport (for example, building materials) are also distributed in a decentralized manner. But because of scale economies not all of these industries are necessarily suitable for small and medium-size enterprises. Manufacturing industries that produce standardized products using relatively simple technology are also suitable for dispersion to small and medium-size towns. Such industries tend to be footloose and thus sensitive to the attraction of rural locations where land and labor are cheaper.

2.39 Many of the characteristics just described can be found in the industries identified by Chinese policymakers as having good development potential for TVEs. Agricultural processing (foodstuffs and processed feeds), building materials (tile and brick), energy (small coal mines and small hydro-power stations), and processing or producing components and parts for large economic activities will also create new nonagricultural employment opportunities, particularly in services. In Gansu, industries that produce bulky or heavy products that are costly to transport (e.g., building materials) still predominate, while footloose industries (e.g., machinery parts, textiles) are underdeveloped (Table 2.5).

Table 2.5: COMPOSITION OF INDUSTRIAL TOWNSHIP AND VILLAGE  
ENTERPRISE OUTPUT  
(% of total)

	Gansu 1984	Jiangsu 1982	China 1982
Metallurgy	4	3	2
Power	1	-	1
Coal	12	-	5
Petroleum	-	-	-
Chemicals	12	10	8
Machinery	14	27	25
Building materials	44	19	21
Wood products	2	1	3
Food	6	3	8
Textiles, leather	3	26	17
Paper	2	3	4
Other	-	8	6
<u>Total</u>	<u>100</u>	<u>100</u>	<u>100</u>

Source: Provincial data; Ho, op cit, Table 18.

2.40 Agroprocessing. The level of agricultural development and the degree of commercialization is much lower in Gansu than in the coastal provinces, but in recent years there has been considerable expansion in agricultural processing which is expected to continue. The growth of marketable surpluses of wheat in certain parts of the province will stimulate the development of flour milling. A rapid expansion of rape seed, linseed and other vegetable oil processing for human consumption and other uses (paints and varnishes) can also be expected. And there is considerable potential for the expansion of fruit and vegetable processing, not only for the provincial market but also for shipment to other areas, especially in the case of temperate fruits. However, economies of scale and market organization are likely to become more important and need to be taken into consideration. There is scope for expanding animal feed production, based on surplus grain and byproducts, particularly in the Hexi region.<sup>4/</sup> There is also considerable potential for development of industries providing inputs to agroprocessing, especially packaging materials (cartons, glass containers and so on).

2.41 Coal and other mineral mining is also expected to increase rapidly. There are a number of small coal deposits in the province that can

<sup>4/</sup> For a more detailed review of issues and prospects in agroprocessing industries, see Appendix 1.

be mined at relatively low cost to relieve the energy shortages which have constrained development of rural industries in the past. There is also substantial scope for small- and medium-scale mining and preprocessing of nonferrous metal ores and other minerals.

2.42 Building Materials. Given the rapidly expanding demand for housing and other construction, the prospects for building materials are good, not only for brick and tile but also for metal- and wood-working. For some building materials though, economies of scale are important (for example, in cement) and call for consolidation of the present dispersed pattern of production. There is also some scope for producing building materials such as marble products or ceramics for markets elsewhere in China. Overall, the share of building materials in total rural industry output is expected to decline from the present high levels.

2.43 Other Industries. Perhaps the most important category of industries to develop are footloose industries which produce standard products of relatively simple technology, for which the availability of low cost labor and land is crucial. This includes a wide range of industries producing simple consumer goods, or parts and components for machinery and electrical goods. For some of these activities, economies of scale are important, but urban location is not essential. Industry could be developed in market towns, for example, to produce consumer goods such as textiles, clothing, and leather products. For small-scale production of machinery components, close linkages need to be developed between small and larger enterprises, although short physical distances are not always necessary. Much more important is the existence of and access to transport and communication facilities. But most important is a production cost advantage based mainly on low labor costs.

2.44 Services. This leads immediately to the importance of an efficient commercial and service sector for the success of rural industries. Indeed, as the experience of other countries shows, service sector employment usually accounts for about onehalf of rural nonagricultural employment. Development of rural industries and services need to go hand-in-hand.

2.45 On the basis of the international experience presented above one can get some idea of the likely creation of rural nonagricultural employment in Gansu. If rural towns in other Asian developing countries are included, rural nonagricultural employment in the early 1970s was 25-40% of the rural labor force (Table 2.2) and this includes even some similarly poor countries or areas. In Jiangsu, rural nonagricultural employment was about 25% of the rural labor force. If rural per capita income in Gansu were to grow at the same rate as projected<sup>5/</sup> for other areas in China (5.5% p.a.), Gansu's rural per capita income in 2000 would be 25% higher than the present rural per capita income in Jiangsu. It is therefore reasonable to assume that rural nonagricultural employment could increase to 20-30% of the rural labor force by the year 2000.

---

<sup>5/</sup> World Bank, China: Long-Term Development Issues and Options, op cit, Chapter 5.

2.46 Assuming no rural-urban and interprovincial migration, the rural labor force is likely to rise from 6.5 million in 1982 to 9.5 million in 2000. Assuming no net migration, agricultural productivity increases are likely to be small, and rural nonagricultural development is likely to be limited, rising perhaps to about 20% of the total labor force by 2000. With some rural-urban and interprovincial migration, agriculture productivity and incomes are likely to rise faster as population pressure on the limited land resources of Gansu is reduced, and the share of nonagricultural employment could reach 30% of the rural labor force. These two scenarios would imply rather high rates of growth of rural nonfarm employment of 11% and 12% p.a. respectively, far above the past record, but well within recent performance (Table 2.1). An average of 100,000 rural nonagricultural jobs would have to be created per year, of which 70,000 would probably be in township and village enterprises and the remainder in specialized households. In the past two years, about 90,000 jobs were created per year in township and village enterprises alone -- quite in line with projections. However, it remains to be seen whether the very recent rapid growth can be sustained by continued reforms.

2.47 Since investment costs per job in rural industries and services are low -- about one tenth of the average cost in state enterprises -- the investment requirements for such a rapid expansion would be a modest Y 100 million per year for TVEs or only about 10% of total investment in industry.<sup>6/</sup> However, compared to recent TVE investments in Gansu (Y 10-20 million in 1983 and 1984) this would require a quantum leap. In 1983, TVE investment represented only 1% of total industrial investment in Gansu, compared with about 9% in China and 29% in Jiangsu province. Provisional data for 1985 indicate that such a quantum leap is already under way. During the first 10 months of 1985, loans by the Agricultural Bank of China to township and village enterprises in Gansu increased by Y 60 million, after very slow growth during the preceding years (Annex E, Table 6.3). In addition to TVE investment, the investment needs of larger rural enterprises using modern technology in, for example, textiles and leather working, could add another Y 100-200 million to investment requirements in rural Gansu, raising the share in total industrial investment to about 20-25%. For 85% of the population this does not appear to be too high. Thus, resource constraints as such cannot be a major obstacle to development of rural industries and services. But rural industry development will depend on the broader policy environment, including absence of entry barriers, access to a commercial and transport infrastructure, access to markets in other provinces or abroad, freedom to contract and set prices, promotion of technology transfer, and so on.

---

<sup>6/</sup> Assuming average costs per job of Y 1,400. At present, fixed assets per job in TVEs are about Y 1,400 in Gansu and are not higher in more advanced areas such as Jiangsu.

Development Issues<sup>7/</sup>

2.48 The rapid growth of rural industries in Gansu in the past two years demonstrates the unrealized potential for raw material processing on a small scale, and the absorptive capacity of markets for a wide range of food products, building materials and even for products of "footloose" industries that depend mostly on the availability of a cheap but diligent and reasonably well-trained labor force. The recent rapid development of rural industries and services stemmed primarily from the policy changes introduced in early 1984, including permission for private households to provide road and water transport services, access to rail transport for TVEs and special households, relaxation of entry restrictions and streamlining of licensing procedures for TVEs and other rural enterprises. The initiative and commitment of the rural population to create productive employment for themselves through rural industry is an important characteristic of this development, as is the capacity in the rural community to generate substantial investment capital.

2.49 The value of rural industries to an economic structure lies in their relatively low fixed capital requirements, creation of employment at a relatively low investment cost per job, flexibility, geographic and ownership dispersal, suitability to small pockets of raw material supply and small markets, and ability to perform component tasks of more sophisticated processes on a subcontract basis. There are, however, several problems inherent to widespread small-scale production: many small units are not able to adopt current technology and therefore suffer disadvantages both in unit costs of production and in quality control; small units require more complex distribution systems for inputs and finished products that are traded outside the immediate area of the enterprise; and small units usually cannot afford to employ on a full-time basis the range of management and technical expertise that they occasionally require and must therefore have recourse to a well-developed system of support and technical assistance.

2.50 There are several issues that require attention by provincial authorities if rural enterprises are to significantly contribute to the economy of the province. International experience suggests that rural industries will have to deal with a number of developments and trends over the next five to ten years, including:

- (a) consumers will have more income to spend on a wide range of products and will increasingly discriminate among products on the basis of quality differences;
- (b) improved distribution systems and larger markets will attract competing products from outside the province;
- (c) wide variation in prices and increasing competition will force enterprises to be more conscious of production costs; and

---

<sup>7/</sup> Some of the broader policy issues are discussed in Chapter IV.

- (d) a larger share of rural industry products will be purchased as inputs by larger enterprises who demand rigorous quality control.

2.51 Appropriate size of enterprises. Rural industries presently engage in a very wide range of processes, many of which could be performed more efficiently on a larger scale. The initiative to stimulate investment at all levels of administration is one of the factors which has contributed to the rapid expansion of industrial activity in recent years. But there appear to be many cases in which the size of an enterprise has been determined primarily by ownership structure and the availability of capital, rather than by assessment of how the alternative processes (and, consequently, sizes) compare with respect to raw material supply, production costs, and market conditions. This situation has been exacerbated by rapid increases in raw material supply and markets which cannot be fully served by enterprises that were adequate even three to five years ago. In order to prevent financial failure because of the displacement of small enterprises from the market, authorities should examine the major activities of rural industry to determine those which are likely to continue to be competitive in the medium term, and those in which larger enterprises should be established, perhaps as joint ventures of several townships. The banks and the provincial Investment and Trust Company could play a leading role in the creation of these large-scale collective enterprises.

2.52 It is unlikely that any type of activity should be categorically denied to small enterprises; local conditions vary too much within the province for such an approach. For example, in cardboard manufacturing, liner-board production has very limited potential on a small scale, whereas the production of corrugating medium and the lamination and forming of carton stock could continue to expand significantly through small enterprises without serious economic inefficiency. In fruit and vegetable canning, it is likely that different local conditions with respect to both raw material for containers and horticultural activity will lead to the use of glass jars on a small scale and cans in larger enterprises. The mining of coal and other minerals could benefit overall from additional capital investment, but the scale of operation will be determined on the basis of the size and distribution of deposits. Small-scale mining will continue to account for a substantial share of total rural industry production.

2.53 A sector by sector examination should be conducted of the alternative technologies to identify the corresponding raw material and market requirements, product characteristics and capital and skilled labor requirements. The product of this exercise would be general guidelines on activities suited to different sizes of enterprises. The critical analysis, however, would still have to be done as part of the feasibility work on individual proposals, where the unique circumstances of each investment would be evaluated.

2.54 Quality control. Products being produced in rural industries are generally inferior in quality to those produced elsewhere with the same basic technology. This will lead to more rapid displacement of such products from the market as other suppliers begin to offer superior goods, and will prevent access to some subcontracting and component markets. The Bureau of Rural

Industries (BRI) is ideally suited both in terms of its mandate and its organization to initiate a program to promote quality improvement. Such an effort could be one of the most cost-effective measures to ensure the best long-term contribution of rural industries to the provincial economy. The three aspects to be included in a quality improvement program should be the quality of the product itself, the technical efficiency of the process, and the cost of processing, particularly with respect to energy and labor.

2.55 Once again, the best approach would be a centralized technical review by subsector to identify appropriate measures to improve and maintain quality, and to prepare a set of guidelines, perhaps in manual form, which could be used by BRI field staff and given to enterprise managers. Such material could also serve as the basis of specialized short courses to be given at the new Rural Industries Training Center in Wuwei -- or in selected locations around the province. The major elements would probably include: ancillary equipment to improve material preparation; changes in the material and location of pipes, ducts and storage tanks; process control, including improved instrumentation; changes in shop layout to improve labor efficiency and, in the case of food processing, to reduce accidental adulteration; and, also for food processing, better handling techniques to improve hygiene.

2.56 Product design. Consumers are very particular about the design of certain durable goods. Furthermore, preferences change over time. Carpets are an important example of this phenomenon. As a source of handwoven woolen carpets, Gansu has a comparative advantage over many other suppliers in China as well as other traditional suppliers in Asia. It has the wool, the skilled weavers, and relatively low labor costs, but marketing of present production appears to be a problem. The cause could be the outmoded styles and colors of the carpets being produced. In contrast, small garmentmakers have responded quickly to changing styles in apparel and they are limited only by the types of material available in their exploitation of the rapidly expanding market. In other cases, for example food products, convenience and appearance are important factors in purchasing decisions, and the size of portions and the quality of packaging are important production issues.

2.57 In order to respond to consumer preference, processing industries must be able to obtain current information on market conditions and they must have access to the materials and technology to respond to those conditions. While large producers can and should have direct access to their markets, small-scale producers in China usually sell to large markets through a series of intermediaries. While this permits efficiency in the distribution system, it has the adverse effect of delaying or preventing market feedback to the producers. International experience shows that direct contact between producers and buyers is one of the most important sources of technology transfer. Liberalizing marketing arrangements and reducing the share of production that is sold through public sector agencies is therefore highly desirable, even for export production such as carpets. For many small producers and for those serving distant markets, there will remain an important information role to be played by support agencies, including foreign trade companies, wholesale distributors and the market intelligence unit of the Bureau of Rural Industries. The Technical and Education Units of the Bureau could also assist producers in identifying sources of appropriate inputs and adopting the technology to enable them to respond to changing markets.

2.58 Quality standards in raw material supply. Technical efficiency and quality of finished product depend on consistent quality of raw material supply. In many cases, technical assistance to raw material producers, and incentives through price differentials can induce the delivery of products most suited for good quality processing. Examples of raw materials in which immediate improvements could be realized include: sugar beets -- sucrose content and cleanliness; fruit and vegetables -- size, degree of ripeness and blemishes; animal feeds--uniformity and nutrient information for ingredients; wool -- dirt and degree of matting; coal -- particle size and foreign material; vegetable oils -- foreign material and oil content. Also in the case of agricultural products, processing characteristics are often related to variety, and quality among varieties may differ between fresh and processed forms. This is the case, for example, with many fruits and vegetables, and there should an ongoing program of varietal trials and seed multiplication related to processing needs. Similar trials and a breeding program will eventually become an important part of the livestock industry as producers look not only for feed conversion efficiency but also for the strains which produce the highest proportion of high-value meat cuts.

2.59 Credit and financial assistance. With growing dependence on open markets for raw materials and product offtake and the resulting variation in prices, commercial risk has become a key factor in the viability of rural enterprises. Changing technology and enterprise management are also important factors. These developments increase the need for flexibility in individual investment appraisals and more direct relationships between sponsors and their technical and financial supporters. These developments call for a more active role in appraisal by the Agricultural Bank of China, with appropriate changes in their staff and procedures. The Gansu Investment and Trust Company (GITC) could also play an increasingly important role in promoting rural and light industries. Continued technical support from the Bureau of Rural Industries during the preparation of proposals would be called for. The role of the provincial Planning and Economic Commissions should also change from a controlling and authorizing role to a policy and promotional role, with investment and financing decisions being taken directly by enterprises and the emerging independent financial institutions (ABC, ICBC, GITC).

2.60 There is a need for substantial increases in the credit resources to support the transformation and expansion of rural industries (para. 2.49). However, the potential economic benefits of accelerated rural industry development justify an expanded share of budgetary and credit support. The experience of other countries shows that subsidized credit is not a prerequisite for rapid and efficient rural industry development and in fact often leads to overinvestment and diversion of funds to purposes other than those intended. The maturity of loans is important, and the current standard maturity of three years is often too short for many townships and village enterprise projects. This can lead to cash-flow problems for TVEs which the provincial government has tried to overcome through interest rate subsidies. An alternative would be to adopt a policy of charging nonconcessional interest rates (including a sufficient spread for the higher cost of small-scale enterprise intermediation) and extending maturities to five to ten years. This would avoid the need to subsidize the use of scarce capital with all the administrative difficulties that this would imply and at the same time would ease cash-flow problems more effectively than the present low interest policy.

### III. URBAN INDUSTRY

3.01 Gansu's natural resources represent an important advantage the province has over the rest of China. However, the extraction and processing of mineral resources often requires large-scale, capital-intensive industries. So far, the output from these industries has not been processed in the province to an economically justifiable extent. Backward and forward linkages are missing. There is also considerable scope for light industries to develop linkages with heavy industry, for example, in metal fabrication, mechanical and electrical components and products and petrochemical processing.

3.02 The potential for medium-scale and light industries will ultimately depend on the extent to which the authorities allow the economy to rely on market forces to introduce innovations and stimulate entrepreneurial activity. The task is by no means easy in an environment where state controlled large-scale resource extraction and heavy industries predominate and will continue to do so in the foreseeable future. The momentum for change is clearly present in Gansu, but in order to develop the province's capacity to absorb new and more sophisticated techniques in a wide range of subsectors, four things are necessary. First, public policies and incentives that encourage local initiatives are needed. Second, institutional arrangements need to be made for the provision of finance, information exchange and technical assistance. Third, the educational system must be improved to produce the necessary managers, engineers, accountants, and skilled workers to operate enterprises. And finally, these authorities must be committed to ensuring that investments in large-scale heavy industries will meet clearly articulated economic and financial criteria. This chapter first reviews present arrangements for ownership and control of urban industries, then reviews the present situation in the heavy and light industry sectors, and discusses some of the policy options that could be pursued by the provincial government even before the reform of state enterprise management is fully carried out.

#### Ownership and Control

3.03 A large enterprise in China falls into the category of either state enterprise or collective. This large-scale industrial sector has been labeled "urban industry" even though a few large state and collective enterprises, such as those engaged in mineral extraction, might be located in rural areas. There were about 1,300 state industrial enterprises in Gansu in 1984, plus 3,100 collective enterprises, including perhaps 2,000 township enterprises, which have already been discussed in Chapter 2.<sup>1/</sup>

3.04 While there are very significant differences between state enterprises and small collective enterprises, the difference between state enterprises and large urban collectives is relatively small in practice. In theory, state enterprises are public property of the society as a whole, while

---

<sup>1/</sup> Out of a total of 12,200 TVEs, 5,400 were industrial enterprises, and about 2,000 were industrial enterprises owned by townships.

collectives belong to the working people in one collective or another. Most collective enterprises belong to a territorial collective (e.g., townships or counties) but a number of collective enterprises have been established by state enterprises <sup>2/</sup> and can be regarded as belonging to the workers of that state enterprise. In the past, all profits (and a large share of depreciation allowances) of state enterprises were remitted to the state budget, while collective enterprises paid taxes on their net income, with after-tax income divided between reinvestment distribution to workers (as bonuses and welfare expenditures), and remittance of a portion of after-tax increase to the "owner" of the collective.

3.05 State enterprises "belong" either to the central government or local governments at various levels (province, prefecture, and county). In 1984, 94 state enterprises in Gansu (7%) were owned by the central government, accounting for 48% of total gross industrial output. All central state enterprises in the province are heavy industry enterprises, while local state and urban collective enterprise output is divided about evenly between light and heavy industry. For national accounting purposes, "ownership" in the state sector used to be defined by the claim on remitted profits: a centrally owned enterprise remits its profits directly to the central budget, a provincial state enterprise to the provincial budget, and so on. Now ownership is defined by the level to which income and adjustment taxes are remitted. The share of enterprises in each category has changed considerably in Gansu in the recent past, as a number of large heavy enterprises have been transferred from provincial ownership and control to the central government. For example, in 1982, there were 84 central state enterprises in Gansu, accounting for 23% of GVIO. By 1984, the number had increased to 94 and the share in GVIO doubled to 48%.

3.06 Ownership, thus defined, does not necessarily translate into control. A crucial element of control in a planned economy is material allocation. With respect to material allocation, there are at least four basic types of enterprises: (a) enterprises under central leadership which receive production, supply and distribution plans from central ministries; (b) enterprises under local leadership which receive all plan assignments from local governments; (c) enterprises under dual, although primarily central, leadership which receive their plans from central ministries with local governments responsible for labor allocation; and (d) enterprises under dual, although primarily local, leadership which receive production, supply and distribution plans from central ministries, with local governments responsible for financial plans and labor allocations. Enterprises in categories (a) and (c) are "tongpei" enterprises whose output is under "unified allocation" by the State Planning Commission. The enterprises in category (a) are mainly defense industries. Enterprises in category (c) and (d) involve differing shares of central and local participation, giving rise to multiple ownership and crisscrossing command over enterprises. With the emergence of "above-

---

<sup>2/</sup> These were often started to provide employment for dependents of state enterprise employees, or to overcome supply bottlenecks.

quota" production, supplies, sales and prices over the past few years, these relationships have become even more complex, and most state enterprises exist simultaneously in different parts of these "plan" and "market" spheres.

3.07 It is thus wrong to assume that light industry enterprises which all "belong" to provincial and lower levels are fully, or even predominantly under local control. For example, most textile enterprises are part of the (central) textile ministry and were, until 1984, under strict production planning as the ministry maintained unified allocation of cotton. The degree of vertical supervision and control varies by industry. For example, enterprises in the "Second Light Industrial System" are subject to greater local control. But profits and losses used to be passed along to the ministries or "systems" and investments were mostly financed by ministerial allocation. The control of the ministerial systems extended even to urban collectives in the subsector. The extent of control by central ministries of locally owned light industry enterprises appears to have diminished considerably over the past two years, as unified allocation has been abolished and replaced by market allocation for a number of important agricultural raw materials for light industries (such as cotton or certain types of hides), but the extent of the new freedom (or local control) is not yet fully clear.

### Heavy Industry

3.08 The industrial sector in Gansu is dominated by large-scale heavy industries based on the exploitation of local petroleum and mineral resources. The Yumen oilfield located in the Jiuquan area was the largest producer of crude oil in the country until the early 1960s, and provided the basis for development of a large refinery, as well as petrochemical and petroleum equipment manufacturing plants in the province (para. 1.07). Similarly, rich and abundant copper, nickel and lead and zinc deposits were the basis for a substantial nonferrous metal industry. The availability of iron ore and coal in the province led to the construction of a ferrous metal industry, producing pig iron, steel, steel alloys and ferro-silicon. These large and capital-intensive heavy industry plants account for three quarters of the gross industrial output value and employment and 90% of the capital invested in industry.

3.09 Nonferrous Metals. The Jinchuan Non-Ferrous Metal Company is the largest nickel complex in the country with extensive mining, ore-dressing and smelting facilities. It produces about 20,000 t/y of nickel and recovers significant amounts of cobalt, gold, silver, platinum, palladium, copper, osmium, iridium and other scarce metals. Most of the sulfur dioxide from the smelting operations is presently not recovered. The planning authorities are devoting considerable effort to finding ways to recover the waste gas by conversion into sulfuric acid which could be used with phosphate ore from Yunan province to yield phosphoric acid or to make diammonium phosphate fertilizer. The latter alternative would require that a new ammonia plant (based on coal gasification) be built at the plant site. Massive investments would be required but little attention appears to be paid to alternatives and to the overall national plans for the development of nitrogenous and phosphate fertilizers. Another idea is to use the sulfuric acid to produce industrial grade titanium oxide (white pigment base for paints and other uses) which

again would require very large capital investments. Little information was available on market justifications for the proposal. As this example illustrates, industrial planning and decisionmaking in Gansu is still primarily based on engineering feasibility, with little regard to economic issues such as optimal size and location, appropriate processes and marketing arrangements.

3.10 The Baiyin Non-Ferrous Metals Company is a large integrated copper complex for mining, ore-dressing, smelting of copper ores, and electrolytic production of copper. Production of copper is about 40,000 t/y and among the metals recovered are gold, silver, lead and zinc. Significant amounts of high quality cryolite, selenium and sulfuric acid are important byproducts. Baiyin is the largest integrated producer of copper in the country. Some conversion of the copper into intermediate products is done at Baiyin and some is done at the Northwest Copper Working Mill. Copper is converted into sheets, strips, foil, tubes, rods and wire. There is also equipment at Baiyin for lead and zinc sheets and plate for use in electric batteries.

3.11 It is difficult to understand why more conversion of the copper into intermediate and final products is not undertaken in the province. Allocation decisions taken by the center appear to be the main reason. In the past, the production of smelters was restricted to pure metals while alloy production and further downstream processing was reserved for user industries. This often involves inefficient small-scale production and considerable waste of energy for heating.<sup>3/</sup> It may be worthwhile for the province to explore joint venture possibilities to expand copper converting activities. Baiyin Non-Ferrous Metals Company has a large lead and zinc smelting and refining facility with a capacity of about 30,000 t/y, but the plant is now operating at only about 2,500 t/y, apparently due to lack of supply of ores. A large lead and zinc ore mine is under construction in Changba to supply the needed ore but it is not clear whether the resulting concentrates would be sufficient for capacity operation of the smelter and refinery at Baiyin.

3.12 In addition to major ore bodies, there are valuable, exploitable small ore deposits and outcroppings scattered throughout the province. There already exist 54 small mining enterprises mostly for lead and zinc and some copper and antimony ores. However, their performance has been hindered by poor mining practices and the high transport costs entailed in getting the ores to Baiyin. The possibility of setting up small ore concentrators and primary smelters in appropriate locations to preprocess these dispersed sources of ores has not been given sufficient attention. The industry is oriented almost exclusively towards large-scale operations. It would be desirable to undertake a survey of the potential for small-scale, nonferrous metal mining. Such a scheme may turn out to be attractive in terms of the significantly lower investment requirements and higher employment generation

---

<sup>3/</sup> In a detailed discussion of management problems due to "multi-headed leadership" in a Chinese nonferrous metals plant, see: Byrd, William A., The Shenyang Smelter, A Case Study of Problems and Reforms in China's Nonferrous Metals Industry, World Bank Staff Working Paper No. 766, 1985.

as compared with large-scale mining. However, under the present infrastructure, nonferrous ore mining is not profitable (in contrast to smelting). This small-scale mining cannot develop without price reform in nonferrous metal mining (and smelting).

3.13 Gansu province also has two electrolytic aluminum plants (out of eight in the country). One is a 33,000 t/y facility located in Lanzhou and the other is a 60,000 t/y facility in Liancheng. Both are medium-scale operations using bauxite mined in Shandong and Henan provinces and were set up to exploit the availability of large amounts of hydroelectric power. There are no immediate plans for expansion. The authorities are said to be considering the construction of a large 200,000 t/y aluminum plant in Baiyin. Aluminum smelting is very electricity-intensive. While Gansu has some of the lowest-cost hydropower sites in the country, the cost advantage of the province may have been overestimated. Compared with thermal electric power generation in coastal provinces, hydroelectric power in Gansu appears to be only 15-30% cheaper, if the opportunity costs of scarce investment funds are properly taken into account (see Appendix 3). More detailed studies would be required to determine the costs of production in alternative locations (for example in the Southwest which has even greater hydropower resources) and the costs and benefits of greater reliance on aluminum imports.

3.14 Most of the subsequent processing of the aluminum ingots is done in other provinces. There are only a few small aluminum processing plants in Gansu. One of them is the Gansu Aluminum Factory in Lanzhou with production of about 9,000 t/y in die-cast products and wire. Plans are under consideration to increase the factory's conversion capacity to about 16,000 t/y. Another aluminum processing plant in Gansu is the Northwest Aluminum Working Mill in Longxi county which used to produce aircraft wings and fuselages for the defense sector and now produces aluminum-alloy tubes and pipes, cast products, aluminum powders, bus bars, and extruded products, including sheets and foil. Both conversion plants are principally for intermediate products. There is probably considerable scope for undertaking more conversion, both for intermediate and final products. However, longstanding contracts with enterprises in other provinces and the role of the center in allocating aluminum ingots has so far prevented expansion. Now may be the time to review the situation and develop plans to undertake converting operations on a significant scale. Joint venture activities may be considered as a way to obtain access to the necessary technology and know-how.

3.15 Iron and Steel. A variety of ferrous metallurgical products are processed in the province, but many of the enterprises have not performed satisfactorily. The largest capital investment is in the integrated Jiuquan Iron and Steel Company which uses iron ore from a large underground mine. The blast furnace for pig iron has an installed capacity of about 800,000 t/y, although production has never exceeded about 600,000 t/y. The pig iron from the blast furnace is sold to others for casting and steel manufacture. A 500,000 t/y steel plant is now under construction at the site and is being designed to use most of the pig iron in production of ingots and billets and wire for sale. The blast furnace has been operating at a loss since inception and it is not yet clear whether the steel operations will turn out to be profitable. The other major steel plant in Gansu is the Lanzhou Steel Factory

which has an electric furnace and oxygen converter with a capacity of 200,000 t/y. The factory uses pig iron produced at the Jiuquan plant and scrap. Rolling capacity is about 160,000 t/y of common structural steel products for the construction sector. The factory has not operated profitably since inception. Plans are being studied to expand the rolling capacity by 100,000 t/y to use the steel to be produced in Jiuquan.

3.16 The Gansu Iron Alloy Factory, located in the Hexi corridor, uses iron ore from a nearby mine and has three small blast furnaces which have a combined total capacity of 100,000 t/y of pig iron. At present only one blast furnace is operating and production is about 30,000 t/y. The original planners envisioned facilities for production of steel or alloys, but these have not yet materialized. The pig iron is sold to others for foundry operations and to Lanzhou Steel. The entire operation runs at a loss and will run at a loss even if the three blast furnaces operate at full capacity.

3.17 The Northwest Iron Alloy Factory has a capacity of 40,000 t/y of ferro-silicon alloy produced by electric furnaces. The input materials are pig iron from Jiuquan and from the factory's own high grade silica mine. The operations are highly profitable and the ferro silicon is of high quality. An expansion to 70,000 t/y is underway and plans are being considered for further exploration to 120,000 t/y by 1990. Metallurgical carbon products are made by the Lanzhou Carbon Factory which has a capacity of 40,000 t/y of graphite electrodes (approximately half the production) for industrial uses, and graphite powder. The operations have been reasonably successful but recently some technical problems have arisen due to the graphite electrodes breaking under use, which has affected export sales. Plans have been finalized to double the operation's capacity, assuming the technical problems can be overcome.

3.18 Except for the Northwest Iron Alloy Factory, the iron and steel operations in Gansu (which also include a number of other small pig iron and steel enterprises) are facing serious technical difficulties and have become a substantial financial drain. It would be desirable to study prospects and options (including plant closures) in some depth before any further investments are contemplated.

3.19 Chemicals. The development of the petrochemical sector began with the exploitation of the Yumen oilfield in the Hexi corridor (para. 3.08). The oilfield has been rapidly depleting (from about 2 million t/y of crude oil to about 600,000 t/y now). The petrochemical sector has been sustained by the output from the oilfield in Changqin (also depleting, present output rate 600,000 t/y). The capacity of the Yumen Refinery is about 1 million t/y crude oil throughput and the capacity of the Lanzhou Refinery is about 3 million t/y. The additional requirements for crude are met primarily by other oilfields in the Northwest. The two refineries are said to be operating profitably, but this might be largely a result of the peculiar pricing arrangements for crude oil and petroleum products in China which make petroleum refining a very profitable operation in most cases.

3.20 The Lanzhou Petrochemical Company is relatively large and based on cracking of crude oil (500,000 t/y) for ethylene, propylene and other basic

petrochemicals. A variety of plastics (polyethylene, polypropylene, styrene, synthetic rubber, etc.), monomers for synthetic fibers, and petrochemicals are produced. Ammonia (300,000 t/y) is also produced by naphtha cracking. The petrochemical complex operates profitably. The Lanzhou Chemical Industry Company manufactures a large number of widely used industrial chemicals (such as caustic soda, soda ash, sodium sulfate, nitric acid, rubber, a variety of salts, and synthetic fibers).

3.21 It is surprising that so little of the production of the petrochemical and chemical companies is used for conversion in downstream plants in the province. The downstream subsector is conspicuously undeveloped, probably as much due to the separate material allocation channels as to unfamiliarity and lack of knowledge among provincial planners about market opportunities.

3.22 The provincial authorities are considering the construction of a 90,000 t/y calcium carbide plant near Jiuquan which would be based on calcium carbonate from a large limestone deposit, coke from the Jiuquan steel plant and an adequate supply of electricity. The calcium carbide would then be used to yield acetylene to make PVC (using excess chlorine available from the Lanzhou Chemical Industry Company), and a variety of organic fine chemicals such as plasticizers, surfactants, dyes, and additives. Worldwide, acetylene is rarely used now as the basic unsaturated hydrocarbon input for vinyl chloride and other organic chemicals. Modern technologies start with ethylene obtained from petroleum sources (for example, refinery gases, cracking of crude oil or refinery fractions). The plans being considered for processing the acetylene involve capacities that are small and are unlikely to be economically viable. The capital investment for the new carbide plant would be rather large (presently estimated at Y 85-100 million). A possible alternative plan would be to obtain ethylene from expansion of existing cracking facilities in the Lanzhou Petrochemical Company. It would be desirable to review this proposal before a final decision is made.

3.23 Machine Building. Gansu has a number of relatively large establishments engaged in machinery and machine building. These include the large Lanzhou Petroleum Equipment Company for oil drilling equipment and refinery units and the equally large Lanzhou General Machinery Factory for oil rigs, pressurizing and fracturing equipment, and oil-well cementing units. Both enterprises are among the largest specialized factories of their kind in China. The Lanzhou Electrical Machinery Factory is also one of the largest manufacturers of power generators for the oil industry. Similarly, the Gansu Tractor Factory is an important manufacturer of a variety of farm tractors in China. Lanzhou Bearing Factory produces a variety of roller and ball bearings and the Longxi Metallurgical and Machinery Factory has well-equipped machinery, welding and metal-working facilities. It was not possible to obtain sufficient information on the performance of these large enterprises in such a short time. However, the mission was told that a number of these plants are not operating at capacity. Nevertheless, the very existence of these various facilities and the levels of technology could have had significant demonstration and spillover effects.

3.24 Unfortunately very little has been done to use these large facilities as a catalyst for development of a thriving machinery industry in Gansu.

There are two possible reasons for this: the relative isolation of activities by these large factories with very little subcontracting and minimal cross-linkages with the rest of the provincial economy; and the limited technical competence in the province. The output even of simple metal fabrications, small machinery, low-level engineering products, tools, household electrical equipment, electric motors, household appliances, instruments, bicycles, automotive parts, and electronic goods, is extremely low. The weakness of the electrical and mechanical industries sector in turn has had a profound effect on the development of light industry. It would be desirable to undertake a review of the capital goods, mechanical and electrical sectors, to determine the constraints affecting growth, assess the potential for development and identify the steps to be taken.

### Light Industry

3.25 The gross output value of light industry in China is about one-half of total industrial output. In Gansu, it is less than one quarter. The existing light industries in the province are relatively small in scope and size, are largely based on agricultural inputs with minimal utilization of intermediate manufactured inputs, and are using rather outdated technologies to produce goods which often are of poor quality. There are few linkages between the heavy and light industry subsectors in Gansu. Very few basic metals and petrochemicals produced in the province are used by light industry enterprises which in turn supply only very few inputs to heavy industry.

3.26 Textiles. The textile industry in Gansu consists mostly of woolen mills which process wool produced in the province. Much of the growth in wool production has taken place in a piecemeal manner with little regard for economies of scale and specialization of operations. With the phasing-out of material allocation, competition from better-quality textiles from other provinces is growing. Efforts are thus required to upgrade quality and should be concentrated on the preparation, preprocessing and spinning of yarns in modern large-scale factories, while some small uneconomic mills should probably be closed down. Different yarns could then be supplied to weaving mills, knitting mills and carpet factories in the province and for sale to others outside Gansu. There is considerable merit in encouraging mills to specialize in weaving a certain type of fabric such as worsted, semiworsted, or another variety of wool or blanket fabric. Subsequently, as production of fabrics increases, there may be justification for supporting integrated (spinning, weaving and finishing) mills specializing in particular fabrics.

3.27 In cotton production, unlike wool, the province has little advantage over other areas in China except possibly lower wages, given the low productivity of agriculture and the lack of other employment opportunities. At present, only about 30% of the provincial cotton textiles consumption is produced in Gansu, and these are mostly coarser fabrics like grey cloth and suiting material with simple finishing. The demand for these coarser high consumption fabrics for general daily use is probably of a magnitude to support a few cotton mills and the efforts should be directed toward producing these fabrics to be sold at an attractive price to capture the market. It remains to be seen whether the more luxurious finer cotton fabrics such as dyed and printed poplins and knits can be justified given the large excess capacity in coastal provinces.

3.28 The garment industry in Gansu is small, backward and somewhat out of touch with the changing patterns of consumer demand. There is considerable scope for revamping the subsector and allowing more entrepreneurial initiatives in garmentmaking and marketing. At present initiatives are still for the most part administratively determined with little consideration of market developments. Garmentmakers should be encouraged to cooperate with successful enterprises in other provinces to learn the trade, the art of following market trends and the techniques to manufacture garments quickly to new designs. The objective is not to make Gansu the trendsetter but rather to efficiently produce mass consumption articles that can compete with goods from other provinces in terms of quality, styling and cost.

3.29 Gansu is famous for its wool carpets which are hand woven with distinctive craftsmanship. The carpets are produced in a number of small factories and sold exclusively by the foreign trade export corporation. The lack of contact between the Gansu rugmakers and the foreign commercial buyers makes it difficult for Gansu factories to respond to market opportunities. Some way should be found to link carpet manufacturers more directly with the market to enable production to be better matched to buyers' requirements. A large share of current production incorporates floral designs developed for export markets some 100 years ago. With changing consumer tastes abroad there might now be more scope for ancient Chinese (and foreign) designs. If carpet-making is to remain viable in the face of rising labor costs, improvements in quality and design are crucial. More support could be extended to assist small and medium-size carpet factories to develop new and revive traditional designs.

3.30 The use of synthetic fibers in textile manufacturing is an important factor in the growth of the subsector. The quality of final fabrics, including those blended with both wool and cotton and the pure synthetic ones, reflect very closely the quality of synthetic fibers used. The preparation of the fiber from the raw material is highly specialized, involving relatively advanced technology on a large scale for successful operations. There are 3 synthetic fiber plants in Gansu which produce only about 10,000 tons/year of fibers, while installed capacity is said to be at least 20,000 tons/year. The low production rate stems from poor quality of fibers for which there is little demand. Given the fact that the input raw materials are produced in the province, it would make sense for the authorities to investigate the causes of poor quality and to seek technical assistance from experienced fiber producers in the established textile centers in the country. With such technical cooperation, there is no reason why Gansu could not be one of the country's leading large-scale producers of synthetic fibers.

3.31 Food. The food industry in Gansu, consisting essentially of three components -- processed grains, fruits and vegetables and beverages -- is principally for local consumption. With rising incomes, there is a need for hygienic large-scale facilities capable of producing flour-based products with longer shelf life to meet the growing demand in urban areas. Meeting this new demand will require careful planning to ensure that the facilities are economically sized, commercially viable and properly located with respect to distribution. At the same time, it would be useful to review the current arrangements for milling corn and wheat. Much of the milling is carried out

in small mills which cannot efficiently recover the valuable byproducts and cannot separate the different grades for the increasingly sophisticated consumers.<sup>3/</sup> The mills also suffer from unnecessary duplication and poor coordination resulting from the fact that more than one bureau has been given responsibility for supervising milling operations.

3.32 Commercial canning, bottling and preservation of fruits and vegetables are at an early stage of development and are undertaken mostly in small facilities which do not meet hygienic standards for food products with a short shelf life. There is considerable potential to modernize and greatly expand this subsector, particularly for the growing urban population in Gansu with its long winter season, and for other urban centers outside the province. Expansion would require, however, that authorities set standards, enforce hygiene and safety regulations, and ensure that packaging materials (bottles, caps, tinsplate, plastic) are available. A significant amount of preparatory, planning and supervisory work will be required on the part of the provincial authorities if this effort is to succeed. Technical assistance from one or more of the large, experienced food processors in the coastal provinces would be helpful to accelerate technology transfer. Similar considerations apply to the beverage subsector which consists mostly of small, uneconomic operations.

#### Development Issues

3.33 Gansu's natural resources are an important advantage that the province has over the rest of China. However, this is not the only advantage. Gansu also has a large rural labor force whose productivity in agricultural employment is very low due to the severe climate and limited land resources. As long as large-scale outmigration remains restricted, the agricultural labor force could still improve its standard of living by accepting employment in urban (and rural) nonagricultural jobs, even at lower wages than in the more advanced areas of China.

3.34 The importance of the natural resource base and consequently the importance of heavy industry for Gansu's development has been exaggerated in the past. This has been compounded by the lack of rigorous economic analysis in investment decision-making, particularly in the heavy industry sector. As shown earlier (paras. 1.30-1.32), the economic results of heavy industry investments were on average very poor. But it is not clear that there has been a change in the planning and evaluation of heavy industry projects, as the examples of some of the recent project proposals show (paras. 3.09, 3.22). While the promotion of efficient light industries in Gansu will strongly depend on the scope and pace of reforms of state enterprise management which are a matter of national policy and will take a number of years to implement, improvements in planning and economic analysis of heavy industry projects could be achieved even under present institutional arrangements, and are at least in part under the control of the provincial authorities.

---

<sup>3/</sup> See Appendix 1 for a more detailed discussion of technical issues in agroprocessing.

3.35 One of the most important principles for selecting industrial projects for investment is to use a sufficiently high rate of interest in calculations to accurately reflect the scarcity of investment funds. The experience of other developing countries shows that such an interest rate, or "opportunity cost of capital," is usually in the range of 10-15% p.a. in real terms. If the rate is set too low, available savings are not sufficient to finance all investments that have passed the test, and arbitrary criteria would have to be used to determine which projects to undertake. If the rate is set just high enough, available investment funds and the costs of accepted projects are just equal. Given the huge infrastructure investment requirements in China that have been neglected in the past in favor of "directly productive" investments, the appropriate level of interest rates to be used in such calculations is probably on the upper end of the range at about 13-15%. Other developing countries as different as Hungary<sup>4/</sup> or South Korea are using these same methods to screen investment projects.<sup>4/</sup>

3.36 The justification for capital-intensive heavy industry and infrastructure projects is usually very sensitive to the "opportunity cost of capital." For example, at an opportunity cost of capital of 10%, the cost of electric power generation at one of the best hydropower sites available in Gansu (Daxia) is about 5 fen/kWh, or 30% lower than the cost of thermal power generation in a coastal province. However, at an opportunity cost of capital of 13% (which is more likely to reflect the scarcity of investment resources in China), the cost of electric power from Daxia is 7 fen/kWh, or only 13% cheaper than thermal power generation in a coastal province (Appendix 3). Thus, the comparative advantage of Gansu as a location for electricity-intensive heavy industry plants (such as aluminum smelters) is not quite as large as is widely thought in China, and much more detailed project analysis would be required to determine the justification of building energy-intensive heavy industry plants in the province.

3.37 Light industries could in the long run become the largest employer in Gansu, but labor costs will have to be lower than in coastal regions if Gansu is to overcome its natural disadvantages such as remote location and lack of direct access to major urban markets in China and abroad. If the cost of labor in Gansu will continue to be determined largely by the uniform national wage scale, light industry in Gansu cannot be expected to develop a comparative advantage over other provinces. Entrepreneurial and technical skills are also not as readily available as elsewhere. Two important sources of technical and managerial skills that could be tapped are (a) subcontracting and affiliation with the existing heavy and large industrial enterprises; and (b) cooperation and technical assistance linkages with experienced partners from other provinces (particularly in the coastal regions) and from abroad. Such partnerships could result in efficient technology transfer, successful distribution and marketing strategies and better use of Gansu's ample and underutilized human resources. The development of light industry in Gansu will also depend on a larger role of market allocation of raw materials, and

---

<sup>4/</sup> Hungary uses a rate of 12% for the screening of project proposals, South Korea, 13.6%.

unrestricted access to markets in other provinces of China, and in particular the large urban areas.

3.38 Processing of agricultural products -- grains, oil seeds, fruits, and vegetables -- to meet the provincial consumer requirements could be systematically developed. Better coordination and cooperation between the administrative authorities and the supervisory bureaus responsible for agricultural products and food processing is essential if this important sector is to serve the needs of provincial and export markets. The livestock subsector, particularly meat and leather production, has considerable potential not only to meet the needs of the province but also for exports. But this requires attention to modern livestock practices and agroprocessing facilities including slaughterhouses, rendering facilities, cold storage and leather processing plants. Gansu could become an important producer of wool yarn and fabrics, but production has to be rationalized and specialization introduced. There will remain for some time the problem of overgrazing in large areas of the province. But growing agricultural surpluses and byproducts in other areas such as Hexi are creating opportunities for improved livestock operations in specialized and mixed farming.

3.39 Also important to light industry development is the production of consumer durables and many kinds of machinery and hardware parts. These operations have been traditionally classified as heavy industry in China because they generate producer goods, but in fact they share many of the characteristics of light industry manufacturing, including labor intensity and low capital requirements. For many of these industries, a reasonably skilled labor force working for moderate wages is the most important ingredient for success. Examples are manufacture of cast iron products, hardware for the construction and household sectors, tools and forged products, electrical fittings and appliances, industrial hardware of brass, bronze and aluminum, and downstream processing of plastics, synthetic rubber and fine chemicals.

3.40 Sectoral planning and resource allocation has worked to the advantage of heavy industries but the system has not been as successful in supporting the development of labor-intensive light industries where innovation, diversification, technology and marketing are critical factors. Part of the reason appears to be a lack of professional expertise in the relevant supervisory bureaus. Gansu had a history of more or less exclusive involvement with large-scale heavy industry. Due to Gansu's relative isolation from the more developed coastal provinces, cadres in the province are understandably less familiar with technological developments and not experienced in managing competitive light industry enterprises facing rapid changes in production technology and markets. Probably one of the most important priorities at this stage is to strengthen the competence and expertise in sector planning and project analysis in the provincial industrial bureaus, and in particular in the Bureau of Light Industry.

#### IV. PROSPECTS AND POLICY OPTIONS

4.01 Efficient industrial development is essential to the economic development of Gansu if a sufficient number of nonagricultural jobs are to be created, if incomes are to increase at the same rate as elsewhere in China, and if the recent slippage in economic performance, relative to the rest of the country, is to be reversed. This chapter summarizes the prospects for efficient industrial development in Gansu and some of the policy options that could be considered at both the provincial and national levels, recognizing that the prospects for efficient industrial development in Gansu will depend at least as much on decisions taken in Beijing on economic reforms as on actions taken by the provincial government in Lanzhou. The major issues addressed in the following sections are the need for rural nonagricultural employment generation on a rather large scale; the need for wage flexibility if employment generation is to succeed given continued restriction on migration; the need for improvements in investment decisionmaking; the need to accelerate technology transfer; and the need to improve institutional support for more independent enterprises.

##### Creating Productive Employment

4.02 The main development challenge for Gansu will be to find more productive employment for the 75% of the provincial labor force that is presently engaged in agriculture. Gansu's climate limits prospects for increasing productivity in agriculture and satisfactory increases in agricultural productivity are possible only if the agricultural labor force can be reduced, making more land resources available for those remaining in agriculture. The two ways in which the agricultural labor force could be reduced are: rural-urban migration and the creation of nonagricultural employment in rural areas. These two options are not mutually exclusive alternatives.

4.03 Table 4.1 illustrates employment prospects in Gansu province over the next 15 years under alternative assumptions about policies towards migration and wages. In Scenario A, there is no interprovincial migration and rural-urban migration is restricted, with the exception of migration into rural market towns. Consequently, the rural labor force would increase by 46% to 9.5 million. Wages are also assumed to increase in line with those in other parts of China, limiting the growth of nonagricultural activities in rural areas, particularly for "footloose" industries whose development would crucially depend on low wages to overcome the disadvantages of Gansu's location with respect to industrial centers and major urban markets in China as well as abroad. Nevertheless, nonagricultural employment is still assumed to increase to 20% of the rural labor force due to increased agricultural incomes and further development of market regulation in the rural economy, especially with respect to township and village enterprises. But the agricultural labor force would still increase by 22% over 1982, and agricultural productivity and incomes could be expected to increase only very slowly.

4.04 In Scenario B, some changes from present policies towards migration and wages are assumed. Restrictions on migration from rural areas to major urban centers in the province are relaxed, increasing the urban labor force by about 40,000 persons p.a. over and above the natural increase of the urban labor force of 26,000 persons p.a. At the same time, interprovincial migration restrictions are also relaxed, both in connection with agricultural resettlement schemes in the Northwest, and some migration towards urban areas in other parts of China, reducing the increase in the provincial labor force by about 80,000 p.a. Under these conditions, the rural labor force would still grow (by 12% between 1982 and 2000), but employment in agriculture could decline, leaving more room for increases in productivity and incomes. At the same time, permitting the hiring of workers at wages lower than the levels in the more advanced areas of China could help attract a number of "footloose" industries to Gansu, increasing the share of nonagricultural employment in rural areas to 30% by 2000 -- quite respectable by international standards.

Table 4.1: EMPLOYMENT PROJECTIONS, 1982-2000  
(million)

	1982 actual	2000 projected	
		Scenario A	Scenario B
Urban	1.70	2.16	2.89
Rural agricultural	6.24	7.62	5.12
Rural nonagricultural	0.29	1.90	2.20
<u>Total</u>	<u>8.23</u>	<u>11.68</u>	<u>10.21</u>

Scenario A: no migration

Scenario B: intraprovincial rural-urban migration 0.3% of total population p.a.; interprovincial migration 0.3% p.a.

Source: Main Report, Appendix E, Table 7.

4.05 While most other developing countries in Asia have experienced rapid urbanization during the transition from a low- to a middle-income country, not all have been successful in promoting rural nonagricultural employment. For example, in South Korea, rural nonfarm employment has remained at about 25% of the rural labor force, similar to Jiangsu, but at far higher income levels. Some other Asian economies have been more successful in creating rural nonfarm employment. One characteristic of rural nonagricultural employment in the more successful countries is that a very significant share of off-farm employment in rural areas is of an urban type, that is, in relatively large establishments that have been located in rural areas to take advantage of low labor costs and lower land values. This is especially true for footloose industries that have no particular link to rural activities, other than lower labor costs (for example, textiles and garments, mechanical and electrical parts and components).

4.06 A number of conditions are required to attract these activities to rural areas. Probably the most important is an educated labor force that can be employed at wages below those in urban and other more advanced rural areas. But equally important are the existence of a developed rural infrastructure, including roads, electricity and communication facilities; the simultaneous development of a service sector providing transport, commerce, financial and other professional services; the ability to pool capital and set up economically sized enterprises; access to domestic and imported technologies; and access to markets elsewhere.

#### Wage Flexibility

4.07 At present, wages in Gansu are 10-20% above those prevailing in the more advanced coastal provinces. This is true not only for workers in state enterprises who are paid wages according to a unified nationwide scale, but also for urban collectives and rural township and village enterprises (Table 1.9). While urban wages in coastal areas are now in line with agricultural incomes, this is not the case in Gansu. Urban wages are still about three times the income of rural workers (Table 1.8), and urban and rural collective enterprises appear to peg their wages to those of state enterprises. Township and village enterprise wages are about one-third below those of state enterprises, but they appear to be higher in Gansu than, for example, in Jiangsu. While this has probably not mattered much in the past when economic considerations were secondary in investment decisionmaking, this is likely to become a large handicap for Gansu in China's emerging socialist market economy.

4.08 The maintenance of present wage practices is likely to limit industrial development in Gansu to either those activities where the province has a distinct advantage in natural resources (for example, nonferrous metal mining and processing), or activities that are protected by transport costs or other barriers to competition from other more efficient producers elsewhere (for example, building materials and agroprocessing). Indeed, Gansu's present industrial structure is characterized by the predominance of such local industries with significant "natural protection." In this situation it is tempting to try to protect local industrialization by strengthening administrative restrictions on trade with other areas. Indeed this has happened many times in China in the past few years. However, such a policy is self-defeating, as it limits gains from increased specialization and trade for all participants.

4.09 The principal alternative, given Gansu's disadvantages of remote location, lack of technology, and lower skill levels of the labor force, is to accept lower wages to compensate for these disadvantages. Indeed, this has been the most important factor in the development of other successful export-oriented developing countries. The difference is that Gansu's export market is principally China and not the rest of the world. This has considerable advantages since Gansu does not need to overcome tariff and other trade barriers, including different customs, tastes, languages, institutions, product standards, and so on. This does not mean, however, that Gansu should neglect other export opportunities which could be significant in terms of income, employment and technology transfer.

4.10 Present wage policies in China are based on a rather one-sided equity principle: wages of all workers in the modern (state) sector are to be equal irrespective of location and alternative employment and income opportunities (that is, the "opportunity cost" of labor). Those lucky enough to find employment in the modern sector are comparatively well off, but those who have to remain in agricultural employment remain a disadvantaged group, subsisting at a fraction of urban incomes. Due to the success of the rural reforms of the past seven years, rural incomes have largely caught up with urban incomes in the more advanced coastal areas. But this has not been the case in Gansu. Nor is it likely that this large and arbitrary income gap can be closed in Gansu without lowering industrial wages. Gansu has the choice between two patterns of industrialization: In the first pattern, the present high wage policy would be maintained and industrial activity would grow slowly. In the second pattern, there would be much more rapid growth of industrial activity achieved by relating industrial wages more closely to the opportunity costs of labor in alternative agricultural employment.

4.11 Such a change in wage policy has frequently occurred elsewhere, but in a less visible way. Developing countries that have shifted from an inward orientation with high protection for urban industrial workers to an outward-oriented strategy based on competition and labor cost advantage have done so through exchange rate devaluations and by keeping nominal wages but reducing wages (often drastically) in terms of purchasing power for imports. Within a country or common currency area, such drastic wage adjustments have occurred only rarely (largely because they have not been necessary) but a few examples can be cited. For example, when more competition was introduced in the US airline industry starting in 1977, wages for pilots and other flight personnel at existing airlines were far too high compared with those of new airlines now permitted to enter the competition. Consequently, many existing airlines had to negotiate large wage reductions to remain competitive and stay in business. In some cases they opted for offering much lower wages to new staff (up to 50% less) while protecting the wages of existing staff, if possible.

4.12 The introduction of competition and the change towards a socialist market economy pose similar problems for Gansu. If significant numbers of industrial jobs are to be created in an efficient manner, wages in these new enterprises will have to be lower than in more advanced areas of China. This should pose the least problem for collective enterprises in rural areas who are free to set their wages as they see fit. However, many footloose industries require scales of operation that are beyond the present financial resources of township and village enterprises, but can only be competitive with others in more advanced areas if they have a labor cost advantage. Thus it will be important to establish relatively large-scale light industrial enterprises outside the state sector, if national wage scales for state enterprises cannot be changed. Another possibility would be to offer lower wages to new entrants into the labor force. At present, differences in the wages of newly hired and experienced workers in state and collective enterprises in Gansu appear to be very small by international standards. The competitiveness of enterprises in Gansu relative to those elsewhere in China would thus be improved by offering lower wages to new employees, while protecting the wages of more experienced workers.

4.13 Another possibility is increased use of performance related compensation, such as piece rates, for above-quota production bonuses. This could also be extended to jobs where productivity cannot be directly measured and piece-rate systems cannot be applied. Managers at all levels could be given greater autonomy in deciding on wage increases for individual workers under their supervision on the basis of qualitative (and admittedly somewhat subjective) judgments about the productivity and contribution of individual workers, as practiced in most market economies. However, it is very important that managers themselves face appropriate incentives to increase productivity and profits if this is to be successful. Competitive and well-functioning markets are a prerequisite. Small collective enterprises come closest to fulfill these conditions, and are the logical starting point for reforms of wage policies.

4.14 Some collective enterprises in the same townships in Gansu appear to pay rather different wages, for essentially very similar jobs, depending apparently mostly on the profitability of the enterprise. If this is a more general pattern, the most important thing to do would be to increase competition and to rationalize prices. Wages should then be converging towards a more or less competitive equilibrium. However, for state enterprises these conditions are far from being fulfilled, and state wage policies will have to take the place of market forces. However, as state enterprises are given more independence in production and marketing decisions one could also imagine the application of the two-tier pricing now used for within-plan and above-quota production to wages as well, particularly insofar as additional employment results from above-quota production.

4.15 Paying wages that take account of the "opportunity cost" of labor will probably also mean some further increase in wage differentials between skilled and unskilled jobs. Experienced and technically trained personnel are in short supply in Gansu and often have greater mobility between jobs in different enterprises within the province and even outside the province. Moreover, it will often be necessary to attract experienced technical personnel from outside the province. It is interesting to note that most other socialist countries, including the Soviet Union, have relatively free labor markets where workers frequently change jobs between enterprises according to market conditions and wages offered by different enterprises. This helps to allocate skilled labor to the most efficient uses, provided product markets are sufficiently competitive (which they are not in the Soviet Union). Job changes are also an important means of transferring technology between different enterprises and helping to spread imported technology within the domestic economy. For these reasons, it will probably be necessary and desirable to maintain the present wage levels for skilled workers in state enterprises and to enable collective enterprises to provide competitive wages and compensation schemes for managers and skilled personnel, while wages for unskilled workers will have to be lower than elsewhere in China, at least in the collective sector.

4.16 The only alternative to lower wages for unskilled workers in Gansu is a very substantial increase in interprovincial migration. At present, interprovincial migration is almost completely restricted, and free mobility and large-scale migration is unlikely to be permitted in the near future.

While this is understandable, it might nevertheless be desirable to arrange for some modest but steady rate of outmigration, perhaps as suggested in Scenario B (Table 4.1). But even with some migration, a substantial change in wage policies would be required, if a sufficient number of nonagricultural jobs are to be created in rural areas in Gansu.

#### Investment Decisions and Financing

4.17 During the past 35 years, the Government has invested very heavily in Gansu's industry. Indeed, Gansu's share in China's industrial fixed assets (3%) is considerably higher than its share of China's population (2%). However, the share of manufacturing in total employment, at 8%, has remained below the national average (14%). By contrast, Jiangsu, with 6% of China's population, has only 4% of China's industrial fixed assets, but manufacturing employment accounts for 21% of total employment in Jiangsu. Thus, it is not for lack of investment funds that Gansu's industrial sector remains backward.

4.18 Rather, it is the disproportionate emphasis on capital-intensive heavy industry development that accounts for the failure to create significant numbers of more productive nonagricultural jobs. On a per capita basis, Jiangsu's industrial fixed assets in heavy industry are only about one third of Gansu's, and in light industry they are about equal. Only in food and textiles does Jiangsu have a higher rate of fixed assets on a per capita basis. In addition to the sectoral allocation of past investments, the efficiency of capital use appears to be far lower in Gansu's industrial enterprises in all sectors, with the exception of township and village enterprises (para. 1.27).

4.19 Thus, if more industrial (and service) employment is to be created, a larger share of industrial investment will have to be devoted to light and rural industries, and the efficiency of industrial investment will have to be increased substantially. It is relatively easy to devise and implement a plan to increase the share of investment in light and rural industries, although it is not fully clear to what extent investment allocation is under full control of the provincial government. The Central Government "owns" about two thirds of Gansu's heavy industry and controls the use of their net income. Even for "locally owned" state enterprises (all of light and one third of heavy industry), the extent of provincial and central control is not fully clear, although control over the resources of provincial and local state enterprises is now primarily a provincial matter. The extent of local vs. central control in the sectoral allocation of bank loans is similarly unclear, but there has also been a marked shift towards autonomous decision-making by provincial and lower-level branches of banks.

4.20 It is not easy to provide a precise figure for the amount of investment required to provide the 100,000 additional nonagricultural jobs that will be needed every year if Gansu is not to fall further behind. Using the average amount of fixed capital per worker in township and village enterprises (Table 1.10) this would come to investment requirements of about Y 140 million p.a., or about 12% of present total industrial investment. But this might not be sufficient, particularly in the longer run. The experience of other countries shows that about half of rural industrial jobs are "urban,"

that is, in large enterprises that do not differ significantly in technology (and capital intensity) from comparable enterprises in urban areas. If half of the nonagricultural jobs to be created are in industry and half of the latter are modern or "urban," with investment requirements of Y 6,000-10,000 per job (light industry in Table 1.10), another Y 100-200 million would be required. While this is equivalent to only another 8-16% of total industrial investment (and less than the increase in total industrial investment in 1984), this would nevertheless represent a massive increase in industrial investment in rural areas. Until 1984, total investment of township and village enterprises was only about Y 10-20 million,<sup>1/</sup> although this appears to have sharply increased in 1985 to Y 70-100 million.<sup>2/</sup>

4.21 While a concerted effort should be made by the provincial and central authorities to shift more resources into labor-intensive light industries, even under the present institutional arrangements, it is by no means guaranteed that this would lead to a more efficient utilization of resources, and to the establishment of viable and competitive labor-intensive industries. Far more profound institutional changes are required. This is recognized by China's leaders who have identified the task of "invigorating enterprises as the key to reforming the national economy" (12th Central Committee, October 1984). However, it will take a number of years to prepare and implement these reforms. The recent World Bank economic report has discussed in more depth the task of improving enterprise performance.<sup>2/</sup>

4.22 The reform of the policy environment in which enterprises operate is mostly a matter of national policy. But there are also a number of actions the province can take before these reforms are decided and fully implemented. First, managers of enterprises under local control should be given more independence in all matters of enterprise management including most investment decisions, particularly those concerned with enterprise modernization and incremental expansion. At the same time, there need to be greater financial and other performance incentives for managers, and accountability needs to be strengthened. Second, the extent and quality of economic and financial analysis of investment decisions needs to be improved. Third, a larger share of investment financing should be undertaken by the banks, who should also assume more responsibility for investment decisions.

4.23 Giving enterprise managers more freedom in all matters internal to the enterprise is essential if enterprises are to be made more efficient. Increased efficiency requires constant efforts to increase productivity, to improve product quality, to introduce new products and to seek out and respond to changing needs and opportunities. Only enterprise managers have the detailed information to make these efforts in the most effective and least

---

1/ The Agricultural Bank of China's outstanding loan balance to TVEs increased by Y 70 million during 1985, after very slow growth during the preceding years.

2/ World Bank, China: Long-Term Development Issues and Options, op cit, Chapter 10.

costly way. To be efficient, enterprises must be motivated to improve their performance, they must have freedom to maneuver, and they must be subjected to competition. These conditions do not exist for all types of enterprises in China at present. But some, in particular township and village enterprises, come close to operating in such an environment.

4.24 For state enterprises and large urban collectives these conditions do not yet exist, but in some sectors, notably light industries, conditions are more favorable in terms of rational prices and existence of some competition. Also, the danger of irrational investments is far less because investment decisions are usually not as irreversible as in the case of most heavy industry enterprises. A large share of fixed assets in light industries is fungible (for example, buildings and multipurpose machinery) and can be used for other purposes or can be resold, if the product for which they were intended turns out to be unsuccessful. By contrast, most heavy industry investment involves far larger outlays per job created and often becomes useless if the operation turns out to be unsuccessful. For this reason, heavy industry investments should be screened much more carefully, and enterprise managers cannot be given as much independence, at least not initially. Furthermore, price distortions and lack of competition are more pervasive in China's basic material industries.

4.25 This leads directly to the importance of better and more rigorous economic analysis of investment proposals. At present, project proposals are mainly based on engineering feasibility with very little regard to such economic factors as optimal size and location, appropriate processes, marketing arrangements and so on. If markets are sufficiently competitive this analysis is relatively simple and not too different from the profitability calculations made by Chinese enterprises at present. However, if markets are not competitive and prices are heavily distorted, more elaborate analyses should be carried out. The World Bank and other international lending agencies have developed methods of project appraisal suitable for such situations. However, the need to use these methods can be minimized in the industrial sector by reforming enterprises, allowing more flexible prices, and introducing competition.

4.26 Recently, state enterprises have started to gain more control over their cash flow, as profit remittances to the budget have been replaced by tax payments, and depreciation allowances are now in large part retained by enterprises. In practice, this change has been more gradual as supervisory bureaus still have rather wide-ranging control over the funds retained by enterprises. While the trend towards greater control by enterprises over their own cash flow is highly desirable, it also carries with it the danger of reinforcing the present compartmentalization of investment resources into too many small and inefficient investments. Such compartmentalization has occurred when enterprises, localities, and industrial bureaus have been allowed to control part or all of their cash flows (depreciation plus net income) but have been unable to earn a satisfactory return unless all of their resources are invested in the enterprise(s) directly under their control.

4.27 One of the most important measures to counteract this tendency toward compartmentalization would be to give banks and other financial

institutions a larger role in the allocation of investment resources. The most important preventive action that banks could take is to pay an attractive rate of interest on enterprise deposits so that enterprises are not tempted to use their resources for small and inefficient investments but instead prefer to earn a reasonable return on their financial assets until they find a project that will promise even higher returns (and for which they might borrow additional funds from the bank). Unfortunately, interest rates on enterprise deposits are still very low in China and virtually any enterprise or other entity can find investments that yield higher returns than enterprise deposits in banks. Under these conditions, no enterprise wants to be a net lender and too many small and inefficient investments result. It would be highly desirable to raise interest rates on enterprise deposits to at least the level of interest on time deposits by individuals (raised to 6-10% in 1985 depending on maturity). While interest rate policy is still a matter for the central government, there might be some scope for the provincial government in this matter, for example, in the case of the provincial investment trust corporation.

### Technology Transfer and Development <sup>3/</sup>

4.28 Industrial technology in China has generally lagged behind that of industrialized and newly industrializing countries. The main reason is the prolonged international isolation with exclusive reliance on domestic development of technology. By contrast, other rapidly industrializing countries such as Japan, or more recently South Korea, have made intensive use of imported technology, concentrating their efforts first on mastering and adapting imported technologies and then on increasing the share of domestically developed technology. Even among industrialized countries, none is completely or even predominantly self-reliant in technology. Keeping up with international competition requires rapid adoption of technology and productivity advances made elsewhere.

4.29 In China, technological self-reliance has been sought not just at the national level but also by individual industries, provinces, localities, and even enterprises (many of which, for example, manufacture their own machinery and design their own products). This has been extremely wasteful of both physical capital and human resources. The talent of China's scarce technical personnel is wasted through duplication of effort. Productivity performance has been disappointing. In most rapidly developing countries, a considerable proportion of productivity growth is due to total factor productivity, that is, output growing faster than the total of all inputs due to improvements in management practices and technology. But in China's state-owned industry, total factor productivity growth has been close to zero. In Gansu's state enterprises the results have been even worse. During 1975-82 total factor productivity declined by 3.3% p.a. compared with an increase of 0.8% p.a. for all state enterprises in China (Table 1.12). In other words,

---

<sup>3/</sup> For a more detailed discussion of technology transfer and development issues in China see: World Bank, China: Long-Term Development Issues and Options, op cit, Chapter 7.

the rate of return to capital invested in state enterprises in Gansu has been close to zero, even in the absence of any technical progress, while rates of return on capital in other countries are usually in the 15-25% range.

4.30 It is widely believed in China that the way to solve these problems of stagnant productivity, high costs and low product quality is to introduce modern technology. But productivity and quality in Chinese industry could often be dramatically improved without new technology. The large differences in performance among firms in a given industry is often determined more by management than by superior equipment. In general, the lagging productivity in Gansu is not the result of a lack of equipment and other fixed capital but rather is due to a much lower level of managerial and technical skills, and some rather poor investment decisions.

4.31 The experience of other countries shows that technology cannot be simply transferred. Considerable efforts and investment are needed to master any technology and to make adaptations to suit local conditions. Research on technology development in other countries has shown that the cumulative effect of small innovations (for example, process modifications or changes in materials or work processes) are more important than completely new products or processes. Also, narrowing the technology gap between the leaders and the laggards is as vital to cost reduction and product improvement as the pace at which the leaders acquire new technology. In other countries, labor mobility is one of the most important means of diffusing technology from leading to less advanced enterprises. The existence of a consulting industry is another important channel for technology diffusion.

4.32 Domestic Technology. Learning managerial and technical skills from enterprises in the more advanced provinces, such as Jiangsu is one of the most important efforts that can be undertaken in Gansu. A significant step forward has been made by township and village enterprises who have recently begun to hire retired managers and technical specialists from more advanced areas to help them to improve existing production methods and quality and introduce new processes and products. These arrangements range from advisory visits of a few weeks to managing enterprises for one or more years. In fact, this is the beginning of a consulting industry in China. It has been made possible by official encouragement and reasonably flexible treatment of the additional income of the consultant retirees. This highly successful experiment needs to be given further encouragement and should be significantly expanded. In particular, it would be highly desirable to make much more use of such arrangements in state enterprises and large collective enterprises.

4.33 Another means of technology transfer that could be used more extensively is to send skilled workers, technicians and middle level managers to more advanced enterprises in the coastal provinces. Such on-the-job training would in most cases last a few weeks or months. But occasionally, it would be desirable to have somebody trained in this way for a year or more. Arrangements should be made with enterprises in other provinces to provide these training opportunities.

4.34 In many cases it will be desirable to have a permanent link with more advanced enterprises elsewhere in China. This could take many forms --

from paying for specific technical assistance, to licensing arrangements for proprietary technology, and permanent joint ventures in production, sales and marketing. The institutional rules and procedures for such cooperation are only slowly emerging as part of the ongoing reforms of enterprises. But enterprises and provincial authorities should take advantage of these new possibilities to enhance technology diffusion and to improve productivity and quality. To use this advantage successfully, it would be important to have clearly defined objectives and follow-up to assess impact. There exist similar possibilities for relationships among enterprises within the province. Joint ventures and subcontracting arrangements -- for example between state enterprises and rural township and village enterprises -- could help to spread industrial employment opportunities to rural areas, would reduce production costs of urban enterprises and would make the provincial industry more competitive.

4.35 Foreign Technology. While domestic sources of technology are likely to remain quantitatively much more important, given the relative backwardness of industry in Gansu, foreign technology imports need also to be increased, but in a selective manner. Indeed the bias of the open door policy towards the more advanced coastal areas is one of the reasons why Gansu's industrial development has fallen behind in recent years. Imported technology and joint ventures with foreigners for production and exports were largely concentrated in special economic zones, open coastal cities and other coastal areas. It would be highly desirable to end this unequal treatment of more advanced and backward areas. Otherwise, it is quite likely that backward provinces like Gansu will fall further behind in technology, productivity and economic development.

4.36 In a number of areas, Gansu has a unique advantage over most other areas of China in developing production for exports. Examples include a number of agroindustry areas such as temperate climate fruits and vegetables, leather and woolen textiles including carpets, nonferrous metal industries, and even footloose industries that depend primarily on low wages. But if these industries are to develop, enterprises in Gansu must be allowed and encouraged to have direct contact with foreign buyers and suppliers and to engage in joint ventures for production or export marketing just as freely as enterprises elsewhere in China.

4.37 The experience of other countries shows that informal ways of acquiring technology are very important. For example, a survey of exporting firms in South Korea showed that the most important sources of process technology, both domestic and foreign, were overwhelmingly informal. Formal sources (licensing, technical assistance and government-supported institutes) were cited as important in less than one third of all cases. Informal sources, particularly assistance from suppliers and buyers, and hiring of personnel with experience in other domestic firms or abroad, were much more important. The role of overseas buyers in providing information, particularly about the many small improvements that are crucial for technology adaptation and quality and productivity improvement, is particularly important and partly explains why the fastest-growing economies in East Asia, with their strong export orientation, have been able to upgrade technology so quickly.

4.38 Worker Safety. There appears to be a general lack of attention to worker safety in industrial enterprises. Among provincial agencies concerned with industrial development, attention to this issue seems to vary according to the degree of awareness and concern among individual officers. The most common dangers include: noise levels which in some cases are probably high enough to cause permanent hearing impairment in a short period of time; the absence of shields or barriers around moving parts of machinery; and inadequate lighting and ventilation. It is important for authorities to address this aspect of worker welfare and productivity. Most dangers can be reduced by simple, low-cost measures and provincial authorities could develop guidelines on the use of shields, ear plugs, lighting and ventilation that will reduce the incidence of impairment and accident. Agencies having direct contact with enterprises should then incorporate these guidelines in their feasibility and technical assistance work.

#### Institutional Support

4.39 Industrial Bureaus. In the past, the role of industrial bureaus was mainly to guide and control enterprises under their jurisdiction. In the more liberal and competitive environment that is emerging, the main role of an industrial bureau should be to support and promote the development of enterprises in its sector. Control over investment resources should gradually shift to the enterprises themselves, and to the specialized banks and other financial institutions such as the Gansu Investment and Trust Corporation (GITC). However, the important functions of technology transfer, training and assistance in marketing would remain with the bureaus. This change of the role of industrial bureaus from a controlling to a supportive role would require fundamental changes in their work, the skills required to carry out these new tasks, and in attitudes towards enterprises.

4.40 This change from a controlling to a supportive role has gone furthest in the case of the Bureau of Rural Industries (Appendix 2). The deregulation of conditions for township and village enterprises and the rapid expansion in this sector since 1984 has placed heavy and entirely new demands on the bureau. Its leadership is to be commended for the competence and enthusiasm in responding to these demands in the face of serious staff and budget constraints.

4.41 In the case of other industrial bureaus, changes have not yet progressed very far and this is mostly due to the fact that the policies for state enterprises and large urban collectives so far have not changed as much as those for township and village enterprises. But there appears to be considerably more room for a new and supportive role by other industrial bureaus that is not yet fully utilized, particularly in the case of the Bureau of Light Industry. The recent ending of unified plan allocation for many agricultural raw materials (e.g., cotton, wool, hides) gives enterprises considerably more freedom to expand production, to specialize, to enter new markets and so on. However, since the commercial and service sector is still very underdeveloped, enterprises have difficulties in learning about new market opportunities, arranging for sales outside the province and finding material suppliers and technical assistance. The Bureau of Light Industry could play a much larger role in assisting enterprises in these areas. This would require

a strengthening of the bureau similar to what has recently taken place in the Bureau of Rural Industries. In view of the many opportunities for cooperation between rural industries and state enterprises, the bureaus could also play a larger role in promoting cooperation in, for example, subcontracting.

4.42 Financial Institutions. The specialized banks and other new financial institutions will have to take on a much larger and very different role than in the past, if industrial development is to become more efficient. At present, the specialized banks are more akin to accounting departments of the government rather than to financial intermediaries that mobilize, and efficiently allocate surplus resources. The challenge is to turn banks into enterprises rather than government departments. The most important role for banks will be to share and help manage the risks of enterprises. With more competition in the industrial sector, both from within and outside the province, enterprises will face the risk of failure and bankruptcy, and banks will have to carefully watch and manage their portfolios to keep nonperforming loans within prudent limits. So far these changes appear to have taken hold most firmly in the case of the Agricultural Bank of China, because township and village enterprises are now fully responsible for profits and losses, and ABC is their principal bank. For the other specialized banks, nonperforming loans (or enterprise failure) are still a much more remote possibility.

4.43 While the extent and pace of the reforms of financial institutions is a matter of national policy, the provincial government can ease the transition towards a more indirectly managed economy. In particular, bank staff will need much training in improved methods of project (or credit) analysis,<sup>4/</sup> portfolio management, and other techniques of managing banks as enterprises. Since the experience of managing banks as enterprises is so far rather limited, it would also be desirable to provide some staff with overseas training in commercial and investment banks. The Gansu Investment and Trust Corporation (GITC) could play a considerable role in introducing improved investment decision-making and providing efficient financial services to enterprises. But GITC will have to undergo very substantial changes in policies, management and organization to become an efficient socialist investment bank under provincial control.

4.44 While banks are the most important institutions for promoting horizontal flows of finance to the highest value uses, leveraging of enterprise resources by bank loans alone will in many cases not be sufficient to pool enough capital to undertake projects for which minimum economic scales are rather large. This is the case, for example, in some agroprocessing activities that are undertaken by township enterprises on too small a scale (para 2.53). One alternative to setting up state enterprises in rural areas to fulfill this function would be to have several townships (and other investors) join in setting up a joint venture enterprise, for example, in the case of canning or the production of packaging materials. GITC, or possibly even a bank or its subsidiary, could arrange and participate in such ventures.

---

<sup>4/</sup> The China Investment Bank has published an "Appraisal Manual for Industrial Credit Projects," and a similar manual has been prepared by the Agricultural Bank of China.

4.45 With a larger role for enterprises and banks in investment decision-making, the role of the provincial Economic and Planning Commissions in project approval should be reduced commensurately. It is hoped that the Central Government will find better ways of allocating foreign exchange, for example, through appropriate exchange rate policies and the creation of a legal market for trading foreign exchange. In that case, the Planning Commission would be freed of this important but awkward and time-consuming task. The Planning Commission would then have more time for its original and more important tasks of providing a vision of where the province is going, coordinating the plans of the various bureaus, and planning and providing the necessary investments in infrastructure.

Appendix 1: Conditions and Prospects for Selected Agroindustries

1. During our visit to Gansu in November 1985, we had an opportunity to visit about 40 rural industries in four prefectures and Lanzhou, and to meet with provincial authorities and technical specialists concerned with this type of enterprise.<sup>1/</sup> While this constituted a useful cross-section of activities in the province, it was by no means a comprehensive survey. Therefore, the following comments and assessment are offered with the full knowledge that they may not reflect the conditions in some enterprises not visited, or the efforts of provincial agencies that may not have been adequately explored by members of the team.

Vegetable Oil Processing

2. The mission visited mills which process rapeseed and linseed. Single-stage screw presses are the common method of oil extraction among small mills, as would be expected by virtue of their low capital cost and relative simplicity of operation. Most mills produce edible oil for consumption within the township, although some large state enterprises buy in bulk to distribute to their employees. Linseed oil is also purchased by state enterprises from small mills for paint and varnish manufacture. There is not a raw material supply problem at the present time and the origin of this industry as a village service is still evident in the exchange of oil and seed with farmers whereby a share of raw material is still secured. Mills also purchase oilseed from the provincial grain bureau.

3. The product of mills visited is generally of poor quality by present commercial standards. This results from several factors:

- (a) inadequate seed cleaning, with the result that straw and other species remain in the material being crushed;
- (b) uneven heating of the material before crushing, with the loss of volatile flavor elements and the introduction of smoke and other oxidation flavors resulting from the burning of some seed and oil;
- (c) acquisition by the oil of off-flavors from iron pipes and poorly sealed seams and joints, as well as adulteration with dirt and other foreign material during handling and storage; and
- (d) higher oxidation and risk of rancidity by heat destruction of natural antioxidants, mixing of oils of different age, and excessive exposure to air between expulsion and storage. (Oxidation also results in lower yields of refined oil.)

---

<sup>1/</sup> Appendix 4 provides a selected sample of profiles of enterprise visited during this mission.

4. The historical markets for village oil processors have been local consumers, including the producers themselves. The markets have been protected by low prices and the absence of regional trade in processed staples, such as cooking oil. However, with increasing specialization of farm production and increasing dependence on trade, the opportunity for larger-scale processing arises, and with it improved technology. In China, quality differences are emerging as key factors in the development of interprovincial trade, and products from coastal provinces will pose a growing threat to traditional oil processors in Gansu as purchasing power and quality awareness increase among consumers. Once consumers have been introduced to a product which is more consistent in flavor and cooking quality, and does not have the off-flavors associated with overheating and accidental adulteration, the market for the inferior product will decline rapidly. Small village-level oilseed crushing mills are not normally seen as part of a well-developed agroindustrial sector, with the exception of isolated pockets of seed production and as primary processors serving the raw material needs of refiners. But for some years to come, these mills could continue to serve a useful function in Gansu provided a concerted effort was made soon to improve the quality being produced with existing technology.

5. In addition to the introduction of better handling practices and better awareness of the effects of conditions in the plant on quality, minor equipment changes would probably be financially and economically justified, including:

- (a) better seed-cleaning equipment;
- (b) more uniform heating, perhaps including the introduction of rotating drum heaters;
- (c) better control of the settings on crushers and regular replacement of moving parts and pressure surfaces;
- (d) closed ducts and storage tanks; and
- (e) replacement of iron ducts by specific plastics or, ideally, stainless steel.

6. It would also be useful to conduct a technical review of the refining process to determine what measures could be introduced at limited cost to improve the finished product. However, the economies of scale are much greater in refining than in milling and it is likely that refining would be more economically expanded among larger firms, perhaps those more typically established at the prefecture level.

7. The removal of oil from seed has traditionally been done by the expellor process that is common to the small mills in Gansu. However, this method has a very high operation and maintenance cost, and results in the expellor cake which still contains 7-8% oil. This not only results in a loss of the higher-value product, oil, but the oil content in the cake also reduces its storage life. In most cases, oilseed cake is fed to livestock as a protein source, and the feeding value of the oil in the cake is not commen-

surate with its value. Solvent extraction methods leave only about 0.5% oil in meal, but also by virtue of reduced handling and exposure to metal surfaces at high pressure, the resultant oil is less inclined to have off-flavors. In the evolution of vegetable oil industries, solvent extraction has replaced mechanical expulsion or is used in combination with it for high oil content species such as rape and flax. The two major problems associated with solvent extraction are initial capital investment and the necessarily much larger scale of operation.

8. Recommendations. A great deal can be done with existing small-scale mills to improve the quality and yield of their products, and thereby protect their local markets for the next few years. However, the long-term strategy for vegetable oil production in Gansu should include consideration of larger-scale units, probably using a combination of pre-exPELLORS and solvent extraction. It is therefore recommended that the responsible agencies consider the conduct of a provincial vegetable oil study that would include the following aspects:

- (a) the likely growth of oilseed production and vegetable oil consumption over the next ten years;
- (b) the comparative advantage of encouraging oilseed production as opposed to importing into the province either seed to support a provincial extraction industry or importing finished oil;
- (c) geographic distribution of production and consumption, to identify suitable locations for expanded processing capacity and local pockets where small-scale processing will continue to be viable;
- (d) low-cost measures which can be introduced to improve the performance of existing mills; and
- (e) guidelines for the selection of technology and scale of operations for future mills.

#### Fruit and Vegetable Preservation

9. Fruit and vegetable preservation among rural industries is presently done by cooking produce in sealed glass jars and by dehydration. While the equipment and processes are markedly different, the conditions in the plants visited by the mission were similar. Fresh produce is purchased from nearby producers, and processing is scheduled to coincide with the harvest season of the produce in question. With minor adjustments in process, different species can be preserved in the same facilities. The last species to mature, for example, pears and carrots, coincidentally have the best storage characteristics, so plant operations can be extended beyond the end of the growing season, thereby increasing fixed capital utilization and reducing unit costs. Both types of operation, as practiced in Gansu, are very labor-intensive, with fixed capital consisting primarily of buildings, work surfaces, water and steam systems and the cooking or drying units.

10. In such simple operations the control of quality and costs are a function of raw material supply, efficient use of labor, energy costs, and careful control of the cooking or drying process. Given that the total volume of raw material is not a problem, as seems to be the case in many areas of the province, the only two aspects of raw material which influence processing are the quality and condition of produce delivered to the plant and the varieties being cultivated. There is at present some use of differentials in prices to reflect the different quality and condition of produce but it is more common for plants to have a minimum standard, and to accept produce above that standard at a single price. Unfortunately, the regulation of prices, or more recently the official monitoring of prices, creates an atmosphere in which processors are reluctant to engage in price adjustment even within the limits of existing regulation. However, when finished goods must be produced to standard specifications, the effective cost of raw material depends very much on its condition and consequent processing losses. The variety of raw material being processed is also important since desirable characteristics of the end-product (such as firmness of fruit sections in a jar or low density of dried material) are often not related to characteristics which are preferred by consumers in the fresh market. Long-term plans for the cultivation of fruit and vegetables for processing should include variety trials and the promotion of varieties selected for their processing characteristics.

11. The present wage bonus system, in keeping with the concept of individual responsibility, rewards workers on the basis of productivity. However, this important factor does not appear to be carried over into plant design. Simple matters such as the height and arrangement of work surfaces, the flow of product from step to step in the process and the location of storage, working facilities, and waste disposal, could be reexamined and low-cost changes made that would increase labor productivity.

12. The abundance of coal and electricity in Gansu may be contributing to the generation and loss of excessive heat experienced in many of the fruit and vegetable plants visited by the mission. This is not simply a matter of plant management but also of equipment design. The wide range of calorie content among coals from different sources precludes any general statement about the appropriate number of tons of coal per ton of a particular finished product but the following are several indications that heat is being wasted: uninsulated and uncovered cooking vats; idle time in heated chambers; uninsulated pipes and duct work; open hot water reservoirs; and poor instrumentation. As energy policy evolves in the province, and rural industries become more conscious of the cost of heat generation, it would be useful for authorities, perhaps in the Bureau of Rural Industries, to have developed a series of measures which can be recommended to rural industries to control energy costs.

13. Process control is not only critical to the taste and appearance of the finished product; it is also important for product safety and in relation to cost control. The following areas are examples of where process control could be improved:

(a) Fruit Canning

- (i) mixing of sugar syrup;
- (ii) temperature and quantity of syrup placed in jars; and
- (iii) temperature and time in cooking and cooling vats.

(b) Fruit and Vegetable Dehydration

- (i) uniformity in shape and size of prepared pieces;
- (ii) temperature and time in drying chambers; and
- (iii) moisture content of finished product.

14. In many processes the experienced operator can judge a product by appearance or touch, but the absence of temperature and pressure gauges on processing equipment and, in the case of dehydration, the absence of moisture testing equipment, suggest too much room for error in the production of products for residential and industrial consumers who will increasingly have the option of alternative sources of supply. Consistency of quality is critical to the establishment and maintenance of market share.

15. Recommendations. There is considerable potential for the expansion of fruit and vegetable processing in Gansu, not only for the provincial market but for shipment to other provinces in the case of the temperate fruits for which Gansu is famous, and for export in the case of dehydrated vegetable ingredients. This expansion will probably take place voluntarily via the establishment of small facilities by producer cooperatives and local governments, and in the near future the only apparent problem for such enterprises will be the supply of glass containers for canneries. However, economies of scale and market organization are likely to become factors in fruit and vegetable processing at some point as rising incomes allow more and more consumers to insist on year-round supplies of seasonal produce. In areas of significant raw material production and good transportation infrastructure, this will lead to the potential for larger, more capital-intensive industries. Unless this development is anticipated, it is likely that branded products from other provinces will capture the growth in this market and begin to displace smaller processors. A strategic review of the province's fruit and vegetable processing industry at this time would enable authorities to plan the growth in the sector in a manner that could ensure the continued viability of small enterprises while gaining the advantage of larger firms in selected locations and activities. Such a review could include the following:

- (a) the location, species, and magnitude of fruit and vegetable production that is viable and consistent with other factors in selecting a cropping pattern;
- (b) a program of variety and agronomy trials to ensure that the best raw material is available for processing. (In this connection, it may prove viable to expand seed multiplication capacity for some of the most popular species;) and

- (c) a study of the situation and trend in food distribution and retailing to determine if there are likely to be structural impediments to marketing by small processors and to recommend appropriate assistance.

### Grain Milling

16. The major crop milled for human consumption is wheat, and about one third of Gansu's wheat supply is brought into the province by the Gansu Province Grain and Oil Industries Bureau. The bureau also buys about 70% of all grain produced in the province. It is therefore the major supplier to the 101 mills in the province and is charged with supervising their operations. Although some wheat is sold to mills at the established price plus Y 0.04/kg handling fee, most is processed on a fee basis and returned to the bureau for distribution. Processing fees are Y 15-20/ton of wheat depending on quality of flour to be produced and about Y 15/ton for corn depending on kernel size. Provincewide, the bureau supplies more than 75% of the grain processed by mills and it is unlikely that this is below 60% for any one mill. Mills are typically limited in working capital for grain purchases, in part because they have traditionally depended on processing for a fee. As a result, much of their dealings with private suppliers is on an exchange basis. The byproduct of grain supplied by the bureau is also returned by the mill for subsequent sale to feed mixing plants and food processors. (Wheat "bran" containing starch and germ is used in soy sauce and vinegar production.

17. Most mills in the province are 20 to 30 years old. While the equipment seen by the mission was consistent with the pattern of good maintenance that is characteristic of industry in Gansu, its design does not incorporate technological advances introduced in flour milling in recent years. The greatest advances have been in the area of particle size separation. The protein content varies with particle size and careful separation permits selection and blending so that specified flours can be produced from different varieties and grades of raw material. This technology is capital-intensive and is most efficient when applied in mills larger than most in Gansu. It is also primarily suited to sophisticated markets, including industrial compounders and bakeries where precise specifications command a price premium. However, flour yield and quality can also be influenced by other, less costly measures for which the modification and upgrading of existing mills might be appropriate. Of particular interest in this regard is better seed cleaning and standardization prior to milling, and improved separation of endosperm and germ from bran.

18. Presently, there is little incentive to millers to incur the cost of improving yields and quality. While there are price differentials among the three specified grades of flour, these are approximately in line with the respective milling costs and byproduct prices. Ancillary equipment for seed cleaning and component separation as well as mill settings and the condition of rollers are major factors in flour yield and there appears to be scope for upgrading these in the Gansu flour milling industry. However, for such a program to be financially viable some change in price structure for millers would be required.

19. Another factor to be considered is the growth of marketable surpluses of wheat in certain parts of the province, particularly Hexi, and the probable continuation of this pattern as new irrigation schemes come into production. This trend is gradually reducing the strategic importance of the Grains Bureau in the prevention of widespread hunger, and provincial authorities should consider expanding the role of direct producer-miller sales in meeting the province's flour needs. In many countries the desired stability in grain prices and the establishment of strategic stocks has been possible with public sector procurement of 10-15% of total production. The provincial imports of about 30% of total consumption are also a powerful tool for price control and regional grain balances and there is therefore little risk in reducing the bureau's share of procurement of provincial grain. The rate and extent of such a change would vary among regions depending on the availability of wheat in relation to local flour needs and the capacity of local mills to efficiently procure and distribute the product. The resources of the bureau which were no longer required for grain procurement could be used to initiate the financing of a warehouse receipt program as a source of working capital for millers. As the Agricultural Bank of China and the Industrial and Commercial Bank of China became familiar with this practice, and procedures became well-established, additional resources could be provided through the financial sector. With the reduction in the procurement role of the Grains Bureau, greater attention could be given to monitoring the flow of grain through the open market and to the development of its technical assistance functions. The bureau could also develop and promote the adoption of grain standards which would be the basis of price differentials paid by millers.

20. With the establishment of a price band (between a lower support price and a ceiling at which bureau stocks would be released), the incentive would exist for millers to introduce processing efficiencies and to produce the mix of products and byproducts most in demand in the province. Economic efficiencies would result not only from this responsiveness but also from reduced grain movements about the province.

21. This proposal would constitute a significant change in the concept of how food security is achieved in Gansu, but the mission believes that the provincial government, through the Grain Bureau, is carrying an unnecessarily heavy financial and administrative burden in this respect and that the checks and balances are in place to ensure minimum risk to the gradual shift of greater responsibility to producers and processors. Strategic stocks and regional imbalances should continue to be the Bureau's concerns, but increasing grain production and the expansion of open markets for agricultural products have created an opportunity to capture economic benefits.

#### Animal Feed Production

22. Like many rural industries, feed mills in Gansu are at different stages of evolution away from their traditional role of providing common services to village farmers in the processing of their products for local consumption. Some are very basic small-scale units that grind only 200-300 kg of grain per hour and may also mix ingredients mechanically; they usually operate on an exchange or fee basis. Others process several tons of grain and other ingredients per hour to produce carefully balanced feeds specifically formula-

ted for layers, broilers, hogs and dairy cows. The provincial agricultural university conducts regular research on animal nutrition and recommends feed formulae. These formulae and modifications using local agricultural byproducts are provided to feedmills by veterinarians assigned to the provincial livestock office in the locale of the mill.

23. Ingredients being used in the feeds in the province presently include corn, wheat bran, fishmeal, bone meal, oilseed cake, salt, mineral and vitamin supplements, and the ground, fermented or cooked residues of cereal and bean food processes. Sugar beet pulp is also fed to large animals where it is available. Many of these ingredients are becoming increasingly available from the expanding agricultural production of the province. This push factor, as well as the pull of rising demand for livestock products as income increases, has resulted in greater attention to animal nutrition, and more willingness on the part of livestock producers to purchase prepared feeds. There is no doubt that a major expansion of livestock production is feasible in Gansu and potentially a viable component of agricultural diversification as well as an area of increased specialization near urban centers or areas of high feed production. Breeding programs and animal health are as important as nutrition to the development of a commercial livestock industry, but in this section, a few comments are offered on the development needs of the feed industry.

24. Consistency in feed formulation. Where feed ingredients are available, the feed industry in a developing country faces one major barrier before it becomes an integral part of an intensive livestock sector: the suspicion of livestock producers who are not accustomed to purchasing the majority of feed for their animals. This is no longer a problem in Korea, for example, but it continues to be a major constraint in Pakistan and India. The performance of livestock under intensive husbandry is dependent on the feeding of a consistent, balanced diet with the prescribed levels of energy and protein. This performance is the only evidence of the quality of feed, and the livestock producers' willingness to continue to purchase prepared feeds depends on there being a sizable and predictable difference in animal performance. Many feed ingredients are not recognizable in processed form, and there is also a significant degree of substitutability among ingredients. Millers must therefore have access to a range of feed formulae which meet the prescribed needs of each type of animal and poultry to be fed, particularly energy and protein levels, and must adhere rigidly to those formulae. The formulae themselves are a function not only of the quality and type of ingredients available, but also of the type of livestock and stage of development. Ideally, large feed mills would have their own analytical capabilities, but as a minimum, the nutrition work of the agricultural university should be given adequate support to maintain a comprehensive program of analysis and feeding trials. The results of that work should be disseminated to all mills, and the level of technical assistance and enforcement increased.

25. Analysis of local byproduct ingredients. The ground, cooked or fermented byproducts of many food industries have significant feed value and are now being used as ingredients or independent supplements. However, if the maximum benefit is to be gained from these materials, and they are not to be permitted to interfere with the consumption and digestion of other feed materials, their nutrient and energy composition must be known. The mission was not able to ascertain the extent of analysis that is being done, but it was apparent that, at the level of the livestock producer, feeding levels and mixes varied considerably. This issue will become increasingly important as more livestock are fed on a regime close to their total consumption capacity.

26. Optimum size of operation. Some types of feed milling can be economically viable on a small scale. For example, cereal grinding and feed mixing are occasionally done at the level of individual feed lots in developed countries and the community feed mill is still a common feature. However, other elements, such as mineral and vitamin supplements should be produced on a larger scale. Some byproduct ingredients such as oilseed cake are available only in conjunction with the activities of other enterprises, the location of which is not based on the distribution of livestock population. A rational livestock feed industry therefore includes centralized producers of specialized ingredients, an efficient trade and handling network for the byproducts of larger related industries, and a large number of grinding and mixing operations typically located in areas of livestock population. Mills currently experience supply problems as a result of purchasing and transport constraints, but as the supply system improves, mills with capacities of one to ten tons per hour could be suited to the range of village and township conditions in Gansu.

### Bean Processing

27. A range of curd, noodle and sauce products are produced from navy beans and soy beans. The various processes of grinding, separation, fermenting, cooking, forming and drying are usually very labor-intensive and capital investment is primarily in buildings, work surfaces and cooking facilities. With the exception of repackaging in the case of some enterprises, the product is purchased by the final consumer in the form in which it leaves the rural enterprise.

28. For the most part, these enterprises cater to fairly small local markets for which they are either the sole supplier or have enjoyed some measure of protection as a result of inefficiencies in the trade and transport of food products. However, increasing consumer incomes and the development of better transport and distribution systems are beginning to create quality discrimination in the buying habits of even small rural communities in the province, and quality control will be essential to the survival of small food manufacturers. Poor handling practices, inappropriate equipment and materials, and inconsistent process control are the most common sources of adulteration and off-flavor. The conditions encountered by the mission varied among enterprises, suggesting more the need for awareness and technical assistance than a radical change in these traditional industries. If the relative cost of labor and food do not change significantly in the coming years, these small labor-intensive enterprises could continue to be viable, but to survive they

will have to anticipate the growing choice of products available to consumers and the quality standards on which purchase decisions among consumers will be made.

### Packaging Materials

29. Rural industries are engaged in the production of plastic bags, glass jars and corrugated cartons. The plastic bag operation visited by the mission was operating as a subcontractor for Lanzhou Petrochemical Industries,<sup>1/</sup> which supplied plastics in chip and crystal form and purchased all finished bags. The enterprise represents a unique combination of current technology - blown extrusion of polypropylene thread, recycling of used equipment -- weaving equipment from a textile mill, and labor-intensive methods -- cutting and stitching of bags. The pricing arrangements appeared to offer a good return to this undertaking and there is a growing demand for bags which could be met by similar arrangements with other small enterprises.

30. Glass jar production is done on a small scale (less than one ton per hour) by several enterprises, using extensive labor in forming and handling. The product is of satisfactory quality for the hand capping and low-speed mechanical capping operations that are used in small canning operations and the cost of these containers does not appear out of line in relation to the other costs of food processing. However, as the demand for containers increases the industry will need to review its total capacity to produce jars, and determine how large any new enterprises should be. Larger enterprises using more mechanized processes could improve unit cost and product quality. Such enterprises require significantly more capital and must be assured a steady supply of raw materials. However, the growing demand for jars, the probable introduction of high-speed capping systems in larger food processing enterprises, and the high cost of transportation of jars suggest that larger bottle plants in Gansu will have to be considered in the next few years.

31. Despite the obvious disadvantages of weight and breakage glass, jars rather than cans have been the containers of choice among small producers and food processors for several reasons: the raw materials themselves are widely available and are not capital-intensive; the manufacturing process is simple and can be done on a small scale; quality control is not as critical; and the food preserving process is simpler with jars. These factors have prevailed in Gansu to date, but the establishment of larger food processing industries and

---

1/ Worker Safety. This operation did highlight one serious problem in a number of rural enterprises visited by the mission, that of worker safety. The noise level in the weaving mill is probably high enough to result in permanent hearing impairment in a relatively short period of time. There and in other parts of the operation there were no shields around moving equipment. Both problems could be overcome at very low cost and with a commitment by authorities to develop a series of low-cost worker safety measures for rural industries and begin a program to promote their adoption, perhaps as a prerequisite for registration, access to allotted raw materials, or state financial assistance.

the introduction of processed foods that require more extensive processing measures may call for the introduction of cans for some share of the food processing industry. Such a decision will also have to take into account the changing technology in can production. For example, the traditional soldered tinfoil can is giving way in some markets to welded tinfoil. Nickel is replacing tinfoil, and extruded aluminum cans are also making inroads, particularly in beverages. No one of these alternatives can be generally considered superior, although the quality control problems of tinfoiling and soldering are such that this container will gradually disappear from the market in developed countries. Otherwise, markets for processed food in most countries of the world will continue for some years to be characterized by a range of cans depending on raw material availability, scale of operation, costs, the characteristics of the food processing industry being served, and consumer preference.

32. The two distinct products in corrugated cartons are the corrugating medium and the linerboard. Both may be produced from straw, but capital cost and quality control considerations usually dictate that linerboard be produced on a larger scale than may be viable for corrugating medium. While both elements contribute to the quality of the finished product, resistance to puncture and tearing, as well as the increasingly important issue of appearance and printing quality are determined by the linerboard. Straw will continue to be the major raw material for the foreseeable future in Gansu, and its availability is increasing rapidly with the growing production of cereals. In fact serious disposal problems are now confronting farmers in some townships of Hexi who, until recently, were faced with annual fodder shortages. The strategic focus for the development of corrugated carton production should therefore be on the best distribution of capital among enterprises engaged in the production of linerboard and corrugating medium from straw and the enterprise doing lamination, printing and forming.

33. Recommendations. The packaging material industry is a critical support sector which can have a fundamental impact on the development of other industries it serves. Because of the diversity of raw materials and technology used and the range of customers in different sectors of industry and commerce, packaging enterprises do not normally fall within the purview of one public sector agency nor are their various activities seen as essentially alternative means of meeting a common need. The present packaging industry in Gansu has satisfied admirably the fairly stable, small-scale demands of various manufacturers in the province until recent years with the expansion of processing activity both in diversity and total production. To anticipate the growing need for packaging materials and to determine the appropriate technology, scale and location of operations, we recommend that provincial authorities conduct an overall assessment of this sector leading to recommendations and guidelines for both new and existing packaging material enterprises. Such a study could include the following:

- (a) the likely growth in demand for containers and cartons and the product characteristics which will influence the type of materials to be used in packaging;

- (b) alternative canning technologies that may be best suited to larger-scale operations in areas of concentrated food preservation activity (this phase should take into account the upstream raw material supply problems associated with each technology as well as the process and product characteristics of container users);
- (c) production efficiency and distribution issues associated with glass container production and the longer-term role of glass in beverage and small-scale canning operations, probably primarily for local markets;
- (d) the location and size of carton production including the relationship between linerboard and corrugating medium producers;
- (e) improved handling and transport systems to reduce the costs of straw delivery to paper mills (including the feasibility of chopping or baling at site for areas of concentrated straw production, combined with truck and rail transport);
- (f) quality improvement, particularly in linerboard production to improve the serviceability of cartons as well as their appearance and printing quality (more important for retail containers and export markets); and
- (g) the establishment of an information and technical assistance capacity to ensure that present and prospective enterprises have access to current technology in packaging material production.

Appendix 2: Institutional Support for Rural Industries

1. Public sector institutions support and regulate the rural industry sector in the following principal areas: establishment, technical assistance, training, finance, raw material supplies, marketing, and prices. The three agencies with the greatest responsibility for these areas are the Bureau of Rural Industry, the Agriculture Bank of China and the Provincial Economic Commission. While the relationship among these agencies is collaborative, they are discussed separately in the following paragraphs with a focus on their primary responsibilities.

Bureau of Rural Industries

2. The Bureau of Rural Industries (BRI) is responsible for promotion and regulation in the establishment of rural enterprises, and for technical assistance and training. It also anticipates an expanding role in marketing assistance. In addition to its headquarters office in Lanzhou, the bureau has branches in each prefecture and municipality.

3. The staffing and until recently the organization of the bureau reflect the historical profile of rural industries, that of a small portion of the economy functioning in a highly regulated environment. BRI registered new enterprises approved by the Economic Commission at the sponsoring political level, aggregated applications for credit and raw material supplies from registered enterprises, and monitored their physical and financial performance. Promotion was not a part of the bureau's activities, and technical assistance appears to have been limited to addressing problems in larger enterprises that created a serious financial or raw material drain. The liberalization of conditions for rural industries and the resulting rapid expansion in this sector has placed very heavy demands on the bureau, and its management is to be commended for the manner in which it has responded in the face of serious staff and budget constraints.

Organization

4. In 1984, the bureau expanded the scope and organization of its technical assistance functions. The regulation and monitoring functions continue to have their own units and staff, but the following units have also been established:

- (a) Marketing Intelligence Unit. Identifies and monitors marketing opportunities; assembles product and interprovincial trade information and liaises with foreign trade agencies.
- (b) Technical Unit. Provides consulting services to rural enterprises in plant design, scale of operations, selection of equipment, and initial training of technical personnel.
- (c) Educational Unit. Organizes and conducts short-term training for management and technical personnel; operates the Training Center at Wuwei (para 2.09); and assists with arrangements for training and further education of the children of rural enterprise personnel.

- (d) Distribution and Sales Unit (established 1980). Processes raw material supply applications and arranges for distribution of allocated supplies among applicants; planned expansion of marketing assistance will be through this unit.
- (e) Technical Evaluation Unit. Appraises loan applications for establishment or expansion prior to transmittal to the Agriculture Bank of China.
- (f) Construction Unit. Provides construction enterprise with assistance in design, engineering, quality control and bidding; also conducts testing and certification program.
- (g) Enterprise Management Unit (not yet operational). Will address quality control and product standardization and will conduct regular site supervision and inspection for these purposes.

In addition, the Bureau plans to establish a Food Processing Association which will consist of the plant managers of all food processing enterprises as well as staff of the bureau. This will be a forum for the discussion of hygiene and quality control issues and the dissemination of related information.

5. The majority of direct contact between the bureau and individual rural enterprises takes place at the branch level. In contrast to the pattern often found in promotion and technical assistance agencies in other countries, BRI appears to have made a special effort to keep good quality staff in branch offices rather than letting them concentrate at headquarters. While there is an overall shortage of staff with formal training, branch personnel met by the mission were consistently well-informed and enthusiastic. They appeared to have frequent and helpful contact with their client enterprises.

#### BRI Branch Operations -- The Example of Jiayuguan

6. The branch in Jiayuguan is typical of the bureau's operations in an area of significant rural industry activity. In addition to the Director, there are 2 Vice Directors in charge of production and technical information issues, respectively, and 14 field staff. Only two of the staff have university training; three are middle-school graduates in education, mining and construction. The branch has only one vehicle, and all operational field work is accomplished using public transport.

7. In 1985, short-term courses in management and technical subjects were provided to personnel from more than 450 of the 2,900 enterprises in the prefecture (5 sessions, ranging from 15 to 20 days each, held at the local agriculture secondary school). Shorter, less formal courses on specific issues such as bookkeeping are also conducted on an ongoing basis at the county level, using schools or community halls. Branch staff arranged study tours and courses in other provinces for 432 managers and staff of rural enterprises. The total cost of training and education for rural industry personnel in the prefecture this year is about Y 770,000, of which all but Y 12,000 is being funded by the rural industries themselves. The other major

technical assistance-cum-training function of bureau staff is to identify and make arrangements for visits by experts invited from other provinces (para. 11). There are presently 754 such experts in various rural industries in Jiayuguan. Needs are identified by Branch staff and they monitor the results of expert contracts, although the identification of experts and arrangements for their assignments are coordinated by headquarters. The Director indicated satisfaction with the results of this program for short-term needs, but emphasized the importance of training enterprise personnel themselves as the long-term solution. The training function of invited experts is, in his view, not always given adequate priority.

8. Two other functions of branch staff should be mentioned. In the case of new products, staff arrange for technical and market evaluation in Lanzhou and carry out appropriate follow-up with the enterprise concerned. And, although greater flexibility has been introduced in pricing policy in recent years, prices must still essentially be based on costs, and branch staff provide supporting information to the price board at the political level responsible for monitoring prices and approving changes for the enterprise in question.

### Training

9. The most widespread training activities of the bureau are those conducted by branch staff as illustrated above, as well as on-the-job training during site visits. However, BRI is also responsible for the Rural Industries Training Center at Wuwei. Formerly an agricultural secondary school, the Center opened in 1985, and will complete the year with 107 students enrolled full-time in 2- to 3-year courses and 500 individuals having been participants in short courses. The center is to serve the dual purpose of training staff for the bureau and training the personnel of rural enterprises. Although there is no rule to this effect, it is expected that the longer-term courses will be used primarily for bureau staff while most short courses will be designed to directly serve the needs of enterprises. The two- to three-year courses (depending on the students' entry level) are presently in industrial and civil construction, as well as enterprise management. (Each field has five to eight areas of specialization.) Short courses (one to four months) are presently offered in agricultural machinery, mining safety, enterprise monitoring, and scientific and technical information. Facilities presently located on the 4.5-ha site include a 3-story academic and administration complex, residence for the 48 staff and faculty, dormitories for over 300 students, common facilities such as a cafeteria and an auditorium and a building presently being renovated for use as a laboratory.

10. It is planned that, for administration and accreditation purposes the center will become part of the secondary technical school system in 1990 under the State Education Commission, but curriculum will remain the responsibility of the bureau. Diploma courses will be added in 1987 in mining and agroprocessing and there will also be a gradual expansion of short-term courses. A detailed development program has been prepared with student, program and facility targets through 1990.

### Invited Experts

11. BRI is responsible for the administration of this scheme whereby experienced personnel from other provinces are engaged to assist rural industries in Gansu. Most are retired engineers or technical specialists, although active employees from related enterprises may also be given leave from their regular employment to participate in the program. The latter is typically the case where a lump sum is paid to an enterprise for the purchase, installation and start-up of a new technology. In total, 3,400 invited experts were engaged by rural industries in Gansu in 1985. Contracts for individuals range from 3-12 months and a typical salary is Y 300 per month although rates may be as high as Y 30,000-50,000 or alternatively may be based on a share of incremental profits (up to 30%.)

12. This is a valuable source of expertise, and while costs are much higher than local salary rates, they are well below the cost of technical assistance from international sources. To ensure that the maximum advantage is realized from the scheme several aspects could be strengthened:

- (a) more attention at the time of contracting to the specific responsibilities of the invited experts and to his or her appropriate skills;
- (b) regular review of work by a technically competent resource person from BRI; and
- (c) increased emphasis on the training of local personnel by invited experts.

### Establishment of Rural Industries

13. Farm households or employees of public enterprises can engage in sideline activities without registration. However, an enterprise must be registered with BRI to receive technical assistance and training offered by BRI, to secure any raw material supplies at allocated prices, or to apply for credit. As a fee for these services, rural enterprises pay 1% of net income to BRI. To qualify for registration, an enterprise must operate at least three months per year. The other condition is that individual and joint household enterprises cannot have fixed investment in excess of Y 300,000. Beyond that level, there must be village or township participation. Registration involves the provision of information on ownership, location, employees, process, capital, raw materials and costs and prices to the local branch of BRI together with evidence of the approval of proposed prices by the (price control agency) of the political unit in which the enterprise operates. Upon registration, the enterprise is granted a three-year profit tax holiday and is eligible to apply for raw materials and formal credit. The distribution of profits during the tax-free period is the same as that normally applied to after-tax profits, namely, 60% retained for reinvestment; 20% paid to the local township (as compensation for services and infrastructure); 1% to BRI; and 19% distributed among the shareholders.

### Credit

14. Final decisions on lending and the administration of credit, are handled by the Agriculture Bank of China (ABC). However, assistance to enterprises in preparing applications, and the conduct of feasibility studies as well as the bulk of appraisal work are done by BRI staff. The extent of headquarters involvement in a particular proposal depends on the level of ownership of the enterprise, the size of the enterprise or application and the complexity of technical or marketing issues. The other active participant in this process is the Provincial Economic Commission and its local equivalents at prefecture and township levels.

15. State investment in rural industries is in the form of an annual allocation to the provincial credit operations of ABC. It is granted initially to the provincial government on the basis of a budget request by BRI and then passed to the provincial branch of ABC for administration. In 1984, these funds amounted to Y 19.2 million and in 1985, more than 300 loans were approved with a total value of Y 40.0 million.

### Raw Material Supply

16. BRI annually compiles the raw material requests of registered rural enterprises and these are pooled with the needs of other sectors of the economy to arrive at an estimate of provincial requirements. After the process of negotiation with Beijing and the determination of provincial allocations, the share available for rural industries is allocated by BRI among applicants. This is done in the form of an authorization which the enterprise may then present to the agency which handles the physical distribution of the material in question.

17. Allocated commodities and prices are rapidly declining as a share of transactions in the economy, a function not only of limited official supplies, but of a freeing up of price regulations so that processors of the raw materials may pass on the higher cost of supplies to their customers. The system now applies primarily to materials for capital construction such as steel and cement, although commodities such as cotton and wool which are traded inter-provincially, and processing inputs such as petrochemicals which are produced by large state enterprises, are still distributed in part through this system. In 1985, it is estimated that only 10% of the overall needs of rural industries in Gansu were supplied through the allocation system.

### Marketing

18. The role of BRI in marketing has been primarily to provide assistance to individual enterprises, although rural market and trade information is compiled in Lanzhou. The bureau plans a much more formal and ambitious program in this area, including a multistory exhibition center in Lanzhou. Marketing is an area that will require careful consideration and perhaps outside assistance, at least from elsewhere in China, if it is to be effective.

Agriculture Bank of China

19. ABC is the only public financial institution which lends to rural enterprises in the province, and the share of lending to that sector is growing rapidly. In 1984, total loans to rural enterprises were Y 67 million; in the first 10 months of 1985, loans had reached Y 101 million, extended to 6,000 enterprises. This amounted to 29.4% of total ABC loans in the province in comparison with only 12.5% in 1978. Fifty percent of these loans were to industrial enterprises, the balance for transportation, construction, and commerce.

20. The two main sources of funds for lending operations in ABC are its own sources, including allocations from headquarters and state investment funds administered by ABC. In 1985, the distribution of rural enterprise loans between these two sources was 60:40. Although ABC officially has the final decision in granting a loan, and it bears the risk in its portfolio, most of the applications are evaluated by BRI and the Provincial Economic Commission. In the highly regulated environment which characterized rural enterprises until recent years, this arrangement was effective because most of the determinants of success were controlled by these agencies, for example raw material, labor and energy costs, and prices. However, with the freeing up of prices and the development of alternative markets and sources of raw materials, much greater risk and variation has emerged in the conditions of individual enterprises seeking credit. Credit risks are becoming much more commercial in nature and the type of appraisal necessary to assess these risks has changed. Under these conditions, it has become important for authorities concerned with the long-term viability of rural enterprises to reevaluate the system, skills and allocation of responsibility for the granting of credit.

Provincial Economic Commission

21. The roles of the Provincial Economic Commission concerning rural industry pertain principally to the allocation of raw materials and the approval of credit. In both cases, relations with individual enterprises are handled by BRI. For raw material allocations, the aggregate needs of rural industries are presented to the commission annually by the bureau; the commission then adds these needs to those of other sectors of the economy and conducts negotiations with the Central Government. Concerning credit, the commission's role is to work with the bureau in assessing the feasibility of individual proposals, particularly with respect to raw material supplies and access to markets controlled by state enterprises and agencies, and ensuring that proposals are consistent with provincial development strategies. Endorsement by the commission is a prerequisite for loan consideration by ABC.

Appendix 3: Costs of Electric Power Generation in Gansu

1. The costs of electric power in Gansu are an important factor for the economic viability of some of the large irrigation projects, and also for some electricity-intensive heavy industry projects such as aluminum smelters. It is widely believed in Gansu (and elsewhere in China) that the cost of hydroelectric power generation in Gansu is as low as 2 f/kWh. However, an economic analysis of one of the best available hydropower sites in Gansu (Daxia), using standard Western methods of project appraisal shows that the cost of hydroelectric power generation is considerably higher, and is of the order of 5-7 f/kWh, not much lower than the cost of thermal power generation in a coastal location that is in the range of 7-8 f/kWh, using the same methods. Thus, electric power generation in Gansu appears to be only 1-2 f/kWh (13-30%) cheaper than elsewhere in China, and this small cost advantage would require further careful project analysis before a decision could be taken on an energy-intensive project (such as a high-lift irrigation scheme, or an aluminum smelter).

2. The main difference between our estimate and Chinese estimates appears to be due to the different concepts of project analysis. Standard methods used by the World Bank and many developing countries, ranging from South Korea to Hungary use the concept of "opportunity costs of capital" in project analysis. It is recognized that investment funds are scarce and only those projects that promise the highest economic returns (consistent with the availability of funds) should be undertaken. The experience of other developing countries shows that even at an interest rate (opportunity cost of capital) of 10% p.a. (in real terms, that is, adjusted for inflation) there are normally far too many "profitable" projects for the available and limited investment resources. As the opportunity costs of capital are increased toward 15%, many projects, particularly those with long gestation periods become unprofitable and are rejected. At some interest rates, available investment funds are just sufficient for all remaining profitable projects. It is difficult to estimate this rate (or opportunity cost of capital) precisely, but it usually lies between 10% and 15%. For example, in South Korea, a rate of 13.5% is used by the Government for appraisal of projects to be financed by the government, and in Hungary the rate adopted is 12%. Given the large demands for capital-intensive infrastructure projects, the opportunity cost of capital in China is probably closer to 13% than to 10% p.a.

3. Table 1 gives an estimate of the costs of electric power generation for the proposed Daxia hydropower station in Gansu for which some cost estimates and other necessary technical data were available. The projected total expenditure for this project with 300 MW was given at Y 500 million by the provincial authorities, using imported construction technology to shorten the construction period to 6.5 years.<sup>1/</sup> It is understood that this cost estimate does not include interest during construction (sometimes called "overnight"

---

<sup>1/</sup> Earlier cost estimates based on Chinese construction technology (and a longer construction period) were given as Y 300 million.

construction costs). For a project with such a long gestation period, interest during construction is an important economic cost of the project and adds about 40-50% to the construction costs. At the estimated average utilization of 57% availability (due to seasonal and year-to-year differences in water), the costs of electric power generation are then 4.9 f/kWh at an opportunity cost of capital of 10%, and 7.1 f/kWh at 13% (Table 1).

4. A similar estimate can be made for a thermal (coal-fired) power plant in a coastal location. We have used data from the Beilungang project being financed by the World Bank for which detailed cost estimates were available. While "overnight" construction costs per kW capacity are only 15% cheaper, total capacity costs including interest during construction, are 17-25% lower, due to the shorter construction period for a coal-fired power station. As the capacity utilization is not constrained by seasonal factors (such as water availability), the projected capacity factor is higher (70%), and total fixed costs are 25-33% lower than in the case of Daxia. The cost of coal has been estimated with the same methodology, and is considerably higher than prevailing coal prices in China (that also do not adequately take into account the capital costs of coal mine development and transport).

5. By international standards, these costs of electricity generation (transmission costs would have to be added) are quite low, due to favorable hydropower sites, low costs of coal mining, and the availability of high-quality coal that makes expensive environmental control measures in coal-fired power plants (such as flue gas desulfurization) unnecessary. But the differences between the somewhat cheaper hydropower in Gansu and the more expensive thermal power in a coastal location do not provide a large cost advantage in electric power generation for Gansu. From the hydrological data available (Table 5) it appears that electric power generation in Gansu is mostly energy (water) constrained, rather than capacity constrained, and for this reason, the cost of electric power generation does not vary much during the year. Also, with the exception of the month of May, when reservoir levels are low, most power requirements for irrigation occur when water supply is ample. Large year-to-year variations in water availability contribute considerably to the projected low capacity utilization of the Daxia hydropower station (57%).

6. Another way to look at the cost of electric power in Gansu is as "opportunity costs" of electric power exports to a coastal area. Table 3 presents cost estimates for direct current (DC) transmission of electric power from Gansu to Beijing/Tianjiu, a transmission distance of about 1,400 km. Such a transmission line is currently planned from the Longyangxia power station in Qinghai, near the border with Gansu, to Beijing. The assumed construction costs for a DC transmission line are based on a recent World Bank project in India with base costs of \$330,000/km, for a capacity of 1,000 MW. Projected transmission costs range between 2.9-3.6 f/kWh for DC transmission, at 70% capacity utilization of the transmission line to reflect daily and seasonal variations in demand and seasonal and yearly variations in water

availability.<sup>2/</sup> The opportunity costs of electric power exports from Gansu to Beijing/Tianjin are the difference between the costs of thermal power generation in a coastal location (Table 2) and the costs of transmission (Table 3), and are about 4.2 - 4.6 f/kWh for opportunity costs of capital of 10 and 13%, respectively. This is somewhat lower than the cost of electric power generation in Gansu (Table 1).

7. Thus, it appears that rapid development of even the cheapest sites on the upper Huang He for electricity export is not economically justified. Planning and construction of hydropower stations in Gansu should thus proceed in line with regional power demand. Interconnection with coastal areas is mainly justified to offset seasonal or yearly water availability and indivisibilities of large new projects, such as Longyangxia (1,200 MW). More detailed project analysis would again be required to evaluate the appropriate extent and timing of interconnection.

---

<sup>2/</sup> The line would probably be used at 95% capacity, importing energy during low water periods thus avoiding additional thermal capacity in Gansu. The economic justification would be based primarily on exports (70% of the time).

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Costs of Electric Power Generation, Daxia  
Hydropower Station in Gansu

Capacity: 300 MW

Projected generation: 1.5 TWh/year (=57% capacity factor)

Projected costs: Y500 million ("overnight" costs)

Construction time: 6.5 years

	10% opportunity cost of capital ----- Y/kW	13% opportunity cost of capital -----
Overnight cost	1,667	1,667
Interest during construction /a	650	867
<u>Total</u>	<u>2,137</u>	<u>2,534</u>
Plant life (years)	30	30
	----- Y/kW/year -----	
Capital cost	227	338
Operation and maintenance (1% of "overnight" costs)	17	17
<u>Total</u>	<u>244</u>	<u>355</u>
Capacity factor	57%	57%
	----- f/kWh -----	
<u>Total</u>	<u>4.9</u>	<u>7.1</u>

/a Assuming a typical construction cost expenditure time profile.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Costs of Electric Power Generation, Thermal (Coal)  
Power Station, Coastal Location  
(Beilungang Project)

Capacity: 1,200 MW

Projected Generation: 7.36 TWh/year (=70% capacity factor)

Projected Costs: Y1,697 million ("overnight" costs)

Construction time: 4.5 years

Fuel costs: Y93.5/t coal delivered; 6,000 kcal/kg

	10% opportunity cost of capital ----- Y/kW -----	13% opportunity cost of capital -----
Overnight cost	1,414	1,414
Interest during construction	353	466
<u>Total</u>	<u>1,767</u>	<u>1,880</u>
Plant life (years)	30	30
	----- Y/kW/year -----	-----
Capital cost	187	251
Operation and maintenance (3% of "overnight" costs)	42	42
<u>Total</u>	<u>229</u>	<u>293</u>
Capacity factor	70%	70%
	----- f/kWh -----	-----
Fixed costs	3.7	4.8
Fuel costs	3.4	3.4
<u>Total</u>	<u>7.1</u>	<u>8.2</u>

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Costs of Electric Power Transmission from  
Gansu to Beijing/Tianjin (1,400 km)

Voltage: 500 kV, direct current (DC)

Capacity: 1,000 MW

Project costs: Y 925,000/km

Line losses: 4%

Construction time: 2 years

	10% opportunity cost of capital ----- Y/kW -----	13% opportunity cost of capital ----- Y/kW -----
Overnight cost	1,295	1,295
Interest during construction	130	168
<u>Total</u>	<u>1,425</u>	<u>1,463</u>
	----- Y/kW/year -----	----- Y/kW/year -----
Capital cost	151	195
Operation and maintenance (1% of "overnight" costs)	13	13
<u>Total</u>	<u>164</u>	<u>208</u>
Capacity factor	70%	70%
	----- f/kWh -----	----- f/kWh -----
Fixed costs	2.7	3.4
Losses (4%)	0.2	0.2
<u>Total</u>	<u>2.9</u>	<u>3.6</u>

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Gansu Electric Power Statistics, 1984

Month	Total available capacity (MW)	Maximum Load		Total electricity generation (GWh)	Total electricity consumption (GWh)	Agricultural electricity consumption (GWh)
		Hydro (MW)	Thermal (MW)			
1	2,000	1,332	650	1,110	870	68
2	1,950	1,288	600	940	780	60
3	2,050	1,259	650	1,000	840	51
4	1,900	1,278	550	970	800	70
5	2,100	1,526	650	1,200	990	200
6	2,150	1,510	650	1,130	950	220
7	2,300	1,374	450	1,210	850	132
8	2,300	1,255	400	1,230	830	102
9	2,400	1,259	500	1,140	800	75
10	2,500	1,436	550	1,290	910	105
11	2,500	1,646	650	1,250	1,040	205
12	2,300	1,450	600	1,030	940	98
<u>Total</u>				<u>13,500</u>	<u>10,600</u>	
(Industry)					7,230	
(Agriculture)					1,376	
(Municipal)					510	
(Communication)					200	
(Transmission losses)					1,280	

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Gansu: Five Year Average Hydrological Data for  
the Liujiaxia Reservoir, 1980-84

Month	Reservoir inflow m <sup>3</sup> /s	Reservoir outflow m <sup>3</sup> /s	Reservoir level m
1	256	525	1,727.46
2	273	457	1,722.7
3	324	449	1,719.13
4	482	661	1,714.85
5	703	900	1,709.7
6	1,248	1,160	1,706.6
7	2,264	1,898	1,715.6
8	1,526	1,374	1,720.7
9	2,134	1,602	1,728.0
10	1,702	1,564	1,734.1
11	770	816	1,734.7
12	370	521	1,732.9



Appendix 4: Profiles of Selected Enterprises in Gansu

State Enterprises

1. No. 1 Woolen Textile Mill, Lanzhou
2. Raw Wool Preparation Plant, Lanzhou
3. Lanzhou Leather Tannery Factory
4. Jin Dong TV Component Factory, Dingxi

Collective Enterprises

5. Dingxi County Carpet Factory
6. Tongwei County Straw Weaving Factory
7. Xigu Township Plastic Weaving Factory
8. Xigu Township Glass Bottle Factory

Collectives of Individuals/Individual Enterprises

9. Tian Ma Food Processing
10. Tao Hai Fruit Canning
11. Tailoring

1. No. 1 Woolen Textile Mill, Lanzhou

Supervisory Corporation:	Gansu General Wool Textile Corporation
Ownership:	State Enterprise (Municipality)
Product:	Wool and blended fabrics
Fixed Assets:	Gross Y 48 million; net Y 32 million
Output Value:	1985 Y 85 million (estimated)
Profit before income tax:	1985 Y 24 million (estimated)
Employees:	5,600

This integrated mill is one of the largest in the province under the control of the Gansu General Wool Textile Corporation, and is administratively supervised by the Provincial Bureau of Light Industry. There are 11 wool mills controlled by the corporation of which 7 are considered to be small; 10 of the mills are located in Lanzhou. There also are a number of smaller mills located in other urban centers in the province under the supervision of the local authorities.

The mill was established about 40 years ago and its present facilities include 11,600 spindles (6,500 for worsted and semi-worsted yarns, 4,000 for woolen yarns, 1,200 for blanket yarns). The preparation of the raw wool (mostly sheep, some camel and yak) prior to drawing and spinning is done in another factory owned by the parent corporation. At present, approximately 2,800 t/y of wool and about 2,000 t/y of synthetics (for blending) are spun into yarns in the mill. The spinning facilities are relatively old requiring large labor inputs resulting in low output efficiency and inconsistencies in quality of the yarns. About 80% of the wool is from Gansu and 20% of finer sheep wool varieties is imported from abroad. The synthetic fibers are mostly purchased from outside the province. In the past raw wool cost Y4/kg and was allocated; now the wool is generally purchased in the open market at Y8.5/kg. Imported wool and Gansu wool used for fabrics to be exported, however, continue to be allocated at Y4/kg since the price received by the mill for exports is fixed by the parent corporation. Procurement of synthetic fiber, depending on the supply situation, is from allocation and free market.

The weaving and finishing sections are operating close to capacity. Annual production is: worsted fabrics - 1.65 million meters, wool fabrics 1.65 million meters, blankets 0.6 million meters. The worsted fabrics are of reasonable (mainly worsted and semi-worsted) are exported and 70% sold domestically. The price received by the factory for exports is determined by the export agency involved, depending on the quality of the fabrics to be exported. There is now no official intervention in domestic sales with regard to either price or quantity except when inputs are allocated (mainly synthetics).

The plant facilities have been expanded and implemented over the years in what appears to be a piecemeal and somewhat haphazard manner. The layout is crowded and organization of materials flow leaves much to be desired. The marketable quality of the worsted fabrics is largely due to extensive manual quality control exercised by the factory, and to the skill and dexterity of the workers many of whom have been with the mill for many years (with preference given to family dependents in recruiting new employees). There is considerable scope for rationalization of production, and given the tightness of the present set-up and lack of space, consideration should be given as to whether this mill should not concentrate on weaving and finishing of worsted fabrics and exploit economies of scale by specializing. This may mean transferring spinning operations and possibly the weaving of other woolen fabrics and blankets, from the present mill. The management of the mill described ideas to specialize in worsteds by expanding the numbers of spindles from 6,500 to 10,000 for worsted yarn (investment cost Y 9.6 million), renovating and expanding the old worsted weaving looms (investment cost Y 19 million). Management also thought it a good idea to separate the lines for weaving and finishing woolen fabrics and blankets. In this connection, consideration should be given to enlarging production in the province of higher quality woolens (e.g., for overcoats) on a reasonable size scale. It is interesting to note that the parent corporation is located on the premises of the #1 Wool Textile Mill.

Specialization of wool production activities occurs to some extent in the province and should be encouraged. For example, the No. 4 Woolen Mill specializes in Jacquard (pattern) weaving and the Gansu Knitting Yarn Wool Mill specializes in knitting yarns. The preparation and preprocessing of raw wool (prior to spinning) is done in a central facility.

2. Raw Wool Preparation Plant, Lanzhou

Ownership:	State Enterprise (Municipality)
Annual Production:	1,500 tons washed wool; 2,600 tons skeines
Fixed Investment:	Y 29.53 million
Circulating Capital:	Y 45 million
Bank Loan:	Y 41 million short term
Gross Product Value:	Y 51 million
Employees: - Fixed:	1,540
- Seasonal:	-
- Total:	1,540
Specific Products:	Washed wool and loose skeines
Market:	Other member mills of the Gansu Woolen Textile Corporation; some open market sales once corporate quotas have been reached.

**Description:** Wool is purchased from individual producers and groups at more than fifty procurement points in Gansu and adjacent provinces. Wool prices were freed this year and the results have been as follows:

Native Wool - 1984: Y 4/kg; 1985: Y 7.5 - 8.0/kg  
 Fine Wool - 1984: Y 5.5/kg; 1985: Y 9.5 - 10.0/kg

The company buys 20-30% native and 70-80% fine wool. Its purchases outside the province are not related to quality differences but to quantity.

**Selection:** One hundred and thirty people each grade 100 kg of wool per day. Selection is based on length of fibre, strength of fibre, and dirt. Because no machinery is used in this process, it is located on the top floor of the complex (3rd floor). One thousand tons of selected wool can be stored on the second floor, above the washing room.

**Washing:** There are four washing and drying lines, each capable of processing 1.5 tons per shift. The plant works on a three shift basis. Dust removal is first achieved by metal fingers on a belt pulling the wool and separating it into a continuous mat, followed by passage over a vibrating screen. An additional stretching and separating of fibres is achieved by drawing the wool onto a continuous belt covered with fine nail-like teeth. Actual washing is in a series of five vats, the first of which has detergent added to the water. Temperatures vary from an initial 45°C to 50°C in the second tank, and declining again to 40 - 45°C in the final tank. The wool then passes through forced air driers at a temperature of 60°C. Drying is accomplished in two minutes.

Blending: Two counter-rotating drums studded with nail-like teeth stretch and blend the fibres. A small amount of vegetable oil is added to facilitate drawing. There are two such blenders in this mill, each capable of processing two tons per shift.

Carding: There are fourteen multi-stage carding machines in the plant, each capable of processing 800 kg of wool per 22 hour day (three 7 1/2 hour shifts). Loose continuous skeine about 1 1/2 inches in diameter is collected in 12 kg net weight drums for transport to the next stage.

Yarn Production: The loose skeines pass through three successive stages of combining, carding and stretching. In the first, ten skeines are combined into one; in the second and third stages, six skeines are combined into one. The wool in a single skeine emerging from these stages therefore originated in 360 of the loose skeines described above. Each of the 120 machines performing these operations produces 46 kg per hour. In a separate operation, the fibres in these intermediate skeines are straightened and knots are removed. In the final step, the wool is given a fine carding and a twisting motion as it is wound into 5 kg skeines. These are wrapped in polyethylene and packed six to a bag for shipment.

Expansion Plans: None disclosed.

Comments: This operation serves the raw material needs of other factories of the company. It is a new plant, and given the poor condition of its wool intake, is probably operating well. However, there are two fundamental problems. Firstly, the incoming wool is in such bad condition (dirty primarily, but also knotted) that yield is only 40% by weight, in contrast to 80% in Australia. Secondly, the price structure is such that the plant cannot generate a surplus. The manager offered the explanation that this was a service unit for the weaving mills, but that begs the basic question of transfer pricing policy and the potential economic gains of market pricing and more latitude for sales to other mills. Washed wool sold for Y 11.5/kg last year, yarn for Y 22/kg. Corresponding prices this year to member mills are Y 16.5/kg and 28/kg respectively, but the open market price is 60% higher than these levels. This plant also occupies prime land on a main thoroughfare within Lanzhou, a site which is not only more valuable for other uses but which probably adds to the time and cost of transport due to congestion.

3. Lanzhou Leather Tannery Factory

Ownership:	State Enterprise (Municipality)
Product:	Tanned leather hides
Fixed Assets:	Gross Y 7 million; net Y 4 million
Output Value:	1985 Y 15 million (estimated)
Profit before income tax:	1985 Y 1.5 million (estimated)
Employees:	450

The factory had been built up over the years since 1964 but remains an antiquated and technologically backward facility. Annual capacity is about 300,000 standard pieces of hide. In 1985, the processing is expected to consist of 90,000 standard pieces of cowhide, 200,000 pighides (2 hides per standard piece) 320,000 goathides (6 hides per standard piece). Production is lower than capacity because of the larger amount of smaller goathides being processed - goat leather is in demand for garment manufacture and Gansu Province is one of the largest single sources of goats in the country.

There apparently are five other tanneries in the province but this is by far the largest, producing about 60% of the output of leather. Even so, the factory's production capacity is barely above minimal size, which to a large extent has been determined by the availability of raw pelts suitable for processing and tanning. Nearly all the raw pelts are purchased from areas around Lanzhou. Pigskin is purchased wet from Lanzhou slaughterhouses and in salted form from other urban slaughterhouses, at subsidized prices (Y 2.8 per wet hide less Y 1.8 subsidy) fixed by the province to encourage use of pigskins by the factory. Cowhides, goatskins and some yakhides are generally purchased air dry since the slaughterhouses' supply of cattleskins is very small and goat abattoirs are primitive at best. Since September 1984, these airdried skins have been purchased at free market prices which are significantly higher than the previous allocated prices (cowhide Y 55/piece - allocated price was Y 20; goathide Y 13/skin - allocated price was Y 5). Sales of finished leather are at fixed prices calculated by the Price Bureau on a cost plus 10% basis depending on quality, grade, etc.

While the quantity of raw material supply to the factory due to inadequate organization in collection and transportation is the major constraint, the more serious factor is the poor quality of the skins (e.g., holes, damage due to injuries, poor slaughter procedures) which can only be improved by better livestock practices. Raw skins are inspected before purchase but given the gross supply constraint, rejection standards are somewhat loose so as to ensure that the factory can gainfully employ its workers. This, however, leads to production of leather that cannot meet quality standards (e.g., unevenness, damaged hides, non-uniform tanning) and therefore to low percentage of utilization of the leather by eventual users.

Gansu Province is one of the largest livestock producers in the country and we understand it has considerable potential for expansion of this sector. Moreover, Gansu borders three other pastoral provinces. The province can be expected to have a significant comparative advantage over other less endowed areas in the supply of hides and in leather processing. It may therefore be advantageous to develop collection and preprocessing centers around the livestock intensive areas in the province (with appropriate abattoir facilities) where the selection and primary treatments of the raw pelts could be done (e.g., there already exist 5 small tanneries which could be used for this purpose). These treated hides could then be transported in bulk to the Lanzhou factory which would be a specialized facility for final processing, tanning and finishing. Such a plan would provide the justification for revamping, reconstruction and expansion of the Lanzhou factory into a large-scale modern leather establishment. It makes little sense to expand the present set up at the factory without addressing the structural deficiencies in the subsector as a whole.

4. Jin Dong TV Component Factory, Dingxi

Ownership:	State Enterprise (Province)
Product:	TV Components (using copper wire)
Fixed Assets:	Gross Y 18.26 million; net Y 15.35 million
Output Value:	1985 Y 78 million (estimated)
Profit before income tax:	1985 Y 21.0 million (estimated)
Employees:	2,824

This factory originally was a centrally owned state enterprise producing electronic radio communication equipment mostly for the defense services. A few years ago, the factory's fairly extensive facilities and most of its employees were transferred to provincial ownership and reoriented toward TV component manufacture. More recently the factory was identified by the Government as one of the 25 key TV component factories in the country (and therefore will get approval for large scale investments) and the only one in the entire Northwest.

At the moment, the factory produces 1.5 million/year of mechanical VHF and UHF tuners, 100,000/year of flyback transformers and 100,000/year of deflection coils, all for black and white TV sets. The Lanzhou TV Factory obtains its requirements of black and white TV tuners and coils from this component factory. Until very recently, the factory also produced cassette recorder and playback mechanisms, and desk-top cassette recorder/players, but these have been discontinued because of severe domestic competition and marketing problems.

The factory received approval from the center and the provincial authorities to undertake a Y 15 million expansion, presently under implementation to produce 500,000/year of electronic tuners for color TV using NEC (Japan) design and know-how, 500,000/year of flyback transformers for color TV based on Matsushita (Japan) design and know-how, and 500,000/year of deflection coils for display monitors (e.g. computer screens) and cathode ray oscillographs for test instruments. We were told that the NEC design for tuners and Matsushita design for flyback transformers are compatible for use in color TVs of other Japanese and European manufacturing design. The above capacities are based on a single shift/day operation and if the market develops in due course, management expects to adopt two shift/day procedures. It is not clear at this time whether the sale price of components will be fixed and allocated to assembly factories or whether free market sales will prevail or whether there will be a combination of both forms of sales. The size of new expansion is appropriate and should result in economically viable operations. The factory has no plans to expand black and white TV component manufacture from the present levels.

The factory is unusual in that certain elementary or simple components used by it are sub-contracted to others - 6 subcontractors in Gansu Province, including 3 in Dingxi County itself, and 15 subcontractors in Zhejiang and Jiangsu provinces. In response to our queries about transferring subcontracting from outside into Gansu province, the management indicated that the level of skills and vocational training institutions in Gansu is inadequate and that subcontracting facilities would require investments in the order of Y10-15 million which the province does not have. Clearly this matter should be reassessed by the provincial planners, particularly since the factory has the capability to provide rigorous training and supportive know-how to subcontractors, especially those located nearby.

5. Dingxi County Carpet Factory

Ownership:	Collective Enterprise (County)
Product:	Wool Carpets
Fixed Assets:	Gross Y1.43 million; net Y0.91 million
Output Value:	1985: Y2.8 million (estimated)
Profit before income tax:	1985: Y0.2 million (estimated)
Employees:	1200

This highly labor intensive factory starts with cleaned and scoured raw wool ready to be carded and spun into carpet yarn, which is then dyed, dried and woven into carpets (mainly traditional designs but some designs woven to order), washed, trimmed, sheared and finished. Part of the weaving and finishing is also done at another location.

The wool is procured by the factory in the free market without any official interventions. Supplies are readily available but prices have been increasing significantly since the market was opened. In 1984, average price of wool was Y4.10/kg; in 1985, the price ranged from Y7.4-8.0/kg. The yarn is spun on small frames of antique design requiring considerable labor and manual dexterity on the part of the workers, but the entire spinning operation is rather well organized and supervised. The yarn is of very good quality and is hand dyed and dried in appropriate facilities. The yarn output, 140,000 kg/y, is in excess of the factory's present needs - about half the output is sold to others.

The weaving is done entirely by hand, as also the washing, trimming and shearing. Nearly all the carpets are sold by the factory to the Foreign Trade Corporation for export; the factory is not authorized to export directly although a very small amount is allowed of those carpets exhibited at the annual Guangzhou Carpet Fair. Total production of the essentially hand-crafted carpets in 1985 is expected to be about 15,000 m<sup>2</sup> (135,000 ft<sup>2</sup>) which is close to the maximum capacity. The weaving section was expanded last year by almost doubling the previous facilities and recruiting about 180 new employees.

The profitability of the factory is quite small in relation to the output value. The price received by the factory from the export agency is presently Y21/ft<sup>2</sup> which yields only about Y1.5/ft<sup>2</sup> profit. Caught between the free market price for the raw wool on the one hand and the fixed price paid by the export agency on the other, the factory's profit prospects appear slim. The quality of the carpets is considered to be among the best in China with good lustre, good color, high pile and high count, and there is a continuing overseas demand for these carpets. The characteristically hand-crafted

quality is much sought after by discriminating carpet experts - so much so, that the factory has been requested by the export agency to weave carpets to non-Chinese designs ordered by overseas buyers. We were told that there are a number of similar small such factories in the province facing similar financial problems. The factory is trying to find ways to improve its profitability and has even gone to the extent of considering the manufacture of non-woven carpets. The provincial authorities need to review the status of the wool carpet subsector and the options available to nurture and develop the unique craftsmanship entailed in Gansu woven carpets. Small factories making handmade carpets, however excellent the quality may be, are particularly vulnerable since they have little flexibility to maneuver unless they find a market niche which they can fill in a singular manner. It might be worthwhile to reassess the role of the export agency and whether this (and other such factories in the province) should not have a closer link with foreign buyers as to be more knowledgeable about and more responsive to market developments.

6. Tongwei County Straw Weaving Factory

Ownership:	Collective Enterprise (County)
Product:	Wheat straw woven products
Fixed Assets:	Gross Y420,000
Output Value:	1985 Y1.1 million (estimated)
Profit before income tax:	1985 Y120.000 (estimated)
Employees:	190

This is a handicraft factory which weaves wheat straw into a variety of consumer and tourist products, e.g. straw hats, place mats, handbags etc. The input material are skeins of straw plaits approximately 1cm wide and 20m long purchased from farmers and their families at Y0.27/skein. A person can make 2 skeins per day and in the county a typical farmer household of four can earn about Y2-3 per day from this side activity. Skein making is done by farmers more or less throughout the year. The price paid for each skein is determined by the factory from time to time. Approximately 20,000 people from farms supplied the 3 million skeins purchased by the factory during the past 12 months.

In the factory the raw skeins are bleached and some are dyed. The skeins are then pressed, sewn and steam treated under pressure into the various products. For example 1.7 skeins are required for a hat which is sold at Y0.80. The processes are highly labor intensive involving considerable manual skills. The equipment is relatively old fashioned, including the presses and sewing machines, but generally well maintained and appropriate for the undertaking. Value added in the factory is about Y 0.20 per skein which is relatively high compared to the cost of the input material. There are four factories similar to this one in the county. Distribution and sales agents advise the factory regarding the products.

The prospects for growth and diversification depend a great deal on the distributorships and the feedback they provide on new markets, trends, products and designs. We were told that factories in other provinces have enquired about purchasing the bleached skeins so as to produce the marketable products themselves. This may imply that there is room for improvements in the role of the distributorships and sales agencies for the products made in this factory. Perhaps it would be in the county's interest to evaluate the present distribution and sales arrangement with a view to ascertaining whether the information and feedback on market developments are appropriate to enable expansion and diversification of the operations, particularly for higher value added products. There also may be merit in some form of cooperation with straw product factories in the more endowed provinces which cater high quality straw products to discriminating consumers both within China and abroad.

7. Xigu Township Plastic Weaving Factory

Ownership: Collective Enterprise (Township)

Annual Production: 3 million m<sup>2</sup>

Gross Product Value: Y 970,000

Employees: 300

Specific Products: Polypropylene bags with polyethylene liners; common size 60 cm X 85 cm.

Market: All production sold to Lanzhou Chemical Factory from which they buy all crystals and pellets.

Description: Polypropylene pellets are melted and drawn as a 30 cm wide sheet through a cooling bath before passing through a set of knives. The flat strips are then stretched and partially rolled as they are cooled under tension to produce uniform coarse threads which are then wound onto spindles. The weaving machinery was purchased secondhand from a textile mill. Cutting the cloth to size with hot wire cutters is labour intensive but uses locally made, low-cost equipment. Polyethylene liner is produced by blow extrusion in a Chinese-made piece of electronically controlled equipment, and the product was very consistent. Liner and bag are paired manually before folding and stitching, the latter step being done on an industrial sewing machine.

Expansion Plans: None disclosed.

Comments: This factory provides another example of employment creation by subcontracting in which the raw material and the market are provided by a state-owned factory. The margin in this case appeared attractive. The most serious problem here is the working conditions: noise level in the weaving mill was quite intolerable, much louder than that in textile mills visited subsequently, and there was no protection from moving machinery either in the weaving mill or in the spinning operation. Although the acceptable level of worker protection in the province may be quite different from that which would prevail in developed countries, there was considerable variation among plants visited.

Plastic WeavingSummary of Costs and Prices obtained  
during field visits in November '85

	<u>Amount</u> (Yuan)	<u>Comments</u>
<u>Finished Goods</u>		
<u>Lined Bags</u>	1.35 each	- Standard size 60 cm X 85 cm - 650,000 bags per year
<u>Raw Material</u>		
Polypropylene:		- Total raw materials
Y 1/bag		- 105 gm. per square meter.
- Allocated Price	2,800/ton	
- Market Price	3,300/ton	
Polyethylene	---	
<u>Labor:</u>		
Weavers/Stitchers	90/month	- Bonus ave. Y 7/month
Mechanical/Technical Staff	150/month	
<u>Administration:</u>	2/bag	- Y 130,000/Yr at full capacity
<u>Net Income (Before Taxes):</u>	.15/bag	- Y 97,500 at full capacity

8. Xigu Township Glass Bottle Factory

Ownership:	Collective Enterprise (Township)
Annual Production:	4,500 tons of jars per year
Fixed Investment:	Y 1.5 million
Gross Product Value:	Y 2.0 million
Employees:	223
Specific Products:	500 gram and 50 gram glass jars
Market:	Gansu and three other provinces, all under contract

Description: Molten material from the oil-fired furnace is mechanically portioned and dropped through conduction tubes to a two-step die casting operation, the first being to create a central recess in the lump, the second to complete the forming by inserting a hydrolically powered expanding piston into the central recess. Both steps are accomplished at a rotating table with two work stations and a discharge station. Jars are then hand-carried to an annealing furnace, also oil-fired. Jars emerge from this last process cool enough to be handled, and are packed in gunny sacks.

Expansion Plans: A new furnace was installed this year, and it will permit expansion of production over the next year to 6,000 tons of finished product.

Comments: There was excessive heat loss from the furnaces, particularly the melting furnace. There is a 15% breakage during processing, which seems high and may be due to the age of the die equipment and consequent uneven stress during molding, annealing and cooling. Jars had slight unevenness of opening, but not enough to interfere with manual filling or low-speed capping equipment. Raw material supply allocated to the plant is not enough for its needs, but free market supplies are available, at higher prices.

Glass Bottle FactorySummary of Costs and Prices obtained  
during field visits in November '85

	<u>Amount</u> (Yuan)	<u>Comments</u>
<u>Finished Goods</u>		
- 500 cc jars	.17 each	- Prices set by Bureau of Rural Industry and Price Bureau of Prefecture (15% breakage).
- 50 cc jars	.06 each	
<u>Soda Ash:</u>		
- Allocated Price	420/ton	- 30% of requirements.
- Market Price	680/ton	- 70 of requirements.
<u>Heavy Oil:</u>	106/ton	- 1,800 tons per year. Market and allocated prices the same in Lanzhou. (Allocation is 90% of needs).
<u>Labor:</u>		
- New	1/day+points	Points related to attendance and output. Typical award is .8 point per day. Each point is worth Y 5.72. Average monthly wage is Y 110 plus a bonus averaging Y 20; no other social benefits. Retirees earn Y 1200 one-time payment after 10 years.
- Regular	1.4/day+points	

9. Tian Ma Food Processing

Ownership: Cooperative

Annual Production: 2,900 tons various foods and beverages, plus  
3,000 tons feed

Fixed Investment: Y 1.04 million

Circulating Capital: Y 800,000

Bank Loan: Y 300,000 (equity Y 1.2 million after 3 years)

Gross Product Value: Y 3 million

Employees: 400

Specific Products: Candy (500 tons), white bean curd (300 tons),  
bean noodles (100 tons), wine (2,000 tons),  
and animal feed (3,000 tons)

Market: Candy - national, other items local

Description: Mr. Chen started Tian Ma (Galloping Horse) three years ago and is today the most important member of the cooperative. He personally invested Y 50,000, others contributed a total of Y 120,000, and he is today still a 40% member. All operations, as well as his attractive residence and housing for all employees, are located on a 24 mu plot, which can accommodate further expansion.

Candy: This year-round operation produces an annual total of 500 tons of ten different types of hard and soft candy. Most are taffy based, and while the production is labour intensive, the work room was clean and the equipment seemed to be well maintained. Five mechanics are employed fulltime to maintain equipment for the whole complex as well as to do fabrication. Candy production employs 100 staff fulltime in four shifts 24 hours each day. Fixed assets in this plant are Y 150,000 and gross product value is Y 1 million per year. An interesting feature of this cooperative is that each staff member is expected to learn several skills and to rotate with peak demand among plants. Packaging for candy alone costs Y 300,000 per year. Boiling and mixing, kneading, cooling, cutting and wrapping are the steps in this simple operation. There are no supply problems, although sugar is Y 1,300/ton delivered compared to the allocated price of Y 1,200.

White Bean Curd: One hundred and twenty workers are employed 7 months per year in producing 300 tons of curd from navy beans. Gross product value is about Y 900,000 per year. Beans are first soaked for four hours and then ground and placed in 100 kg cookers in an 8:1 water ratio for 30 minutes. Open pan evaporators are used to heat the cooked solution and curd forms on the surface to be regularly skimmed off and hung on racks above the pans. The

400 pans are each .3 X .4 metres and are steam heated such that evaporation takes place at 45°C. The solution has an initial depth of about 7cm. Production is 350 kg per 6-hour shift. Subsequent drying takes place in a heated room, and the product is packed in 0.5 kg plastic bags. One kg of beans yield 0.5 kg of curd.

Bean Noodles: Soybeans are ground and screened before being cooked. Cooked bean starch then hangs in cloth sacks for four hours before being transferred to the extrusion process. After the addition of a little water, the dough is extruded through a forming nozzle to fall into a bath of water to remove free surface starch. Noodles are then hung either indoors or in the sun depending on the time of year. The ratio of bean to noodle is 3:1. Forty workers are engaged in this plant, but not all year.

Wines: This is in fact a sparkling fruit drink to which is added 2% alcohol. The technology was imported from Beijing this year, and consists of juice blending (4% juice concentrate, 10% sugar, 10% wheat germ, 72.5% water, 2% alcohol, and flavors. The mixture is filtered twice, pasteurized, bottled, and CO<sup>2</sup> is added during capping. (Alcohol is added after pasteurizing.) This is a popular seasonal drink, but very little is consumed during the winter months. In six months of operation next year, the plant expects to produce 2,000 tons of wine which sells ex-plant for Y .68 and costs Y .50 to produce. Bottles at Y .21 each come from Lanzhou and amount to an annual cost of Y 300,000.

Feed Mill: 3,000 tons per year are produced using grain and processing byproducts. The fixed investment is Y 250,000.

Expansion Plans: The plan is to process all products in the immediate community by 1990, and to generate a gross product value of Y 30 million. Immediate plans call for corrugated carton production, bottle manufacture, and a brewery which will employ 1,500 people and produce 10,000 tons of beer per year.

Comments: This is an exciting venture, and it demonstrates the entrepreneurial spirit as well as demand in the rural areas. However, the venture also represents a widespread risk, that is, the early success being experienced by most rural enterprises is fostering some large plans which are either beyond the capacity of firms to implement, or are clearly in the realm where economies of scale dictate that another size of enterprise should be doing them. This is a well run firm, but there are still technical issues which should receive greater attention, and there should be more consideration of activities that fit their size and management structure.

Food ProcessingSummary of Costs and Prices Obtained  
during Field Visits in November '85

	<u>Amount</u> (Yuan)	<u>Comments</u>
<u>Finished Goods:</u>		
Candy	1.05 - 1.20/jin; 2.10 - 2.40/kg	
Bean curd		
- ex-factory	2/jin; 4/kg	- Total cost of production, 1.45/jin
- retail	2.40/jin; 4.80/kg	
Bean noodles	1/jin; 2/kg	
"Wine"	.68/bottle	- Carbonated fruit drink with 2% alcohol added. Total cost of production, .50/bottle.
<u>Raw Materials:</u>		
Sugar	1,300/ton; 1.30/kg	- delivered
Navy beans	.35/jin; 70/kg	
Soybean	.20/jin; 40/kg	
<u>Labor:</u>		
- Fixed, regular	70/month	- Bonuses as high as Y50/M
- Administration	50 - 200/month	
- Technicians	300/month	- Including all benefits
<u>Packaging</u>		
- Corrugated cartons	1.50 each	- About 1 ft
- Glass bottles	.21 each	- one litre size

10. Tao Hai Fruit Canning

Ownership: Collective of individuals (six families)

Annual Production: 1,000 tons of fruit in jars

Fixed Investment: Y 450,000

Circulating Capital: Y 210,000

Gross Product Value: Y 2,200,000

Employees - Fixed: 120  
- Seasonal: Up to 80  
- Total: Up to 200

Specific Products: Peaches, apricots, apples, pears in 500 gm jars and 20% sugar syrup

Market: 90% to state-owned stores, balance to collectives and individuals, primarily Lanzhou

Description: This is a very simple, labor-intensive operation, consisting of cutting and blanching the fruit, putting it in jars, adding sugar syrup, capping (the only mechanical step in the process), and cooking for 40 minutes in an open vat into which is lowered a basket containing 720 jars per charge. The product is then cooled successively in two vats of 70°C for 15 minutes each. Jars, old and new, are cleaned before filling by being dipped in tubs of potassium permanganate and a final boiling water wash. Storage adjacent to the plant, in some buildings, is solid and dry. Fruit is purchased from local orchards, and there is evidently no supply problem. The company has its own truck. Production started late in the harvest season this year; output is expected to reach 800 tons next year and full capacity the year after.

Expansion Plans: An identical building is under construction adjacent to the fruit operation, in which meat canning, in jars, is planned to begin next year.

Comments: This is a very basic operation and it is not being run carefully either from the hygiene or labor and energy efficiency standpoint. Work surfaces are not at a good height or well arranged; syrup preparation is not accurately controlled, and the temperature of the syrup entering the jars and the headspace in the jars varies considerably. As a result, there is some bulging of caps during boiling. Vats are not insulated or covered, and thermometers were not in evidence. Bottle washing was not observed. Some jars are off-round or have uneven lid surfaces; 11% average breakage.

Fruit CanningSummary of Costs and Prices  
Obtained during Field Visit in Nov. '85

	<u>Amount</u> (Yuan)	<u>Comments</u>
<u>Finished Goods</u>		
<u>(Ex-factory)</u>		
<u>(500 gm.glass jars)</u>		
Peach halves	1.18/jin; 2,360/ton	- Packed in 20% sugar syrup
Pear halves	1.06/jin; 2,120/ton	Packed in 20% sugar syrup
Apple section	1.06/jin; 2,120/ton	Packed in 20% sugar syrup
<u>Raw Materials</u>		
Peaches	.7/kg	
Appricots	.64/kg	
Apples	.7/kg	
Pears	.55/kg	
Sugar	1.46/kg	
<u>Packaging</u>		
New 500 gm Jars	.15 each	- Average breakage 11%
old		
Used 500 gm Jars.	.10 each	
Ring Seals	.015 each	
Labels	.022 each	
Lids	.08 each	- Also quoted .07
<u>Labor</u>		
Fixed - Wage	80/month	- 120 staff
- Bonus	20/month	
Seasonal- Wage	3/day	- Up to 80 at peak season
- Bonus	N/A	
<u>Utilities</u>		
Electricity	300/month	
Water	80/month	
Coal (delivered)	40/ton	- 80 tons per month; seems extremely high.
Administration	.02/jar; 40,000/yr	
Social Costs	.03/jar; 60,000/yr	
Repair & Maintenance	.015/jar; 30,000/yr	
Additives	.068/jar; 136,000/yr	- At Full Capacity
Depreciation	.03/jar; 60,000/yr	- Ave.13.3% of Fixed Assets

11. Tailoring

Ownership: Individual

Fixed Investment: Y 4,000 without building (estimate)

Gross Product Value: Y 8,000

Employees - Fixed: 8  
- Seasonal: 4  
- Total: 12

Specific Products: Jackets, pants, dresses and uniforms

Market: Individuals in township and "units" which place quantity orders

Description: The owner was formerly a tailor in a commune factory. His enterprise is run out of his home. One modest room contains the two trimmers and the eight sewing machines which make up the equipment of the operations. (The cost of trimmers is Y 400 each; sewing machines cost Y 200 each). Most individual sales are received from a rented display facility opposite the town's train station (Y 300/yr for 10 m<sup>2</sup>). Customers provide their own material. An apprentice system is in effect, with new employees working without pay for six months, after which salaries are increased from Y 30/month to Y 80/month.

Expansion Plans: Plans include (a) expansion of the rail station display facility to include production; (b) sending the son off to study advanced tailoring; and (c) purchasing materials and producing ready-made clothing.

Comments: The energy and sense of direction of this entrepreneur are quite remarkable. He has a very clear picture of where he wants to go and how to get there. He clearly earns more than others in the village and the mission was appraised of a number of social contributions he has made which indicate a strong sense of community. There were several style magazines in the workroom suggesting his contact with the market outside China.

12. Carpet Weaving

Ownership: Township

Annual Production 10,000 sq. ft. cap: 7,300 sq. ft. '85

Fixed Investment: (Est.) Y 300,000

Circulating Capital:

Bank Loan:

Gross Product Value: Y 94,900 in '84 (Y88,000 in 10 months to 10/85)

Employees - Fixed: 120  
- Seasonal: -  
- Total: 120

Specific Products: Good quality semi-finished carpet of Peking, imitation antique, plain, and art designs.

Market: All production is sold to the General Carpet Factory which supplies the prepared yarn.

Description: This is a very labor-intensive operation. The general purpose buildings that house the various looms are cramped but adequate, steel tube looms are solid, and one is capable of handling up to five meter widths. The enterprise is one of eight in a compound established for enterprises owned by the district of Lanzhou.

Expansion Plans: Plans include expansion of carpet production by another 30,000 sq. ft per year, and to add a finishing plant. The total new fixed investment of Y 600,000 is evenly distributed between the two proposals.

Comment: This operation functions essentially as a satellite labor unit of the G.C.F. The only benefit that accrues to the township is the labor payment, and in fact it appears that there are financial losses on the operation as a whole. Workers produce on average 30 sq. ft. of carpet per month and they appeared to be efficient workers. The problem lies in the poor margin between the yarn and carpet prices. The proposed finishing would appear to be profitable, but there is a serious risk that they will have a marketing problem as well as a raw material supply problem if they try to separate themselves from the G.C.F. Consistency of yarn quality and supply in the open market needs to be carefully checked, and despite the quality of the finished product, sales promotion and outlets could be hampered by lack of knowhow and obstruction by the G.C.F. In light of their financial situation, it is not surprising that they are having problems raising the equity to qualify for a loan.

Appendix 5: Selected Industrial Statistics

Note

There are considerable differences between Chinese and Western economic statistics. The most important and most obvious is that Chinese economic statistics use predominantly gross output value, whereas in Western province value added (gross output minus intermediate inputs) is preferred, to avoid double-counting. There are also considerable differences in the definition of sectors. Chinese economic statistics exclude "nonproductive" personal services from national income. The most frequently used economic indicator in China, "Gross Output Value of Agriculture and Industry" (GVIAO) excludes also construction, transport and commerce. Until 1984, the output of village enterprises was included in agricultural output (GVAO), but, starting with the publication of the 1985 Statistical Yearbook, output of village enterprises were included in the respective sectors (industry, construction, transport). Another difference is that the industry sector in World Bank statistics usually includes mining, manufacturing, construction and electricity, gas and water, whereas in China, construction is excluded from "industry." The Chinese definition of industry is thus intermediate between the World Bank definitions of "industry" and "manufacturing" (that is, manufacturing plus mining plus electric power).

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEGross Value of Industrial Output  
(Y million in 1980 prices)

	1949	1979	1982	1983	1984
Gansu /a	104	8,279	8,075	8,811	9,799
Jiangsu /b	1,223	36,345	50,291	56,881	-
China /c	11,269	457,202	557,745	616,441	702,985
<u>By Ownership</u>					
<u>State</u>					
Gansu		7,782	7,555	8,239	9,039
Jiangsu		n.a.	30,606	33,724	-
China		374,445	434,030	474,778	517,120
<u>Collective</u>					
Gansu		497	516	566	728
Jiangsu		n.a.	19,137	22,278	-
China		83,371	119,281	135,423	175,786
<u>By Broad Industrial Category</u>					
<u>Light</u>					
Gansu	-	1,476	1,883	2,021	2,277
Jiangsu	1,156	19,408	29,843	33,440	-
China	8,635	194,112	281,487	305,974	348,416
<u>Heavy</u>					
Gansu	-	6,803	6,192	6,790	7,522
Jiangsu	67	16,937	20,478	23,505	-
China	2,635	260,253	276,258	310,467	354,569

/a Figures for 1949 and 1979 were rough approximations based on Almanac of China's Economy 1981, pp. 797-798.

/b Jiangsu's Thirty-Five Years 1949-83, pp. 25-26.

/c Statistical Yearbook of China, 1984, pp. 23-24 and China: Statistics Survey, 1985.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCE

Gansu: Gross Industrial Output Value (GVIO)  
(Y million, 1980 prices)

	1978	1979	1980	1981	1982	1983	1984
State	n.a.	7,782	n.a.	6,962	7,555	8,239	9,039
Collective	n.a.	497	n.a.	479	516	566	728
Other	-	-	-	-	-	6	32
<u>GVIO</u>	<u>8,032</u>	<u>8,279</u>	<u>8,086</u>	<u>7,444</u>	<u>8,075</u>	<u>8,811</u>	<u>9,799</u>
Light	1,491	1,476	1,610	1,727	1,883	2,021	2,277
Heavy	6,541	6,803	6,476	5,717	6,192	6,790	7,522
Metallurgy				1,137	1,108	1,279	1,486
Power				790	867	893	950
Coal				188	210	224	256
Petroleum				1,197	1,281	1,325	1,412
Chemicals				844	911	1,028	1,116
Machinery				1,452	1,681	1,902	2,191
Building materials				248	290	318	378
Forestry				102	106	113	124
Food				560	606	604	627
Textiles				376	405	464	515
Clothing				128	128	137	148
Leather				67	69	70	74
Paper				24	25	31	36
Other				331	388	423	486
<u>Total</u>				<u>7,113</u>	<u>8,075</u>	<u>8,811</u>	<u>9,799</u>

Source: Gansu Statistical Bureau.

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Jiangsu: Gross Industrial Output Value (GVIO) /a  
(Y million, 1980 prices)

	1978	1979	1980	1981	1982	1983	1984
State	n.a.	n.a.	n.a.	28,523	30,606	33,724	36,367
Collective	n.a.	n.a.	n.a.	17,634	19,137	22,278	30,072
Other	n.a.	n.a.	n.a.	412	578	943	1,574
<u>GVIO</u>	<u>32,017</u>	<u>36,345</u>	<u>43,115</u>	<u>46,569</u>	<u>50,321</u>	<u>56,945</u>	<u>68,013</u>
Light	16,585	19,408	24,576	28,464	29,843	33,440	39,316
Heavy	15,432	16,937	18,539	18,105	20,478	23,505	28,697
Metallurgy	1,108				1,649	1,861	2,249
Power	823				1,119	1,148	1,290
Coal	441				458	556	568
Petroleum	1,008				1,201	1,287	1,361
Chemicals	4,089				6,743	7,647	8,845
Machinery	8,161				11,765	13,999	18,287
Building materials	2,076				2,004	3,293	3,953
Forestry	-				305/b	338	407
Food	3,038				6,214	6,442	7,043
Textiles	-					15,104	17,544
Clothing	- 7,159				12,046	1,477	1,801
Leather	-					493	574
Paper	255				385	425	1,775
Other	3,859				6,432	2,875	2,316
<u>Total</u>	<u>32,017</u>				<u>50,321</u>	<u>56,945</u>	<u>68,013</u>

/a Jiangsu's Thirty-Five Years, 1949-83, pp. 23, 43; Statistical Yearbook of China, 1985, pp. 139, 322-326.

/b Approximated from "forestry" in agricultural output, p. 29.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCE

China: Gross Industrial Output Value (GVIO) /a  
(Y million, 1980 prices)

	1978	1979	1980	1981	1982	1983	1984
State	347,100/b	374,445	395,441	405,437	434,030	474,778	517,120
Collective (Township)	81,371	83,857	99,600	168,927	119,281	135,423	175,780
<u>GVIO</u>	<u>428,417</u>	<u>457,202</u>	<u>497,211</u>	<u>517,767</u>	<u>557,745</u>	<u>616,441</u>	<u>702,990</u>
Light	177,116	194,112	229,824	266,289	281,487	305,974	348,842
Heavy	241,645	260,253	263,898	251,478	276,258	310,467	354,457
Metallurgy	37,701/c			45,669	48,523	52,368	57,940
Power	16,280			19,486	20,707	22,023	23,560
Coal	11,996			15,726	16,630	17,833	18,220
Petroleum	23,563			28,213	28,798	31,009	33,410
Chemicals	53,124			59,143	65,901	74,114	83,030
Machinery	116,958			107,995	122,506	144,048	175,571
Building materials	15,851			19,507	22,258	24,544	28,730
Forestry	7,712			10,490	11,225	11,606	12,680
Food	47,983			69,012	75,552	79,425	86,580
Textiles	-			85,602	86,685	95,604	-
Clothing	- 53,552			14,724	14,194	15,346	-108,290
Leather	-			5,858	5,567	5,701	-
Paper /d	5,569			6,940	7,396	8,141	9,220
Other	38,128			29,402	31,803	34,679	65,759
<u>Total</u>	<u>428,417</u>			<u>517,767</u>	<u>557,745</u>	<u>616,441</u>	<u>702,990</u>

/a Statistical Yearbook of China, 1981-84; China: A Statistics Survey in 1985.

/b Industrial Development in China, 1949-84; Chinese Statistical Bulletin, p. 67.

/c Ibid, p. 45. Approximated from the 1975 composition.

/d Excluding cultural and education materials.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEGross Value of Industrial Output by Industrial Subsector, 1983

	<u>Gansu</u>		<u>Jiangsu</u>		<u>China</u>	
	<u>Y mln</u>	<u>%</u>	<u>Y mln</u>	<u>%</u>	<u>Y mln</u>	<u>%</u>
Metallurgy	1,279	14.5	1,861	3.3	52,368	8.5
Power	893	10.1	1,148	2.0	22,023	3.6
Coal	224	2.5	504	0.9	16,664	2.7
Petroleum	1,325	15.0	1,287	2.3	31,009	5.0
Chemical	1,028	11.7	7,647	13.4	74,114	12.0
Machinery	1,902	21.6	13,999	24.6	144,048	23.4
Building materials	318	3.6	3,293	5.8	24,544	4.0
Forestry	113	1.3	338	0.6	11,606	1.9
Food	604	6.9	6,442	11.3	79,425	12.9
Textiles	464	5.3	15,104	26.5	95,604	15.5
Clothing	137	1.6	1,477	2.6	15,346	2.5
Leather	70	0.8	493	0.9	5,701	0.9
Paper	159	1.8	1,499	2.6	21,555	3.5
Other	295	3.3	1,853	3.3	22,434	3.6
<u>Total</u>	<u>8,811</u>	<u>100.0</u>	<u>56,945</u>	<u>100.0</u>	<u>616,441</u>	<u>100.0</u>

Sources: Gansu Statistical Bureau, 1984; Jiangsu's Thirty-Five Years 1949-83, Jiangsu Statistical Bureau (May 1984); Statistical Yearbook of China, 1984.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEGrowth of Gross Value of Industrial Output (GVIO), 1949-84  
(% p.a.)

	1949-79	1979-82	1983	1984
<u>Gross Output Growth</u>				
Gansu Province	15.7	-0.8	9.1	11.2
Jiangsu Province	13.2	11.5	13.2	19.4
China	13.3	5.0	10.5	14.0
<u>State Enterprises</u>				
Gansu Province	...	-1.0	9.1	9.7
Jiangsu Province	...	8.3	10.2	7.8
China	13.6	5.0	9.4	8.9
<u>Collective Enterprises</u>				
Gansu Province	...	1.3	9.7	28.6
Jiangsu Province	...	16.4	11.9	36.3
China	12.3	12.5	13.5	29.8
<u>Light Industry</u>				
Gansu Province	10.0	8.5	7.3	12.7
Jiangsu Province	11.1	15.4	12.1	17.6
China	11.0	13.2	8.7	14.0
<u>Heavy Industry</u>				
Gansu Province	21.3	-3.1	9.7	10.8
Jiangsu Province	20.8	6.5	14.8	22.1
China	16.5	2.0	12.4	14.2

Sources: China: A Statistics Survey, 1985 and those listed in Tables 3 and 5.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Industrial Output by Ownership (Including Village Enterprise Industrial Output), 1979-83

	1979						1983					
	Gansu		Jiangsu		China		Gansu		Jiangsu		China	
	Y mln	%	Y mln	%	Y mln	%	Y mln	%	Y mln	%	Y mln	%
State	7,782	93.4	24,116	62.9	374,464	79.1	8,239	92.6	33,724	55.2	474,778	74.1
Urban collective	323	3.9	7,466	19.5	60,577	12.8	384	4.3	11,753	19.2	91,266	14.2
Township	174/a	2.1	4,662/a	12.2	23,262	4.9	182	2.0	10,525	17.2	44,197	6.9
Village	53/b	0.5	1,991/b	5.2	13,958/b	2.9	84	0.9	4,177/b	6.8	24,478	3.8
Other	-	-	101	0.3	1,416	0.3	6	0.1	943	1.5	6,240	1.0
<u>Total</u>	<u>8,334</u>	<u>100.0</u>	<u>38,336</u>	<u>100.0</u>	<u>473,677</u>	<u>100.0</u>	<u>8,895</u>	<u>100.0</u>	<u>61,122</u>	<u>100.0</u>	<u>640,919</u>	<u>100.0</u>
Value added per capita							447		996		625	
<u>Total (Excluding Village Industry)</u>	<u>8,279</u>		<u>36,345</u>		<u>457,202</u>		<u>8,811</u>		<u>55,945</u>		<u>616,441</u>	
Value added per capita							159		269		201	

/a Estimated by assuming that ratio of individual to total township enterprise output in Gansu and Jiangsu has changed proportionally to China average.

/b Estimated by assuming that rate of IVE/VE and ITVE/TVE output is equal to 1983 China average (= 0.832).

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEIndustrial Structure  
(% of total industrial output)

	1949	1979	1984
<u>Light Industry</u>			
Gansu	77.6	17.8	23.2
Jiangsu	94.3	53.4	58.7
China	73.6	43.7	49.6
<u>Heavy Industry</u>			
Gansu	22.4	82.2	76.8
Jiangsu	5.7	46.6	41.3
China	26.4	56.3	50.4

Sources: Gansu Statistical Bureau; Jiangsu's Thirty-Five Years 1949-83, Jiangsu Statistical Bureau (May 1984); Statistical Yearbook of China, 1984.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEInvestment in Capital Construction by Broad Industrial Subsector /a  
(Y million)

	1953-80		1981		1982		1983		1984	
	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy
Gansu /b	n.a.	n.a.	51	380	51	399	41	488	120	597
Jiangsu /c	1,824	10,360	636	182	379	572	482	622	-	-
China /d	52,404	306,437	4,645	16,200	5,644	19,728	5,049	22,584	-	-

/a "Light industry" includes forestry, food, textiles, clothing, leather and paper.  
"Heavy industry" includes metallurgy, power, coal, petroleum, chemicals, machinery and building materials.

/b Gansu Statistical Bureau, 1985.

/c Jiangsu's Thirty-Five Years, 1949-83, Jiangsu Statistical Bureau, May 1984, p. 136.  
State-owned enterprises only.

/d Statistical Yearbook of China, 1984, p. 309.

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Investment in Capital Construction and Technical Renovation  
in State Enterprises, 1983  
(Y billion)

	Industry				Manufacturing			
	Capital construction	Technical renovation	Total	%	Capital construction	Technical renovation	Total	%
<u>Gansu</u>								
Heavy	483.15	245.54	728.69	88.6	324.20	221.40	545.60	85.4
Light	32.37	61.16	93.53	11.4	32.37	61.16	93.53	14.6
<u>Total</u>	<u>515.52</u>	<u>306.70</u>	<u>822.22</u>	<u>100.0</u>	<u>356.57</u>	<u>282.56</u>	<u>639.13</u>	<u>100.0</u>
(Metallurgy)	163.06	61.73	224.79	27.3	163.06	61.73	224.79	41.2
<u>China</u>								
Heavy	23,984	19,305	43,289	67.6	14,231	15,709	29,940	59.1
Light	4,244	16,478	20,722	32.4	4,244	16,478	20,722	40.9
<u>Total</u>	<u>28,228</u>	<u>35,703</u>	<u>64,011</u>	<u>100.0</u>	<u>18,475</u>	<u>32,187</u>	<u>50,662</u>	<u>100.0</u>
(Metallurgy)	4,277	2,504	6,781	10.6	4,277	2,504	6,781	13.4

Note: For the definitions of "heavy" and "light" industry, see footnote /a to Table 22.

Sources: Gansu Statistical Bureau, 1985; Statistical Yearbook of China, 1984.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEFixed Assets by Industrial Subsector at Original Cost, 1983  
(Y million)

	Gansu /a	Jiangsu /b	China /c
<u>Broad Category</u>			
Heavy industry	14,589	15,160	387,168
Light industry	1,681	5,309	89,612
<u>Detailed Breakdown</u>			
Metallurgy	3,109	1,011	67,576
Power	2,437	2,881	60,203
Coal	662	1,952	45,944
Petroleum	2,085	551	34,966
Chemicals	1,705	3,306	47,691
Machinery	4,049	5,307	113,409
Building materials	542	963	19,154
Forestry	218	40	11,198
Food	246	1,288	22,341
Textiles	418	2,375	31,540
Clothing	24	50	651
Leather	72	46	1,137
Paper	48	180	6,117
Other	655	519	14,853
<u>Total</u>	<u>16,270</u>	<u>20,469</u>	<u>476,780</u>

/a Gansu Statistical Bureau, 1985.

/b Jiangsu's Thirty-Five Years, 1949-83, Jiangsu Statistical Bureau, May 1984, p. 110.

/c State-owned, independent accounting units only. Statistical Yearbook of China, 1984, 1985.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCERatio of Fixed Assets at Original Value and  
Employment by Industrial Subsector, 1983  
(Y/employment)

	China (State-owned)	Gansu (State-owned and collectives)	Gansu's cost of workplace as % of China's
Metallurgy	20,908	31,090	149
Power	59,607	110,773	186
Coal	10,991	9,457	86
Petroleum	55,239	41,700	75
Chemical	14,992	32,780	219
(Fertilizer)	(17,786)	-	-
Machinery	10,973	19,281	176
Building materials	9,591	13,550	141
Forestry	8,420	12,824	152
Food	7,962	9,840	124
Textiles	7,447	9,952	134
Clothing	3,994	8,000	200
Leather	5,519	10,286	186
Paper	12,234	12,000	98
<u>Total</u>	<u>13,423</u>	<u>23,890</u>	<u>178</u>

Sources: Statistical Yearbook of China, 1984; Gansu Statistical Bureau, 1985.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEGansu: Industrial Employment, 1980-84

	1980	1982	1983	1984	Growth (%) 1980-84
State	661,140	672,000	680,900	723,829	6.3
Urban collectives	102,903	107,221	110,030	119,282	8.4
Individuals and other	703	1,547	4,141	11,016	116.0
ITVEs	-	-	108,692	131,083	20.6
<u>Total</u>	<u>764,746</u>	<u>780,768</u>	<u>903,763</u>	<u>985,210</u>	
<u>Labor Force ('000)</u>	-	-	-	-	
Urban	1,684	-	1,911	2,054	
Rural	5,740	6,399	6,688	6,901	
<u>Total</u>	<u>7,424</u>	<u>-</u>	<u>8,599</u>	<u>8,955</u>	
TVEs		225,000	243,800	-	

Source: Gansu Statistical Bureau, 1985.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEJiangsu: Industrial Employment, 1980-83  
( '000)

	1980	1981	1982	1983	Growth (%) 1980-83
State	n.a.	1,938	2,014	2,068	-
Urban collectives	1,286	1,353	1,409	1,426	3.5
Individual workers and others	4	11	19	58	-
ITVEs	3,000	2,970	3,436	3,696	7.2
<u>Total</u>		<u>6,272</u>	<u>6,878</u>	<u>7,248</u>	
<u>Labor Force</u>					
Urban			20,771	21,216	
Rural			9,159	9,355	
<u>Total</u>			<u>29,930</u>	<u>30,571</u>	
TVE				4,590	

Sources: Jiangsu's Thirty-Five Years, 1949-83, Jiangsu Statistical Bureau (May 1984), pp, 28, 45, 47; Statistical Yearbook of China, 1981, 1983 and 1984.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEChina: Industrial Employment, 1980-84  
( '000)

	1980	1982	1983	1984	Growth (%) 1980-84
State	32,460	35,027	35,520	35,920	2.6
Urban collectives	14,280	15,320	15,740	16,410	3.5
Individuals	-	-	240	380	-
ITVEs	19,240	20,728	21,681	25,489	7.3
<u>Total</u>	<u>65,980</u>	<u>71,075</u>	<u>73,181</u>	<u>78,199</u>	<u>4.3</u>
<u>Labor Force</u>					
Urban	105,250		117,460	122,290	3.8
Rural	313,710		342,580	353,680	3.0
<u>Total</u>	<u>418,960</u>		<u>460,040</u>	<u>475,470</u>	<u>3.2</u>
TVE	30,000		32,346	38,481	6.4

Sources: Statistical Yearbook of China, 1981, 1983, 1984; China: A Statistics Survey, 1985.

## CHINA

## GROWTH AND DEVELOPMENT IN GANSU PROVINCE

## Total Factor Productivity of State Enterprises

	Gansu		Jiangsu		China	
	1975	1981	1975	1981	1975	1981
1. Gross output (Y mln)	6,831	7,555	16,601	30,606	267,855	434,030
2. Gross fixed assets (Y mln)	9,142	14,974	8,344	18,558	238,724	437,495
3. Net fixed assets (Y mln)	6,869	9,708	5,744	12,414	168,635	291,401
4. Circulation capital (Y mln)	2,053	3,097	4,137	6,697	83,277	123,885
5. Total Capital (3+4)	8,922	12,805	9,811	19,111	251,912	415,286
6. Employment ('000)	524	674	1,216	2,014	26,910	35,027
7. Average wage (Y/year)	744	967	595	773	665	864
8. Total Capital/work (Y)	17,027	18,999	8,126	9,489	9,361	11,856
Share of capital (SOC) in total return to capital and labor at a rate of return (ROR) to capital of (%) /a						
9. 10%	69.6	66.3	57.7	55.1	58.5	57.8
10. 15%	77.4	74.7	67.2	64.8	67.9	67.3
11. 20%	82.1	79.7	73.2	71.1	73.8	73.3
Index 1975 = 100						
12. Net output /b	100.0	110.6	100.0	184.6	100.0	162.0
13. Labor inputs	100.0	128.6	100.0	165.6	100.0	130.2
14. Capital inputs	100.0	143.5	100.0	193.4	100.0	164.9
Total input weighted by implicit (1982) shares of capital and labor for rate of return on capital of:						
15. 10%	100.0	138.5	100.0	180.9	100.0	150.3
16. 15%	100.0	139.7	100.0	183.6	100.0	153.6
17. 20%	100.0	140.5	100.0	185.4	100.0	155.6
Total Factor Productivity (TFP) for Rate or Return on Capital of: /d						
18. 10%	100.0	79.9	100.0	101.9	100.0	107.8
19. 15%	100.0	79.2	100.0	100.4	100.0	105.5
20. 20%	100.0	78.9	100.0	99.5	100.0	104.1
Rate of Change 1975-82 (% p.a.) for Rate of Return on Capital of:						
21. 10%		-3.2		+0.3		+1.1
22. 15%		-3.3		+0.1		+0.8
23. 20%		-3.4		-0.1		+0.6

/a  $SOC = ROR [8] / (ROR [8] + [7])$ 

/b Assuming no changes in net/gross output ratios.

/c  $SOC [14] + (1 - SOC) [13]$ /d  $TFP = [12] / [18]$  etc.

Source: Data provided by the State Statistical Bureau.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCETownship and Village Enterprises (TVEs) - All Sectors

	1976-79	1979-82	1983	1984	
<u>Employment Growth (% p.a.)</u>					
Gansu Province	...	-3.5	8.1	37.5	
Jiangsu Province	...	8.6	6.9	...	
China	17.5	2.3	3.9	19.0	
<u>Gross Output Growth (% p.a.)</u>					
Gansu Province	...	1.5	15.3	55.3	
Jiangsu Province	...	21.7	25.3	...	
China	21.6	16.3	20.3	36.6	
<u>Gross Output per Employee (Y)</u>					
	<u>1976</u>	<u>1979</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Gansu Province	...	1,367	1,685	1,797	2,030
Jiangsu Province	...	2,231	3,137	3,675	...
China	1,525	1,668	2,479	2,871	3,296
Gansu % of Jiangsu		(61.3)	(53.7)	(48.9)	
Gansu % of China		(82.0)	(68.0)	(62.6)	(61.6)
<u>Growth of gross output per employee (% p.a.)</u>					
	<u>1976-79</u>	<u>1979-82</u>	<u>1983</u>	<u>1984</u>	
Gansu Province	...	7.2	6.6	...	
Jiangsu Province	...	12.0	17.2	...	
China	3.0	14.1	15.8	14.8	

Source: See Table 21.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEIndustrial Township and Village Enterprises (ITVEs)

	<u>1979-82</u>	<u>1983</u>	<u>1984</u>	
<u>Employment Growth (% p.a.)</u>				
Gansu Province	-1.4 /a	2.7	20.6	
Jiangsu Province	...	7.6	...	
China	4.5	4.6	17.6	
<u>Gross Output Growth (% p.a.)</u>				
Gansu Province	4.9 /a	10.1	27.2	
Jiangsu Province	...	24.7	...	
China	15.7	19.0	38.9	
<u>Gross Output per Employee (Y)</u>				
	<u>1979</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Gansu Province	...	2,278	2,447	2,494
Jiangsu Province	...	3,431	3,978	...
China	2,051	2,783	3,168	...
Gansu % of Jiangsu		(66.4)	(61.5)	
Gansu % of China		(81.9)	(77.2)	
<u>Growth of gross output per employee (% p.a.)</u>				
	<u>1979-82</u>	<u>1983</u>	<u>1984</u>	
Gansu Province	...	7.4	8.2	
Jiangsu Province	...	15.9	...	
China	10.7	13.8	...	

/a 1980-82.

Source: See Table 21.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCENumber of Township and Village Enterprises (TVEs)  
( '000)

	1976	1979	1980	1981	1982	1983	1984	1985
<u>Gansu Province</u>								
Township					4.2	4.0	4.5	5.7
Village					9.6	8.2	6.8	6.5
<u>By Sector</u>								
Agriculture					4.0	3.4	2.3	1.6
Industry					6.3	5.4	5.4	5.9
Transport					1.6	1.3	1.1	1.1
Construction					0.9	1.0	1.5	2.0
Other					1.0	1.1	1.1	1.7
<u>Total</u>		<u>20</u>			<u>13.8</u>	<u>12.2</u>	<u>11.4</u>	<u>12.3</u>
<u>Jiangsu Province</u>								
Township					27.3	27.1		
Village					42.8	41.4		
<u>By Sector</u>								
Agriculture					3.9	3.0		
Industry					55.6	56.5		
Transport					3.2	3.1		
Construction					2.4	2.4		
Other					4.0	3.6		
<u>Total</u>		<u>72</u>			<u>77.8</u>	<u>68.5</u>		
<u>CHINA</u>								
Township		320	338	336	339	338		
Village		1,160	1,087	1,002	1,024	1,008		
<u>By Sector</u>								
Agriculture		444	378	319	293	270		
Industry		767	758	726	749	744		
Transport		82	89	89	96	92		
Construction		49	51	48	54	57		
Other		138	149	156	170	184		
<u>Total</u>		<u>1,115</u>	<u>1,480</u>	<u>1,425</u>	<u>1,338</u>	<u>1,361</u>	<u>1,346</u>	

Source: See Table 21.

CHINAGROWTH AND DEVELOPMENT IN GANSU PROVINCEEmployment of Township and Village Enterprises (TVEs)  
( '000)

	1976	1979	1980	1981	1982	1983	1984	1985
<u>Gansu Province</u>								
Township					118.3	133.8	203.0	269.0
Village					107.2	110.1	131.9	150.0
<u>By Sector</u>								
Agriculture		37.2	29.2	23.4	18.4	13.4	9.5	
Industry		108.9	99.9	105.8	108.7	131.1	171.6	
Transport		12.6	10.8	9.8	9.3	9.7	14.9	
Construction		58.5	58.5	78.2	100.1	172.5	211.2	
Other		8.8	6.1	8.3	7.3	8.3	12.2	
<u>Total</u>		<u>251</u>	<u>226.1</u>	<u>204.6</u>	<u>225.6</u>	<u>243.8</u>	<u>334.9</u>	<u>419.4</u>
<u>Jiangsu Province</u>								
Township					2,637	2,822		
Village					1,657	1,768		
<u>By Sector</u>								
Agriculture					122	76		
Industry					3,436	3,696		
Transport					160	161		
Construction					502	587		
Other					73	70		
<u>Total</u>		<u>3,350</u>			<u>4,294</u>	<u>4,590</u>		
<u>CHINA</u>								
Township	13,144	13,940	14,180	14,950	15,669	18,792		
Village	15,949	16,060	15,520	16,179	16,677	19,689		
<u>By Sector</u>								
Agriculture	5,330	4,560	3,800	3,440	3,092	2,839		
Industry	18,144	19,420	19,810	20,728	21,681	25,489		
Transport	1,169	1,140	1,070	1,129	1,097	1,893		
Construction	2,984	3,340	3,490	4,213	4,827	6,835		
Other	1,466	1,530	1,530	1,619	1,649	2,025		
<u>Total</u>	<u>17,919</u>	<u>29,093</u>	<u>30,000</u>	<u>29,700</u>	<u>31,129</u>	<u>32,346</u>	<u>38,481</u>	

Source: See Table 21.

CHINA

GROWTH AND DEVELOPMENT IN GANSU PROVINCE

Gross Output of Township and Village Enterprises (TVEs)  
(Y million, current prices)

	1976	1979	1980	1981	1982	1983	1984	1985
<u>Gansu Province</u>								
Township					229	271	531.7	856.8
Village					151	167	225.2	368.0
<u>By Sector</u>								
Agriculture			17	15	14	13	13.0	12.8
Industry			219	205	241	266	351.0	553.9
Transport			32	31	29	30	30.0	47.4
Construction			57	60	76	105	331.0	577.7
Other			16	17	20	24	32.0	53.6
<u>Total</u>		<u>363</u>	<u>341</u>	<u>328</u>	<u>380</u>	<u>438</u>	<u>757.0</u>	<u>1,245.4</u>
<u>Jiangsu Province</u>								
Township					8,784	11,109		
Village					4,685	5,761		
<u>By Sector</u>								
Agriculture					152	157		
Industry					11,790	14,702		
Transport					356	391		
Construction					852	1,209		
Other					319	410		
<u>Total</u>		<u>7,475</u>			<u>13,469</u>	<u>16,870</u>		
<u>CHINA</u>								
Township	26,990	33,220	37,900	43,823	53,089	70,967		
Village	22,120	26,390	29,140	33,354	39,781	55,848		
<u>By Sector</u>								
Agriculture	3,850	3,940	3,900	4,006	4,372	5,172		
Industry	37,220	45,560	51,100	57,690	68,675	89,795		
Transport	2,300	2,450	2,500	2,918	3,263	4,716		
Construction	3,500	4,490	5,260	7,509	10,189	16,199		
Other	2,240	3,170	4,280	4,054	6,372	10,933		
<u>Total</u>	<u>27,330</u>	<u>49,110</u>	<u>59,610</u>	<u>67,040</u>	<u>77,177</u>	<u>92,870</u>	<u>126,815</u>	

Sources: 1976-79: World Bank, China: Socialist Economic Development (1983).  
Vol I, Tables 6.9-6.11 (pp. 373-376).  
1980/81: Statistical Yearbook of China.  
1982/83: Agricultural Yearbook of China, 1981-84.  
1984: Gansu provincial data and State Statistical Bureau "China, A  
Statistics Survey in 1985."



ANNEX C: BASIC AND VOCATIONAL EDUCATION

Table of Contents

	<u>Page No.</u>
I. <u>BRIEF OVERVIEW AND INTRODUCTION</u> .....	351
Economy, Population, Labor Force, Employment.....	351
Education Sector.....	351
II. <u>GOVERNMENT OBJECTIVES</u> .....	354
Introduction.....	354
Rationale for Investment in Education.....	354
Government Objectives.....	357
III. <u>CONDITIONS OF BASIC AND VOCATIONAL EDUCATION</u> .....	360
Overview.....	360
Student Enrollment.....	360
Completion, Dropout and Repetition Rates.....	361
Overage Students.....	363
Female Enrollment.....	366
Transfers from Incomplete Village Schools.....	366
Disparities Between Schools.....	366
School Facilities and Instructional Materials.....	370
Teachers.....	372
Teacher Qualifications.....	372
Inservice Teacher Training.....	375
Demand for Teachers.....	376
Teacher Training Facilities and Programs.....	376
Structure of Upper Secondary Education.....	382
Different Types of Vocational Secondary Education.....	382
Policy for Vocational Education.....	384
Assessment of Vocational Education.....	389
Planning Vocational Education in Gansu.....	390

	<u>Page No.</u>
IV. <u>MANAGEMENT AND FINANCING OF EDUCATION</u> .....	393
Overview.....	393
Sectoral Organization and Management.....	393
Issues in the Management of Basic Education.....	399
Division of Responsibilities.....	399
Supervision .....	400
Management Information System.....	401
Educational Costs and Financing.....	402
Estimates of Public Expenditure.....	403
Distribution of Public Expenditure.....	404
Fees and Private Costs .....	413
Financing of Basic Education in Gansu Province.....	417
V. <u>STRATEGY FOR BASIC AND VOCATIONAL EDUCATION</u> .....	420
Education Action Program.....	420
Improve Full Access to Basic Education.....	420
Upgrade Existing School Facilities .....	420
Improve the Quality and Coverage of Preservice and Inservice Training.....	421
Develop a More Differentiated and Cost-Effective Approach to Meeting the Vocational Requirements of Students.....	421
Changes in Organization and Management.....	421
Delineate Management Roles and Responsibilities .....	421
Develop an Improved System for Supervision and Provide Management Training.....	422
Establish an Educational Management Information System ....	422
Changes in Financial Policy.....	422
Increase Public Financial Support for <u>Minban</u> Teachers and Transfer Qualified Teachers to the Public Sector .....	422
Reduce School Fees and Related Charges to Poorer Families .....	423
Adopt a System of Responsibility Agreements for Cost-sharing .....	423
Conclusion.....	423
VI. <u>COST AND FINANCING OF BASIC AND VOCATIONAL EDUCATION</u> .....	425
Introduction.....	425
Prospects to the Year 2000.....	426

<u>Tables in Text</u>	<u>Page No.</u>
2.1 The Returns to Education by Region and Country Grouping .....	355
3.1 Gross Enrollment Ratios: Basic Education .....	362
3.2 End-of-Year Dropout and Repetition in Primary Grades, 1980/81 to 1984/85 ..	364
3.3 Primary Education Completion Rates for Selected Countries .....	365
3.4 Female Participation, Primary and Lower Secondary School .....	367
3.5 Statistics on Types of Primary Schools, 1984 .....	369
3.6 Gansu Province: Teacher Educational Qualifications, 1983 .....	373
3.7 Teacher Qualifications: Three Counties, 1984 .....	374
3.8 Demand for Primary Teachers, 1985-2000 .....	377
3.9 Demand for Lower Secondary School Teachers, 1985-2000 .....	378
3.10 Basic Data on Preservice Training Institutions, 1984 .....	379
3.11 Basic Data on Inservice Training Institutions, 1984 .....	380
3.12 Types of Secondary Schools in Gansu Province, 1983 .....	383
3.13 Entrance Requirements, Duration of Courses, and Eligibility for Higher Education by Type of Technical and Vocational Education .....	385
3.14 Percent of Teaching Time in Technical and Vocational Secondary Schools .....	386
3.15 Employment Characteristics by Level of Education or Training .....	387
3.16 Demand for Upper Secondary School Teachers, 1985-2000 .....	388
4.1 Public Recurrent Expenditure on Education in Gansu by Level of Government .....	407
4.2 Distribution of Students and Distribution of Public Recurrent Expenditure by Level of Education, 1984 .....	408
4.3 Per Capita Public Recurrent Expenditure on Education by Prefecture or Municipality, 1983 .....	410
4.4 Private Expenditure per Student per Year on Fees, Textbooks and Materials, 1984 .....	412
6.1 Alternative Scenarios for the Development of Basic and Vocational Education in Gansu Province .....	427
6.2 Estimates of Public Educational Expenditure in Gansu Province .....	430
6.3 Estimates of Educational Resource Requirements for Gansu Province by Source of Finance .....	431

Figures in Text

4.1 Allocation of Management Responsibility in Gansu Province .....	394
4.2 Provincial Educational Administration Organization Chart .....	395
4.3 County Educational Administration Organization Chart .....	397
4.4 Urban-Rural and Public School Versus Village School Differentials in Per Student Recurrent Expenditure on Primary Education, 1984 .....	412

Appendices

A. Comparative Education Indicators .....	435
B. Education Performance Indicators .....	436
C. Student Flowchart .....	437
D. Education Data on Four Counties .....	440
E. Survey of Sample of Schools in Four Counties .....	445
F. Student Enrollment Pattern and Resource Requirements .....	447

<u>Tables in Appendices</u>	<u>Page No.</u>
A.1 Comparative Education Indicators .....	435
B.1 Four Rates for Universal Primary Education Used in China .....	437
C.1 Student Flowchart. ....	439
D.1 Under- and Overage Primary School Children in Hui County Primary Schools: Number of Students .....	440
D.2 Under- and Overage Primary School Children in Lintao County Primary Schools: Number of Students .....	441
D.3 Under- and Overage Primary School Children in Xiahe County Primary Schools: Number of Students .....	442
D.4 Under- and Overage Primary School Children in Yongdeng County Primary Schools: Number of Students .....	443
D.5 Distribution of Students by Level and Sex .....	444
E.1 Summary of Visits to Primary Schools .....	445
E.2 Summary of Visits to Secondary Schools .....	446
F.1 Scenario I, Gansu Province Enrollment Pattern in Primary, Lower and Upper Secondary .....	447
F.2 Scenario II, Gansu Province Enrollment Pattern in Primary, Lower and Upper Secondary .....	448
F.3 Estimates of Total Recurrent Expenditure on Primary and Secondary Education in Gansu Province .....	449
F.4 Teacher Requirements for Primary and Secondary Education in Gansu Province. ....	450
F.5 Estimates of Capital Expenditure Requirements for Primary and Secondary Education in Gansu Province .....	451
F.6 Estimates of Public Capital Expenditure for Education in Gansu Province by Source of Input .....	452
F.7 Estimates of Capital Expenditure Requirements for Primary and Secondary Education in Gansu Province by Source of Resources Input .....	453
F.8 Estimates of Total Recurrent Expenditure on Primary and Secondary Education in Gansu Province by Source of Finance .....	454

## I. BRIEF OVERVIEW AND INTRODUCTION

### Economy, Population, Labor Force, Employment

1.01 Despite continuing growth in agricultural and industrial output, Gansu, situated in the interior northwest part of China, has not benefitted from recent economic reforms as much as other provinces. Real gross output value of agriculture has grown at about 3.7% a year since 1978 and real industrial output has expanded at about 1.9% a year over the same period. But progress as measured by these growth rates is well below the national averages, and Gansu remains one of the poorest provinces in China. Average per capita income, at Y 405 in 1984, was 76% of the national average as compared to 85% in 1980. Rural per capita income, at Y 220 in 1984, had also slipped from 75% of the national average in 1978 to 62% in 1984. In 1982, 35% of the rural population had incomes below the poverty level, as compared to 11% nationally. Large numbers of families receive relief grain from the state and every year drinking water for humans and livestock is trucked free of charge to many villages during the dry season. The harsh environment, characterized by barren soil and an arid climate over much of the province, has impeded development. Several of the province's 86 counties are among the poorest in China by any measure.

1.02 By the end of 1983, Gansu had a population of 19.9 million, second largest among the five provinces of northwest China. In that year the growth rate was reported as 1.2%, compared with 1.1% for the country. Within the province 18% of the population is classified as urban and 82% as rural, a lower urbanization level than the national average of 23% urban. Gansu's population is also younger. According to the 1982 population census, 36.4% of the population of Gansu province is under 15 years of age, while the corresponding national average is 33.6%. Outflow of population from the province has exceeded inflow over the years, but the proportion of the migrants to the total population is small, less than 2%. Minority population is about 8% of total provincial population with Hui (Moslem) as the largest minority group of about 100,000 people.

1.03 Agriculture is by far the main source of employment. In 1984, 85% of the labor force was in agriculture (including, as defined in Gansu, rural industry); only 9% worked in industry and 6% in other activities, including construction, transport or commerce. Within the agriculture sector, over 90% of the labor force worked on collective farms or individual responsibility plots, only 2% worked on state farms; the remainder in off-farm activities. In industry, state-owned enterprises are the dominant form employing 82% of the industrial labor force. The remainder worked in collectively owned enterprises. In commerce, catering and personal services, about 45% were staff and workers employed in collective units or as individual laborers.

### Education Sector

1.04 China has made great progress in the provision of education, but the unevenness of economic development among different regions has left the rural and interior areas far behind the urban and coastal areas (See Appendix A for

education indicators of China, Gansu, Jiangsu and 15 developed or developing countries).<sup>1/</sup> The rate of adult literacy in Gansu is 46%, well behind the national average of 76%. And, in Gansu the current situation of basic education (primary and lower secondary education), especially in the rural areas, is far from adequate to meet the needs of reducing poverty and developing the provincial economy. A realistic assessment of primary schooling in Gansu province in the early 1980s suggests that of ten children of primary school age, about eight may begin school and about four continue to attend to fifth grade. The completion rate for primary school is about 65% nationally. In 1983 only 50% out of a total of 86 counties in the province had reached a net enrollment rate of 95%, one criterion used by the central government for Universal Primary Education (UPE). Many primary school age children, and girls in particular, remain outside of school. Compared with the national average, the dropout and repetition rates are high. At the same time the net enrollment rate in lower secondary was about 30%. The condition of school facilities is also poor, especially in rural areas. The quality of instruction is generally poor due to the low qualifications of the teachers, particularly minban teachers who are locally hired and paid well below the level of gongban or public teachers. At the primary level, about a third of the teachers have not met the minimum educational level for their position. At the lower secondary level, the situation is even worse, 75% have not met the requirement. The current level of teacher training, especially in-service training, is insufficient to raise the majority of teachers up to an adequate standard in a reasonable period.

1.05 At upper secondary level, with an enrollment rate of about 11% of the corresponding age group, considerable attention is being given to the expansion of vocational programs. In 1983, the province enrolled about 20% of upper secondary students in some form of vocational program. The remainder are in academic programs. Since universities can absorb only about 10% of students in the academic stream, the great majority leave the schools with only a general education.

1.06 Unlike basic education and upper secondary education, which are behind the national level, higher education in Gansu province displays a better profile. The enrollment rate of about 4% is close to the national average of 4.8%. The province has 14 higher education institutions including a provincial television university and broadcasting system. Several research institutes affiliated with the Chinese Academy of Sciences also offer higher education courses. The establishment of higher education institutions in Gansu province was the result of Central Government's policies of relocating many institutions from the coastal areas to the interior in the 1950s.

---

<sup>1/</sup> Regional disparities in educational development is the subject of a recent two-volume report by the International Institute for Educational Planning (IIEP) of UNESCO. This publication examines causes of regional disparities in level and standards of education, and policies to redress these differences, in Hungary, Cameroon, Madagascar, Thailand, Kenya and Tanzania. See Carron, G. and Chau, T. editors, Regional Disparities in Educational Development, IIEP, Paris, 1980.

Despite the number and quality of higher educational institutions in Gansu, the province is experiencing an acute shortage of high level manpower. The Provincial Planning Commission reports current level of output satisfies only about 30% of annual requirements.

1.07 This annex surveys basic (primary and lower secondary) and vocational education in Gansu. Chapter II contains a statement of government objectives, a rationale for investment in education, and reviews the provincial strategy for development of basic and vocational education in Gansu. Chapter III assesses overall conditions of student enrollment and completion, school facilities and instructional materials, qualifications of teachers, and needs for preservice and inservice training, and finally, the balance in upper secondary education between regular secondary and vocational education. Chapter IV examines educational management and finance in Gansu. Chapter V assesses actions required in educational programs, as well as management and finance in order to realize provincial goals. Chapter VI weighs alternative scenarios in terms of resource requirements and investment programs for developing basic and vocational education in Gansu.

## II. GOVERNMENT OBJECTIVES

### Introduction

2.01 China's ultimate objective is to catch up with the developed countries, while maintaining a socialist system in which the benefits of prosperity are widely shared. Accordingly, the post-1977 period has seen a major commitment in China to increase enrollments and raise the quality of education, as the Government of China has recognized that an educated population, the consequence of full provision and completion of basic education, is a necessary condition for modernization. It is also recognized that, although basic education for all students cannot be realized across the whole country at the same time, it remains a fundamental goal within the Four Modernizations. No region or target population can be disregarded permanently.

### Rationale for Investment in Education

2.02 Although it is generally accepted that education contributes to a country's development effort, there has been, quite naturally, less agreement on what types or levels of education are most efficient in promoting economic growth. In the 1950s and 1960s economic analyses of education world-wide tended to emphasize the contribution of skilled and technical manpower to economic growth. An additional body of research literature has accumulated in the last 15 years or so giving much greater recognition to the economic benefits of basic education, that offers students a solid grounding in reading, writing and arithmetic, particularly in developing countries or regions of developing countries where adult literacy remains low.<sup>2/</sup> There is by now a considerable amount of evidence to suggest that, in addition to furthering fundamental cultural and national objectives, basic education makes a substantial contribution to economic and social development.

2.03 One line of investigation has demonstrated that, in many countries, the economic returns to investment in education among a population are generally high when compared to returns to investment in other sectors. Review of this work by the World Bank, as summarized in Table 2.1, has led to three conclusions that are largely sustained across 22 developing countries (including eight in Asia) where studies of the returns to education have

---

<sup>2/</sup> See World Bank Research News Volume 5, Number 3; and Colclough, C., Primary Schooling and Economic Development: A Review of the Evidence, World Bank Staff Working Paper No. 399, 1980.

**Table 2.1: THE RETURNS TO EDUCATION BY REGION AND COUNTRY GROUPING  
(percentages)**

Region or country	Private returns			Social returns		
	Primary	Secondary	Higher	Primary	Secondary	Higher
Africa	29	22	32	29	17	12
Asia	32	17	19	16	12	11
Latin America	24	20	23	44	17	18
Developing countries average	29	19	24	27	16	13
Intermediate countries	20	17	17	16	14	10
Advanced countries	n/c /a	14	12	n/c /a	10	9

/a Not computable, due to lack of a control group of non-attenders.

Source: World Bank Education and Training Department.

been carried out: that the social rate of return to investment in education is at least as high as returns to alternative investment projects; that when the average years of schooling among a population is low the rates of return to investment in primary education are higher than those in other levels of formal schooling; and that the lower the level<sup>3/</sup> of a country's development, the higher the returns to any level of education.

2.04 A second body of research concerns the economic value of education in an agricultural setting. The results of over 30 studies relating basic education to agricultural productivity concluded that, on average, farm productivity increases by about 9% as a result of a farmer having completed at least four years of primary schooling, rather than having no schooling

<sup>3/</sup> Psacharopoulos, G., "The Contribution of Education to Economic Growth: International Comparisons," in J. Kendrick (ed.), International Productivity Comparisons, Washington, DC: American Enterprise Institute, 1983. Private returns are calculated from the point of view of the individual: earnings differentials are after tax and the costs include only what the individual actually pays for his/her education. Social rates of return are calculated from the point of view of society, hence earnings differentials are before tax and the costs represent all the resources necessary to sustain the student at school regardless of who pays them.

whatsoever.<sup>4/</sup> The importance of this finding stems from the fact that measurements of productivity in agriculture are in terms of physical output, thus avoiding the use of wages as a proxy for productivity. One of the ways in which education contributes to the agricultural economy is that it may enhance the adoption and efficient use of new inputs. One study has reported that the probability of a farmer adopting improved agricultural technology -- improved varieties, fertilizers, pesticides and herbicides -- is about 60 percentage points higher if the farmer has four years of education rather than none. In an environment, such as in Gansu province, where individual farmers have increased responsibility for decision making about crops, farming systems, agricultural techniques and investment in land and equipment, there is greater scope for efficient use of resources as facilitated by basic education. To the extent that women are also farmers -- and in some countries and regions, they have greater responsibility than men in agricultural production -- the same payoff to the education of girls is likely. Since women often have lower education than men in rural societies, the returns to their schooling may even be higher than for males. Higher levels of education for both men and women may also hold additional benefits in terms of greater likelihood of engagement in sideline production and specialized off-farm activities now encouraged in China.

2.05 A third link in the economic rationale concerns the indirect effects of schooling in a wider context of social welfare. Numerous studies indicate that schooling affects demographic factors through different channels, the demand for children, fertility of women, and contraceptive use.<sup>5/</sup> For example, the majority of case studies seem to conclude that basic education for women has a fertility reduction effect. There is also a strong positive relationship between mother's education and child nutritional status, between schooling and family health factors, including life expectancy, and between schooling of parents, particularly mothers, and participation of children in school.

2.06 Finally, the evidence is strong that education facilitates adjustment to new occupations and new economic opportunities as may be presented by mobility from the countryside into towns or cities, or by migration from a poor region to another with greater prospects for economic development.<sup>6/</sup> Migration of this kind is the essential process by which labor is reallocated to more productive uses. The migration literature is full of findings pointing at the positive relationship between basic education and the decision to move to other areas, as well as the positive relationship between basic education and the capacity to cope effectively in a new setting. The import of

---

<sup>4/</sup> Jamison, D.T. and Lau L., Farmer Education and Farm Efficiency. Baltimore and London: The Johns Hopkins University Press, 1982.

<sup>5/</sup> Cochrane, S.H., Fertility and Education: What Do We Really Know? Baltimore and London: The Johns Hopkins University Press, 1979.

<sup>6/</sup> Greenwood, M.J., "Research on Internal Migration in the US: A Survey." Journal of Economic Literature, 3, No. 2 (June), pp. 397-433, 1975.

this finding should not be lost in Gansu where the government proposes to encourage movement of population from areas of limited prospects for development to more promising areas.

2.07 Some assessment of the relevance for Gansu of these general considerations can be made using data drawn recently from a sample of households in Gansu. In March 1985 a household survey was conducted in Hui County, Gansu to obtain information pertaining to income, residency, health status, education level and several other variables. The survey covered a sample of 500 households, 300 in rural areas and 200 in urban areas. Analysis of the data has been broken down into two sets: urban, reporting income mainly from wage employment; and rural, reporting income from both agriculture and other, off-farm sources. Analysis has included various specifications of wage functions for urban workers and income functions for rural households. It is worth noting that the average monthly earnings for urban male workers was Y 73 and for females Y 63. Average farm income for rural households was Y 748 per year, while the average income from sideline activities was Y 263, or about 25% of total income. These levels are broadly representative of a middle-income county in Gansu.

2.08 For both urban and rural data in the survey there is a positive relation between years of schooling and earnings. This relation is stronger for urban males than for females -- although in both cases the average private return to an additional year of schooling is only about 7%, less than half the expected result. This is due, no doubt, to the nationally regulated wage system to which virtually all urban workers in the sample are subject. Another sample drawn from the potentially more competitive, although relatively small, market of urban unorganized workers in self-employment and services would possibly reveal a greater premium to schooling. In rural areas, education of the head of the household is again positively linked to income. In this case, however, available land is such a constraint on agricultural income that its effect dwarfs all others. For off-farm income, the relationship between earnings and years of schooling is the strongest, with each year of schooling associated with an average increase in earnings of 12%. Altogether these results confirm the expected finding that years of schooling has a positive impact on income generating capacity of adults.

#### Government Objectives

2.09 The Decision on the Reform of the Educational System, announced by the Party Central Committee on May 29, 1985, contains a statement of objectives on the development of basic and vocational education in China. In recognition of the underlying social as well as economic benefits of schooling, the statement indicates that nine-year compulsory education will be introduced step by step across China. This program will be generally composed of six years of primary and three years of lower secondary school education, although the actual combination of years in each level for the nine year system may vary by region. China will seek to make lower secondary school education universal by the end of 1990 (Seventh Five-Year Plan) in the cities and coastal areas, and within the next 10 years (Seventh and Eighth Five-Year Plan) in towns and villages with a medium level of development. In more backward areas, accounting for about 25% of the national population, the nine-year

system will be made universal according to schedules determined by local officials in accordance with the level of economic development and financial capacity. The Central Government will assist these regions. At the same time at least 50% of upper secondary students will be encouraged to enter some form of vocational school. The document also specifies the following guidelines with respect to objectives and management:

- (a) "the principle of implementing 9-year compulsory education and having various localities assume responsibility for developing basic education at different levels will be the foundation for developing our country's work ... Therefore, it is necessary to formulate a compulsory education law, and promulgate it after being examined and approved by the National People's Congress;"
- (b) "(the) people's congresses at various levels ... are to formulate regulations for implementing compulsory education, according to local conditions ...;"
- (c) "(jurisdiction) over basic education lies with the local authorities. The central authorities will decide on the cardinal principles and policies, as well as on the macroscopic plans, while the local authorities have the responsibility and power to formulate, and implement, specific policies, rules, regulations, and plans, as well as supervise, manage, and inspect schools. Provinces, autonomous regions, and municipalities will decide how the administrative responsibilities should be divided among the provincial, prefectural, county and township levels;"
- (d) "To guarantee local educational development, in addition to state appropriations, an appropriate proportion of local financial resources should be used for education. Township financial revenues should be used mainly on education. Local authorities may collect additional revenue for education. This money will first be used to improve teaching and facilities for basic education. The local authorities should encourage and instruct state-run enterprises, social organizations, and individuals voluntarily to donate funds to educational undertakings."

2.10 Within Gansu Province, these guidelines have so far been translated into the following goals. The Province will devote a major effort to achieving a nine year compulsory system in urban areas and more developed counties by 1990. It will also seek to ensure provision of sufficient school places for primary school-age children in a large part of the province by 1990. Lower secondary should reach about 70% of the age group by 1990 and about 90% by 2000. This goal will be supported by a major strengthening of preservice and inservice teacher education to reduce the number of unqualified teachers. Improvements in school facilities and upgrading of teachers will be targeted to approximately 46 out of 86 counties where performance of the school system is below average for the province, but the prospects for significant improvement are judged as realistic.

2.11 The province will also seek to accelerate the restructuring of upper secondary education by developing vocational education on a larger scale. The fields of study would include, among other fields, forestry and agricultural disciplines, technical subjects for chemical and coal industries, and finance and personal services related to the expansion of the services sector of the economy. The province intends to increase by 1990 the proportion of students in vocational programs to at least 50% of students in upper secondary school, so that the pressure for higher education can be reduced and more upper secondary graduates can be prepared for direct entry into the labor market.

### III. CONDITIONS OF BASIC AND VOCATIONAL EDUCATION

#### Overview

3.01 In the light of prevailing educational conditions, this chapter identifies the need for improvement in several aspects of education in Gansu. These include: with respect to primary and lower secondary -- basic education as defined by the State Education Commission (SEdC) -- assuring access to full primary school for all children, but especially those enrolled in incomplete schools in rural areas, in order to ease the transition to lower secondary school; upgrading school buildings, equipment and materials; and improving preservice and inservice training of teachers. With respect to the balance between general and vocational education, the chapter assesses the need for planning vocational education that gives greater emphasis to short-term training for school leavers and lower secondary graduates, and that is cost-effective in the use of centralized facilities such as regional vocational training centers. The following chapter, Chapter IV, analyzes closely related issues of educational management and finance.

#### Student Enrollment

3.02 The Central Government has announced a goal of gradually universalizing education to Grade 9. Gansu has set as an intermediate goal reaching universal primary education (UPE) by 1990 in all but the most remote counties. Lower secondary enrollment should reach about 70% by 1990 and 90% by the year 2000. According to provincial data, in 1984 about 85% of the 7 to 11 age cohort were enrolled in school, significantly short of UPE.<sup>7/</sup> And the disparities between counties are quite striking. In 1983, 20% of the 86 counties were reported to have achieved UPE and another 26% were within ten percentage points of the target. At the other extreme, four counties had enrollment ratios under 50% and about one quarter of them had ratios between 50% and 75%.

---

<sup>7/</sup> There are indications that existing data on student enrollment are not of uniformly high quality. The evidence of this problem is found both in the inconsistency of data provided by different sources and in the difference between reported data and conditions observed in visits to schools. It should not be surprising that educational statistics in China, and Gansu, are occasionally found to be inconsistent or at variance with observed conditions. Indeed, this problem is common in low income countries where schools and school districts, particularly those in rural areas, function with virtually no assistance in statistical reporting and with unreliable means of communication to statistical officers. World Bank staff who have visited rural counties in Gansu and other provinces share the view that there is frequently an overestimate of enrollment. For the purposes of this report, the possibility that some of the educational statistics are unreliable suggests that quantitative estimates, particularly those of enrollment in primary schools, may be too high. For the larger purpose of developing a program for the achievement of UPE, this possibility underscores the importance of improving the information system (see Chapter IV).

3.03 The Government defines UPE in terms of achieving four target rates: an enrollment rate of 90%, an annual retention rate of 97%, a graduation rate of 95%, and a universalization rate of 95%. Appendix B contains definitions of these four rates along with student flow rates commonly used by UNESCO and the World Bank. The four rates applied in China for assessing UPE are useful in that they allow for comparison across the country, or even across counties within a province, based on an objective standard. A disadvantage in the use of only these four rates is that they fail to identify high student repetition or dropout. And they, therefore, fail to highlight the low completion rate, which is revealed in the ten-eight-four pattern generally acknowledged for Gansu in the early 1980s (para. 1.04).

3.04 At present, primary school enrollment in Gansu is changing as the result of three trends: (i) an increase in the proportion of the age cohort enrolling in school, defined here as children aged seven to eleven for the existing five-year primary system; (ii) changes in the number of overage children in school; and (iii) most important, a significant decrease in the size of the school age population. Table 3.1 shows actual and projected population and primary school enrollment based on estimates prepared by the mission (See Appendix F for detailed projections). The primary school age population has already been dropping steadily since 1980. It will stabilize in 1990 at roughly 71% the 1980 level. Between 1980 and 1984 primary enrollment declined, but less steeply than population as more children were drawn into the school system. In recent years, the Grade 1 intake has been significantly in excess of the seven-year-old cohort; gross enrollment ratios for Grade 1, that include overage students, have been on the order of 180% to 210%. To the extent that these numbers are correct, they most likely reflect significant efforts to enroll previously unreached children, large numbers of whom are older than seven. A World Bank survey of four counties indicated that in 1985 the proportion of seven year olds not entering school was probably less than 8% and those are entirely in rural areas and disproportionately females.

3.05 Lower secondary enrollments, according to Table 3.1, have exhibited a similar trend during the past five years. During the period 1980-84, the number of lower secondary students decreased along with the 12-14 age group. Gross enrollment ratios for lower secondary school dropped slightly from 1980 to 1982. But this trend appears to have reversed in 1983, when the number of students enrolled grew while the size of the age group continued to decrease. As with the population of primary school age, the number of children in the lower secondary age group has reached a peak. From 1980 to 1990, the rate of decrease of the target age group will be high, declining to about 68% of the 1980 level by 1990. From 1990 to 2000 the target population will fall a further 8%.

3.06 Completion, Dropout and Repetition Rates. In Gansu completion rates are lower, and dropout and repetition rates are higher, than in China overall or in a comparator group of low-income developing countries. At the primary level, for example, the number of children completing primary school in 1984 was 34% of the size of the entering class five years previously. This rate contrasts with about 65% for China nationwide. Another approach to estimating the completion rate is to use grade-specific rates for dropout and repetition

Table 3.1: GROSS ENROLLMENT RATIOS: BASIC EDUCATION

	1980	1981	1982	1983	1984	1985	1990
Total primary enrollment (million)	3.19	2.97	2.79	2.65	2.69	2.32	2.39
Estimated 7-11 population (million) <u>/a</u>	2.58	2.47	2.36	2.25	2.14	2.04	1.84
Gross primary enrollment ratio (%)	124	121	118	118	125	114	129
Total lower secondary school enrollment (million)	0.81	0.72	0.68	0.69	0.72	0.70	0.85
Estimated 12-14 population (million)	1.71	1.70	1.66	1.61	1.55	1.48	1.16
Gross lower secondary school enrollment ratio (%)	47	43	41	43	47	48	69

/a Since at present in Gansu, the five-year primary system is more widespread than the six-year program, the corresponding primary age group is population seven to eleven years old. In later projections for the years 1990 to 2000, the six-year primary system is assumed.

Source: Mission estimates for population projections. Enrollment data from Bureau of Education, Gansu Province. Data for 1980-84 are actual. Figures for 1985 and 1990 are projections based on Appendix F, Scenario II, Table F.2.

as in Table 3.2. Dropout is high at all grade levels and, except for the first grade, substantially higher than national averages. Repetition is also high; about 20% of all children in the province repeat first grade. (National data on repetition are not available.). Table 3.2 also estimates that for 1,000 new entrants, only about 600 students would progress to Grade 2. By the beginning of Grade 5 only 270 would remain. Thus, by this method of estimation, on average, about 27% of the children who enter Grade 1 progress normally through the five grades of primary school. According to the World Bank Comparative Indicators, completion rates for primary education in Gansu province -- estimated here as in the range of 34% to 27% -- stand at the level of the lowest quartile for developing countries. (Table 3.3). At lower secondary, rates of dropout and grade repetition are apparently less of a problem. The completion rate, for those who enroll, averages about 70%.

3.07 Low completion rates undoubtedly derive from several factors: a higher tendency for overage students and repeaters to leave school; a propensity for families to take girls out of school before completion of the primary cycle; and the difficulty for students in incomplete schools to complete five grades.<sup>8/</sup> A World Bank review, using data from the 1970s, reported that for a group of low-income Asian countries, repetition rates averaged 29% for first grade and 9% for the last primary grade.<sup>9/</sup> But many countries in the region have much lower repetition rates because they require automatic promotion by law or encourage passing all but a few exceptional individuals. Among Asian countries that have automatic promotion policies for the primary cycle, for example, are Japan, South Korea, Malaysia and Singapore.

3.08 Overage Students. The phenomenon of overage children in school is present even at the entry level. According to official policy in China, children should begin primary school at age 7, or age 6 when circumstances are favorable, and progress through five or six grades, one year at a time. No information was available to the mission on the number of overage children at the primary level in Gansu. But the proportion must be at least 25% given gross enrollment rates for the full cycle of between 115% and 125% in recent years alongside completion rates in the neighborhood of 27% to 34%. In the mission survey of four counties in Gansu province, 4% of the children were underage for their grade, indicating that they had started early and were progressing normally. (See Appendix D, Tables D.1 to D.4). By contrast, 18% of the children were more than one year overage for their grade. There is a large urban-rural difference in these figures: 19% of rural children, as compared with 11% of urban children, are overage. Experience in other countries has shown that overage students have a higher likelihood to drop out of school.

---

8/ Economic factors affecting the cost of and demand for schooling also contribute to low completion rates. See paras. 4.35-4.37.

9/ Haddad, W., Educational and Economic Effects of Promotion and Repetition Practices. World Bank Staff Working Paper No. 319, March 1979.

Table 3.2: END-OF-YEAR DROPOUT AND REPETITION IN PRIMARY GRADES, /a  
1980/81 to 1984/85

Grade	Percentage dropping out at year-end				Percentage repeating in following year - Gansu		Normal progression per 1,000 entrants
	Gansu		China /b		Mean	Range	
	Mean	Range	Mean	Range			
1	21.1	18-23	18.2	17-19	18.5	18-20	1,000
2	11.0	5-13	7.2	6-8	7.8	3-10	600
3	18.4	11-26	5.8	5-6	5.2	4-7	490
4	15.9	13-23	11.5	10-12	11.1	5-18	380
5	N/A/c	N/A	N/A	N/A	4.5	4-5	270

/a Flow chart containing raw data in Appendix C.

/b For 1979/80-1983/84.

/c Not available.

Source: Bureau of Education, Gansu Province.

Table 3.3: PRIMARY EDUCATION COMPLETION RATES FOR SELECTED COUNTRIES

Country	%	Country	%
Japan	100	Cameroon	45
Germany, Fed. Rep. of	100	Pakistan	41
United States	100	PDR Yemen	34
Korea, Republic of	98	Liberia	32
Malaysia	97	Paraguay	32
Tanzania	87	Benin	30
Philippines	65	Ethiopia	30
Mexico	53	Somalia	29

Source: World Bank Comparative Education Indicators, June 1985.

3.09 Female Enrollment. Females are under-represented at both primary and lower secondary school in Gansu province, as noted in Table 3.4. While females are just under 49% of the relevant age groups, only 38% of primary students and 36% of lower secondary students are girls. The corresponding averages for the four counties surveyed are close to those for the province. These average figures mask a range, from a low of 28% girls in the lower secondary schools of Lintao county, to a high of 45% girls in the primary schools of Yongdeng county (Appendix D, Table D.5). Underenrollment of girls has been a common problem throughout Asia, but one that, in many countries, is being solved. According to UNESCO, Asian countries with female enrollment in primary school approximately equal to that of males include Indonesia, Japan, South Korea, Malaysia, the Philippines and Thailand. The only major Asian country with a lower percentage of female enrollment than Gansu province is Pakistan with 33%. There are several common social and economic reasons for low female enrollment. Many families place a higher value on education for boys than girls and girls may be assigned more domestic responsibility than boys in child care, food preparation and other household chores. Also long school hours in Gansu (typical of China) -- from 8:00 a.m. to 4:30 p.m. (or 7:00 a.m., if morning physical exercises at the school are included, to 5:30 p.m., if after school activities or school chores are included) -- may add to the opportunity cost of sending girls to school (see para. 4.37).

3.10 Transfers from Incomplete Village Schools. Incomplete schools in rural areas, providing in many villages no access for children to the upper grades of primary school (and therefore qualification for lower secondary), are an obstacle to completion of full primary education. About 40% of the primary schools in Gansu are incomplete, which means they have fewer than five grades, typically two or three. But it is likely that many children finish three grades in one school and do not transfer to a complete school farther away. As noted in Table 3.2, the dropout pattern at the end of third grade is strikingly different for Gansu than for China as a whole, about 18% in Gansu as compared with 5% in China.<sup>10/</sup>

#### Disparities Between Schools

3.11 Educational policy in China has long followed a dual approach: public or enterprise-run schools in urban and more advanced rural areas; village-run schools in much of the rural hinterland. During the late 1970s the government introduced on a selective basis measures to improve the quality of basic education. These included the introduction of key schools, a few high quality institutions run directly by a province or prefecture, and of central schools, the premier county schools. Combined with a dual system of schooling, these measures have resulted in wide differences among schools,

---

<sup>10/</sup> The same table shows that the failure rate at the end of fourth grade is about twice as high as the grades before and after, 11% compared with 5%. One factor contributing to this high failure rate may be that students from incomplete village schools who are able to transfer to complete primary schools are inadequately prepared to handle fourth grade work.

Table 3.4: FEMALE PARTICIPATION, PRIMARY AND LOWER SECONDARY SCHOOL

	Percentage of females	
	Primary	Lower secondary
China - students	44	39
Gansu - students	38	36
Mission survey of four counties - students	40	36
Gansu - teachers	25	27

/a Both lower and upper secondary school.

Source: Gansu data provided by the Bureau of Education, Gansu Province, and mission estimates for four counties.

particularly primary school. These differences are only partly differences between urban and rural schools. While virtually all urban schools are relatively well off publicly supported or enterprise-run schools, there is considerable diversity among rural schools, ranging from key or central schools, which receive substantial and targeted public support, to village schools, which depend much more on local resources. (See paras. 4.31-4.34.)

3.12 The Gansu Bureau of Education describes primary schools as falling into one of five categories: urban, enterprise, central rural, other complete rural, and village schools. Table 3.5 shows their main operating characteristics. All but the last category are complete; that is, they have five or six grades (depending on location and other factors), and graduates are eligible to take lower secondary entrance examinations. Complete urban schools, many of which are key schools, financed by public sources, comprise fewer than 2% of the province's schools, but enroll almost 10% of the students. Enterprise-run schools, complete schools located principally in urban areas, enroll only about 5% of all primary students. Central rural schools are complete schools financed publicly and at a higher level than other rural schools. They enroll about 14% of primary students. Other complete rural schools, financed either publicly or by local sources are by far the largest type with about 61% of all students in about 50% of all schools. Village schools, defined here as incomplete schools in rural areas financed largely by local sources, comprise 41% of the schools, but enroll only 11% of the students. Urban schools tend to be larger, with an average of two teachers per class, allowing for more flexibility in assigning teachers to tasks. Complete rural schools are about one-third the size, and have only 1.2 teachers per class. Rural central schools fall between the two. Enterprise schools have a teacher to class ratio like that of urban schools but classes only two-thirds as large. Compared with those in other provincial primary schools, teachers in these latter schools are working under favorable circumstances. Village schools are very small, averaging only 30 students and less than one teacher per class. Since village schools generally provide only grades one through three and have on average only two classes, many teachers are teaching more than one grade level within a single class.<sup>11/</sup> This puts a heavy burden on the teachers who are, in many respects, the least prepared for the task. Virtually all teachers in village schools, and the majority of teachers in complete rural schools, are locally hired, minban teachers, and they are usually less well educated and trained (paras. 3.20-3.21). At lower secondary similar disparities in the conditions of the schools exist, but the consequences are less grave in that over 90% of lower secondary students are enrolled in the relatively well-financed publicly supported or enterprise-run schools. The major apparent weakness in lower secondary schooling is the higher proportion of unqualified teachers who are also concentrated, for the most part, in the rural areas.

---

<sup>11/</sup> This is called "multigrade" teaching. In many parts of the world effective one-room schools exist, in which a well trained teacher, who has adequate amounts of texts and other teaching materials, can without difficulty handle thirty students, the average number in Gansu's village schools, at several different grade levels.

Table 3.5: STATISTICS ON TYPES OF PRIMARY SCHOOLS, 1984

School type	No. of schools	No. of classes	Classes/school	No. of teachers	Teachers/class	No. of students	Students/school	Students/class	Students/teacher
Complete <u>urban</u>	420	5,300	12.6	10,800	2.0	252,700	600	47.7	23.3
Complete <u>factory and enterprise</u>	490	4,100	8.4	8,000	2.0	133,200	270	32.5	16.6
Central <u>rural</u>	1,490	10,400	7.0	15,700	1.5	372,600	250	36.0	23.8
Other complete <u>rural</u>	13,090	59,700	4.6	68,700	1.2	1,676,900	130	28.1	24.4
Village schools (grades 1-3)	10,680	20,300	1.9	17,500	0.9	317,500	30	15.6	18.1
Other	50	200	4.0	300	1.5	5,700	110	28.5	19.0
<u>Total</u>	<u>26,220</u>	<u>100,000</u>		<u>121,000</u>		<u>2,758,600</u>			

Source: Bureau of Education, Gansu Province.

3.13 Another way to compare schools is simply by location, urban versus rural. As noted earlier, in the mission survey of four counties almost twice as many rural students as urban students were more than one year overage. Rural schools have fewer students at or under the correct age for their grade and more overage students than urban schools. It is also likely that the dropout rate in rural schools is higher than that in urban schools. Across the province, almost all urban primary graduates, but only about two-thirds of rural graduates, continue to lower secondary school. Other data from within China give evidence of the kinds of urban-rural differences suggested here. A study conducted in Jiangsu province <sup>12/</sup> reports repetition rates of 9.5% for urban schools as compared with 16.6% for rural schools.

3.14 Another urban-rural difference with important consequences for student progress is the number of years in the primary cycle. During the past several decades, China has shifted the length of primary school several times between five and six years. At the end of the Cultural Revolution, five years was the norm. This is the current arrangement in much of rural Gansu with a six year cycle available only in the towns and cities. The present policy is to move towards six years provincewide. By 1990, all students are expected to have access to six years of schooling. To provide instructional materials for the two different programs, the Peoples' Educational Press has developed two sets of primary-level textbooks, one for a five-year program, one for six years. They cover roughly the same material. Thus, students in six-year schools have an extra year to complete the same required material and are likely to be better prepared for the lower secondary school entrance examination. Data on the numbers of five- and six-year schools in the province are not presently available. However, student data collected for the four counties covered in the mission survey suggest that about one-third of urban primary schools in Hui and Lintao counties, and two-thirds in Yongdeng county have six years. There appears to be only one such school in Xiahe county. Lintao and Yongdeng counties may also have one or two rural schools with six grades. Thus, the province has made progress in expanding urban schools to six grades.

#### School Facilities and Instructional Materials

3.15 Primary and lower secondary schools in Gansu province, particularly those in rural areas, are generally inadequate for instructional purposes. Many buildings are poorly designed; many have dark interiors. Most classrooms in older buildings are small, or long and narrow and have limited provision for heating. In 1983 there were approximately 25,500 primary schools in Gansu province. The total building area for these schools was estimated at 6.7 million m<sup>2</sup>. Of this space, the Bureau of Education estimates that 1.0 million m<sup>2</sup>, or about 15%, is "dangerous," that is, sufficiently dilapidated to be unusable. Not all of these buildings are old; some were constructed during the last 15 years. Rather the poor conditions are a consequence of low qual-

---

<sup>12/</sup> Ma Yuqi, "An investigation and study of the current rate of grade repetition in rural elementary schools," Educational Research, Vol. 9, 1984, Central Institute for Educational Research (in Chinese), Beijing.

ity materials and lack of maintenance. Major investments will be required to renew and maintain the stock of school buildings.

3.16 Current policy for location of primary and lower secondary schools has resulted in a reasonably good distribution of schools. In urban areas schools are located in the vicinity of housing and built to provide sufficient space for all children of school age. In rural areas existing guidelines are: a primary school per 1,000 population; or a primary school in a radius of two or three kilometers in inhabited areas; or a primary school for each natural village; a lower secondary school per 10,000 people; or, in areas of lower population density, a lower secondary school for every two townships. Given the sharp decrease in school age population over the next 10 years, construction of new schools and rehabilitation of existing ones will have to be planned with a view to population size and distribution. A most important objective in rural areas will be to provide sufficient space in appropriate locations to ensure students access to the full primary cycle of six years and to the three years of lower secondary school. This will require some consolidation of schools and careful designation of feeder schools and complete schools in close proximity.

3.17 Equipment, teaching materials and furniture are in short supply in all schools in the mission survey, with the poorest conditions in schools in rural areas. Classrooms generally have at least one blackboard; all children have a full set of textbooks, which they are required to purchase in order to attend class; and some lower secondary schools had laboratory equipment for purposes of demonstration. There is seldom any other teaching aid in the school. There are few books or reading materials beyond the required texts, and few posters or pictures displayed on walls. The situation with regard to furniture is somewhat better. Past surveys of problems in Gansu had identified the lack of school furniture as especially severe, but recent efforts to rectify the situation seem to have made headway. Virtually all the schools in the mission survey had wooden benches and desks, many apparently recently acquired to replace clay or concrete furniture. However, the space allotted to each child is often quite small; three, four, or even five children sitting at a desk meant for two was not uncommon. A major determinant of quality in rural education and a distinguishing feature of effective schools is the availability of texts, teaching materials and other aids to student learning.<sup>13/</sup> There is no doubt that a modest increase in provision of educational materials would enrich the learning environment, promote student learning and increase the attraction and holding power of schools, particularly in rural

---

13/ See, for example: Heyneman, S.P. and Jameson, D.T., "Student Learning in Uganda: Textbook Availability and Other Factors" Comparative Education Review, Volume 24, June 1980, pp. 206-20; Cohn E. and Rossmiller R., Research on Effective Schools: Implications for Developing Countries, draft, Education and Training Department, World Bank, Washington, D.C., 1985; and Heyneman, S.P. and Loxley, W.A., "The Effect of Primary - School Quality on Academic Achievement Across Twenty-Nine High- and Low-Income Countries," American Journal of Sociology, Volume 88, Number 6, pp. 1162-1194.

areas where no other alternatives such as libraries or bookstores are available.

### Teachers

3.18 Gansu authorities consider the low qualification of teachers to be a major problem facing the provincial education system. Many teachers do not have minimum educational or pedagogical qualifications, and this deficiency is particularly evident among minban teachers. Some teachers are considered by the authorities to be sufficiently incompetent to be removed from their posts; all teachers need refresher training to keep their skills and knowledge current. Several circumstances might be expected to provide direction to the strengthening of the teacher training system. As a result of the decline in the school age population, in the near term the demand for primary teachers will drop substantially and output from existing institutions may be in excess of need. The situation is less clear for lower secondary schools, where demand for teachers will also decline initially but will increase again in the 1990s as more students begin to complete the nine year cycle. Thus, a general consequence of demographic factors, and increase in student completion rates, is that to the year 2000 there will be substantial annual changes in the demand for teachers at different levels. The teacher training system will need to respond to changing levels of demand.

3.19 Teacher Qualifications. Teachers are expected to have minimum levels of both formal education and pedagogical training, but, as summarized in Table 3.6, many teachers fail to meet the standard. Only two-thirds of primary teachers have a full upper secondary education, the minimum educational requirement at this level. For lower secondary teachers, the minimum requirement, two years of post-secondary schooling, is met by only one quarter of the teachers. With regard to formal education, the lower secondary school teachers are clearly the weakest group, but substantial numbers of teachers at both levels are in need of upgrading to bring their educational qualifications to the minimum standard. Relatively few of the teachers in Gansu have had pedagogical training. About 25% of primary school teachers have spent some time in normal schools. (Comparable figures for lower secondary teachers are not available). Data concerning both formal education and pedagogical training were collected in three of the counties in the mission survey. These are presented in Table 3.7. Only Hui county has more than a small fraction of teachers with one or more years of pedagogical training. The table also gives data about educational attainment. The level of education achieved by the teachers in the three counties surveyed is roughly the same as that for

Table 3.6: GANSU PROVINCE: TEACHER EDUCATIONAL QUALIFICATIONS, 1983

Teaching level	Full educational qualifications		One level below full qualifications		More than one level below full qualifications (%)
	Level completed	%	Level completed	%	
Primary	Upper secondary	65.9	Lower secondary	28.3	5.8
Lower secondary	2-year college	22.7	Upper secondary	(68.0)/a	(9.3)

/a Data source does not break down numbers in these categories. Breakdown estimated from other sources.

Source: Bureau of Education, Gansu Province.

Table 3.7: TEACHER QUALIFICATIONS: THREE COUNTIES, 1984

---

<u>Primary Level</u>					
<u>County</u>	<u>No. of teachers</u>	<u>Percentage of teachers</u>			
		<u>USS /a</u>	<u>LSS /b</u>	<u>Less than LSS</u>	<u>One year or more pedagogical training</u>
Hui	1,160	73.6	24.2	2.2	29.8
Xiahe	540	64.7	28.8	6.5	6.5
Yongdeng	2,880	60.8	31.9	7.3	11.4

<u>Lower Secondary Level</u>					
<u>County</u>	<u>No. of teachers</u>	<u>2-year college</u>	<u>USS</u>	<u>Less than USS</u>	<u>One year or more pedagogical training</u>
Hui	290	38.2	55.6	6.2	76.0
Xiahe	100	29.3	67.7	3.0	10.1
Yongdeng	1,360	16.5	73.0	10.5	2.7

---

/a USS is upper secondary school education.

/b LSS is lower secondary school education.

Source: Mission estimates.

the province as a whole, but Hui county is somewhat more advantaged than the others on all measures.<sup>14/</sup>

3.20 The low qualifications of teachers, particularly at the primary level, is to some extent a reflection of the status of minban teachers. There are substantial differences between the conditions of service of the two types of teachers, those who are public employees, the gongban teachers, and those hired at the local level, the minban teachers.<sup>15/</sup> Gongban teachers are public servants with a fixed salary level controlled by the Government. They also receive subsidies and free medical care. Furthermore, they are considered urban residents, no matter where they teach, and are therefore provided a grain ration. In contrast, minban teachers serve under terms agreed with the village or township that hired them. Many receive partial payment in cash, others payment in grain, still others a combination of cash and grain. Minban teachers also receive a public subsidy but at less than a subsistence level (see para. 4.33). Employment is also less stable for minban teachers. Some have attempted to farm as well as teach. Others have left teaching in recent years for higher income in other activities. Altogether the rate of turnover is higher than that of gongban teachers.

3.21 In Gansu province in 1983, 59% of the primary teachers were minban teachers. The percentage in lower secondary schools is quite small, only 7%. It has since dropped even lower. The combination of low salaries and, in many cases, the need to supplement teaching to add to family income make the likelihood of recruiting qualified minban teachers quite low. An important incentive for people to become minban teachers is the possibility, on qualification via inservice training, of eventually transferring to the status of a gongban teacher. Thus, the rate at which such promotions occur is likely to have a substantial impact on the success in recruiting minban teachers.

3.22 Inservice Teacher Training. In a survey conducted in 1984, the provincial Bureau of Education asked school principals to assess teacher competence and trainability, independently of the formal credentials held. According to the results, about 27,000 primary teachers (23%) were judged inadequate. Of these, supervisors estimated that about 7,300 could not be trained and should be replaced. The remainder could be upgraded through

---

<sup>14/</sup> There is little evidence to provide guidance on how much teacher education is needed for primary teachers. In a study conducted for the World Bank Husen et al. note that most professional educators believe that "beyond a certain threshold, additional teacher preparation would likely prove unimportant in raising student performance levels in developing countries, thus wasting scarce resources, both in terms of costs and facilities" (p. 43). Husen, T., Saha, L. & Noonan, R., Teacher Training and Student Achievement in Less Developed Countries. World Bank Staff Working Paper No. 310., 1978.

<sup>15/</sup> The conditions of service described here refer to minban teachers in Gansu province. Since minban teachers are hired by local authorities, townships in richer provinces may be able to provide better conditions.

training. Comparable figures for lower secondary teachers were 7,400 (21%) without qualification, of whom 1,100 should be replaced. Priority in the use of resources for inservice training is undoubtedly in programs for upgrading unqualified teachers. All teachers require periodic refresher training, and at present there is only a modest amount of short-term inservice training for practicing teachers. It is the intention of provincial authorities that key schools and central schools, which receive extra subsidies and are expected to be exemplary, would serve as models for surrounding schools. Some of the more enterprising local authorities have organized a few short courses or meetings in these schools. But the practice of providing short-term inservice training to all teachers on a regular basis, regardless of qualifications, has not yet been institutionalized.

3.23 Demand for Teachers. Estimates of the demand for primary and lower secondary teachers are presented in Tables 3.8 and 3.9. The Bureau of Education anticipates that existing and planned training facilities will produce a surplus of primary teachers and a shortage of lower secondary teachers. These projections, as well as several other indicators, suggest that the number of people receiving preservice training for lower secondary teaching should eventually increase. The number of teachers in training, as a percentage of the existing stock, is 10% for primary and 7% for lower secondary. Also, attrition tends to be higher at lower secondary, because the better teachers are recruited to teach at upper secondary level, thus creating a greater need for replacement at this level than elsewhere.

3.24 Teacher Training Facilities and Programs. Teacher training in Gansu is of two types. One group of institutions provides preservice training to students who have completed the immediately preceding level of education. A second group of institutions, largely different from the first, provides long-term upgrading courses for inservice teachers who are not fully qualified. Table 3.10 provides basic information on preservice institutions. Five specialized normal schools train lower secondary teachers. Each of the five schools draws its students from specific prefectures, the level of administration above the county. This results in some geographic imbalance; Qingyang Specialized Normal School (SNS) the largest of the four with 800 students, covers an area that presently has 5,800 secondary teachers, while Lanzhou SNS, with 640 students, services an area with 14,400 secondary teachers. Twenty-one secondary normal schools for primary teachers enroll 12,300 students. In addition, a few enterprises and other entities run normal schools; these account for approximately 500 more students. These schools all recruit within prefectures and all are boarding schools. In some cases, the instructional program is four instead of three years.

3.25 Table 3.11 contains basic information on inservice institutions for primary and lower secondary teachers. Although larger in number of institutions, this level of training is much smaller in number of people reached. It has only recently been organized and is still under expansion. By 1990 provincial authorities are planning seven prefectural normal colleges, with a total capacity of 2,000 students, and 70 county-run continuing education schools, with a total capacity of 8,000. The table presents Provincial Bureau of Education estimates of the number of teachers at each level lacking qualifications. Once again, the relative disadvantage of lower secondary teachers

Table 3.8: DEMAND FOR PRIMARY TEACHERS, 1985-2000

Source of need	Number of teachers	
	1985-90	1991-2000
Normal attrition	6,000	20,000
Replacement of those in full-time inservice training	4,700	4,400
Replacement of unqualified teachers	4,500	1,100
Replacement of <u>minban</u> teachers	10,500	8,000
<u>Total</u>	<u>25,700</u>	<u>33,500</u>
Projected secondary normal school graduates	26,900	37,200
<u>Balance</u>	<u>+1,200</u>	<u>+3,700</u>

Source: Bureau of Education, Gansu Province.

Table 3.9: DEMAND FOR LOWER SECONDARY SCHOOL TEACHERS, 1985-2000

Source of need	Number of teachers	
	1985-90	1991-2000
New schools	9,300	7,900
Normal attrition	3,800	9,000
Replacement of those in full-time inservice	1,500	1,800
Replacement of unqualified teachers	1,200	900
<u>Total</u>	<u>15,800</u>	<u>19,600</u>
Graduates from senior normal schools expected to teach in lower middle schools /a	9,600	24,300
<u>Balance</u>	<u>-6,200</u>	<u>+4,700</u>

/a Eighty percent of graduates in 1985-90; 90% of graduates in 1991-2000.

Source: Bureau of Education, Gansu Province.

Table 3.10: BASIC DATA ON PRESERVICE TRAINING INSTITUTIONS, 1984

	Level of teacher being trained	No. of insti- tutions	Enrollment	New entrants	Graduates	Full-time teachers
2-year college (specialized normal college)	Lower secondary school teachers	5 /a	3,520	1,480	1,060	600
Upper secondary school (secondary normal school)	Primary teachers	21	12,300	3,060	4,470	3,860

a/ Data for 1985.

Source: Bureau of Education, Gansu Province.

Table 3.11: BASIC DATA ON INSERVICE TRAINING INSTITUTIONS, 1984

	Level of teacher being trained	No. of insti- tutions	Enroll- ment	Entrants	Gradu- ates	Full-time faculty	Estimated no. of teachers needing upgrading	% of existing stock	% being reached
Normal college	Lower secondary school	<u>3/a</u>	850	320	190	160	27,500	76.8	3.1
Continuing education schools	Primary	67	3,020	2,420	2,680	290	37,100	57.2	8.1

/a A fourth was established in 1984.

Source: Bureau of Education, Gansu Province.

is evident. While about 75% of such teachers lack credentials, the present training program is reaching only about 3% of them each year.

3.26 A problematic feature of the teacher training system in Gansu (and in China) is the high degree of separation of the preservice and inservice programs. There is, of course, substantial overlap in the courses, specialist teachers and facilities needed for these two types of training. Gansu officials argue that a major barrier to combining them is the different age level of the students. Preservice students are at the secondary level; the inservice students are adults. Because of the economies possible and because greater flexibility will be needed to deal with changing requirements for teachers, provincial education officials are exploring the possibilities for better coordination between these two programs. The separation of teacher training in China into two streams, one for preservice and one for inservice, is not common in other countries. The reason for this development of parallel sets of training institutions in China may derive from the long-standing need to supplement the inadequate basic education of unqualified teachers. Also once teachers entered employment their future training became the responsibility of their employing units. Whatever the historical antecedents, the continued maintenance of these two systems would seem to have several disadvantages in management and in cost. Since inservice training of teachers is at present largely directed toward compensating for their weak prior education, the courses of study currently offered in the two systems are largely the same. Thus programs, facilities, even requirements for teacher trainers are largely duplicated. There is little doubt that greater efficiency in the use of resources could obtain from general consolidation of teacher training institutions -- which, in any case, are operated in China with relatively small enrollments by comparison with other countries. Second, the emphasis in the inservice training institutions on long term programs results in very little attention to inservice training needs as it is understood in other countries. The modernization of courses of study in primary and secondary schools must be supported not only by teachers who have fulfilled the formal requirements for qualification, but also by teachers who have received orientation and refresher training in the newer curricula. This latter purpose is the principal objective of inservice training throughout North America and Europe. In China it has been largely disregarded. When a high proportion of teachers is unqualified -- as is the case with primary and lower secondary teachers in Gansu -- there is no question but that their formal education needs to be raised. But beyond that first objective lies a second, equally important goal of ensuring the continued effectiveness of teachers over a working lifetime as courses of study change and develop. This second challenge must be more widely recognized.

3.27 This examination of primary and lower secondary teacher training in Gansu highlights two areas for adjustment. First, there is a substantial need for short-term programs to upgrade teachers, both those without formal qualifications, and those who received their education many years ago. Since the needs that such programs must satisfy are likely to change with time, new investments should be made with a view to flexibility so that programs can be easily modified in response to changing requirements. As provincial authorities are aware, the mass media -- including the Television University and Radio Schools -- are good vehicles for reaching large audiences at relatively

low cost with programs that can be easily modified. And second, improvement in the quality of education in Gansu will require establishment of regular programs of short-term refresher training for all teachers so that they can continue to bring new information and new pedagogical advances into all the provincial classrooms.

### Structure of Upper Secondary Education

3.28 There are four types of upper secondary schools in the province: regular secondary; specialized secondary; agricultural and vocational secondary provided in schools operated by the Provincial Bureau of Education; and skilled workers schools. (See Table 3.12). The majority of students, 95.6% of all secondary students or 80.3% at the level of upper secondary, attend regular (academic) lower or upper secondary schools. Specialized secondary schools are run by education departments of central ministries and produce technicians who are generally assigned jobs in the sector training them. (Teacher education under the Provincial Bureau of Education is also classified as specialized secondary education.) The Bureau of Education is converting some upper secondary schools into agricultural and vocational schools.<sup>16/</sup> In 1983 students in agriculture or vocational schools comprised about 7% of the upper secondary enrollment. The agriculture curriculum is designed to provide skills needed in on- or off-farm employment in the countryside. In 1983, 73% of students in agricultural schools were male. The vocational programs are typically designed as preparation for different service occupations. In 1983, 56% of students in vocational schools were female. In contrast to graduates of specialized secondary schools, graduates of agricultural and vocational schools are not guaranteed jobs under the system of state allocation, though they are assisted in finding employment by the labor bureaus. In addition to specialized secondary, and agricultural and vocational secondary education, there is another set of schools operated at the secondary level. These are usually identified as skilled workers' schools and they provide further education and skills training for lower secondary graduates in two or three year programs. The level of the skilled workers schools is between the specialized secondary schools and the agricultural and vocational schools operated by the education department. In Gansu province in 1983, there were about 8,800 students enrolled in these skilled workers schools, though a sizeable proportion of these students may actually be workers undergoing retraining. For that reason, this category is not included in the totals in Table 3.12.

3.29 Different Types of Vocational Secondary Education. There are, therefore, three main types of vocational (or job-oriented) schools at the secondary level: secondary technical schools (within the category of secondary specialized schools); skilled workers schools, both operated by enterprises or educational departments of central ministries; and secondary agricultural or vocational schools administered under the Provincial Bureau of Education. These three types can be distinguished according to their entrance

---

<sup>16/</sup> For a review of technical and vocational education in China, see Chapter 3, China: Long-Term Issues and Options, Annex A: Issues and Prospects in Education, World Bank, Washington, D.C. 1985.

Table 3.12: TYPES OF SECONDARY SCHOOLS IN GANSU PROVINCE, 1983

School type	Number of students	Number of teachers	% of students	
			All	Upper
Regular lower	691,700	35,300	78.2	-
Regular upper	154,100	9,100	17.4	80.3
Specialized /a	24,700	3,200	2.8	12.9
Agricultural	10,800	{	1.2	5.6
Vocational	2,300	{ 650	0.3	1.2
Skilled workers /b	(8,800)	-	-	-
<u>Total</u>	<u>883,600</u>		<u>100.0</u>	<u>100.0</u>

/a Specialized secondary includes secondary normal (12,900 students) and secondary technical (11,800 students) schools, including schools for industry, agriculture, forestry, medicine, finance and economics, politics and law, physical education, fine arts and other fields.

/b In addition, within Gansu, there are skilled workers schools with an estimated enrollment in 1983 of about 8,800 students. These students were not reported in the provincial education yearbook. Some of them may, indeed, be workers undergoing retraining and may not be properly classified under formal secondary education. Enrollment in skilled workers schools is not, therefore, included for present purposes in the totals for secondary students enrolled in technical or vocational education.

Source: Bureau of Education, Gansu Province.

requirements, duration of courses offered and regulations regarding students' eligibility to compete for higher education as shown in Table 3.13.

3.30 In terms of curriculum characteristics, the programs offered in the three types of institutions are also different. The data in Table 3.14 show, for example, that the proportion of teaching time allocated for practicals ranges from 25% to 55%. There are many different specializations offered in the network of technical and vocational schools. Each school may offer as few as three, two or even one of these specializations, so that the schools are also quite specialized and small, with enrollments averaging about 350 students.

3.31 Finally, it is useful to note the training objectives in each type of school. The most important of these is obviously preparation for the labor market. Table 3.15 shows that graduates are expected to enter employment mainly at lower levels in the hierarchy of jobs.

3.32 As a result of expected growth in upper secondary enrollment in both general and vocational programs, there will be an increase in demand for upper secondary teachers (see Table 3.16). Regulations governing the employment of upper secondary teachers require four years of college for qualification. At present, this condition is met by only about 50% of the total number of 9,600 upper secondary teachers. Of this group, the Bureau of Education estimates that about 1,150 teachers, 12% of total, require immediate upgrading and about 200 teachers should be replaced. North-West Normal College in Lanzhou is the only institution in the province that trains prospective upper secondary teachers. It graduated about 500 teachers in 1984. Unlike the institutions of teacher training for primary and lower secondary teachers, North-West Normal College offers both preservice and short-term inservice training. There is also one inservice institution, Gansu Education Institute; it graduated about 200 in 1984. A major weakness in the training system for upper secondary teachers is the limited capacity to train teachers specialized in vocational, including technical or agricultural, fields. In addition to recruiting specialized teachers from outside of the province -- about 10% of recent recruitment has been of this kind -- the Bureau of Education could increase capacity at the two existing institutions and also establish specialized departments of vocational teacher training within other colleges and universities within the Gansu system of higher education.

3.33 Policy for Vocational Education. Plans for the development of vocational education in Gansu call for rapid expansion with priority assigned to the level of upper secondary. The Provincial Bureau of Education is preparing to increase sharply, to at least 50%, students at the level of upper secondary receiving some form of vocational education. In addition to opening new vocational and agricultural programs within existing upper secondary schools, the Bureau of Education is planning to build about seven specialized vocational training centers in prefectural capitals by 1990. These institutions would enroll their own students as well as offer courses for students enrolled in regular, or vocational secondary schools in the vicinity, and provide courses for vocational teachers. For its part, the Agriculture Bureau is proposing to add three new specialized agriculture schools in order to increase enrollment by about 60% to 3,100 by 1990. Other major ministries,

Table 3.13: ENTRANCE REQUIREMENTS, DURATION OF COURSES, AND ELIGIBILITY FOR HIGHER EDUCATION BY TYPE OF TECHNICAL AND VOCATIONAL EDUCATION

Type of institution	Entrance requirements	Course duration	Eligibility for higher education
Secondary Technical School (STS)	Lower secondary education + success at entrance examination with lower grades than general secondary entrants	Average 4 years	Permitted to sit for national university/college entrance examination after two years of employment
Skilled Workers' School (SWS)	As above, but entrance examination grades are lower than STS entrants	3 years or less	As above
Secondary Vocational or Agricultural School (SVAS)	As above, but entrance examination grades are lower than SWS	Average 3 years	As above, but two years work requirement does not apply. Success rate is, however, low

Source: State Education Commission, Beijing.

**Table 3.14: PERCENT OF TEACHING TIME IN TECHNICAL AND VOCATIONAL SECONDARY SCHOOLS**

Institution	General subjects /a	Specialized subjects		Economics & management	Total
		Theory	Practical		
Secondary Technical School (STS)	25	35	35	5	100
Skilled Workers' School (SWS)	20	25	55	0	100
Secondary Vocational or Agricultural School (SVAS)	45	30	25	0	100

/a Includes language, mathematics, politics, science.

Source: State Education Commission, Beijing.

Table 3.15: EMPLOYMENT CHARACTERISTICS BY  
LEVEL OF EDUCATION OR TRAINING

Level of training	Expected employment	Expected level of job responsibility
University	Professional	Managerial decision-making; product design and research
Polytechnic (short-term university)	Senior technician	Bridge gap between engineers and workers
Secondary Technical School (STS)	Junior technician	As above but at a lower level as shop supervisor or foreman
Skilled Workers' School (SWS)	Skilled worker	Competence in chosen skill or craft
Secondary Vocational or Agricultural School (SVAS)	Operative or individual worker	Competence in one or more operations

Source: State Education Commission, Beijing.

Table 3.16: DEMAND FOR UPPER SECONDARY SCHOOL TEACHERS, 1985-2000

Source of need	Number of teachers	
	1985-90	1991-2000
New schools	7,000	10,100
Normal attrition	1,800	5,000
Replacement of those in full-time inservice	400	1,000
Replacement of unqualified teachers	300	200
<u>Total</u>	<u>9,500</u>	<u>16,300</u>
Numbers that can be supplied by normal colleges and universities	7,200	17,000
<u>Balance</u>	<u>-2,300</u>	<u>+700</u>

Source: Bureau of Education, Gansu Province.

including public health and technical ministries such as metallurgy, chemical industry, coal industry, have plans to increase enrollment in their secondary technical schools.

3.34 Policy to increase vocational education in Gansu is based on several considerations. Provincial authorities estimate that there are as many as 1.3 million lower or upper secondary graduates in the labor force with no formal skill training. There are about 3.3 million primary school graduates in the same condition. They also estimate that about 220,000 students leave the school system annually without job-related skills. Standard programs in the general stream, especially at the upper secondary level, are designed for those aspiring to higher education, but only a small proportion, perhaps 15% of upper secondary graduates, will proceed to higher education. In addition, the provincial authorities recognize that there is excess demand in both urban and rural areas for skilled and technical staff and workers. This condition, which reflects in part the decline in vocational education during the Cultural Revolution, has deepened as demand for qualified personnel has increased with recent high growth in agriculture, industry, and in side-line activities and services, including village and township (or rural) industry.

3.35 Assessment of Vocational Education. Yet the experience of other countries in implementing pre-employment vocational education has been mixed. On the one hand, graduates of secondary vocational programs generally possess stronger academic backgrounds than those who enter the work force without secondary education and are better prepared for immediate job requirements. On the other hand, several shortcomings have been observed in some systems: schools cannot easily duplicate actual working conditions for students; school equipment is often inappropriate (either outdated or in some cases too sophisticated); teachers may lack practical trade experience themselves; and the syllabus may fall behind changing skill requirements. A hallmark of vocational education in developed countries where programs have been judged as most successful -- for example West Germany and Japan, among others -- is the very close linkage between the industries or sectors for which students are being prepared and the schools and training institutions. In both West Germany and Japan, for example, associations or representatives of employers, as well as craft or trade unions, have held significant responsibility in designing curriculum, qualifying teachers, and setting educational and training standards. Arrangements of this kind, which may even extend to operating schools -- as in the case of specialized schools under technical ministries in China -- have helped maintain the quality and ensure the relevance of vocational education.

3.36 A sizeable research literature has developed on vocational education, broadly defined, including cost, financing and the linkages between

education, training and employment.<sup>17/</sup> A recent World Bank study reported on the results of a policy to diversify secondary school curriculum in Tanzania and Colombia. The objective of policy in these two countries was to combine prevocational courses with academic secondary-school curricula to make schooling more relevant to work and national development goals. It was hoped that graduates possessing some job-related education would have an advantage in the job market. Although this study covered only a few years in two countries -- whose experience may not be very relevant for Gansu or China -- the findings are interesting. In general, it was found, first, that vocational curricula are difficult to implement if a country lacks instructional materials, equipment, laboratories, teachers trained in the new curricula. Second, more diversified secondary education did not appear to improve students' economic performance above that of regular secondary education. Nor did graduates of these programs, on the whole, tend to end up in jobs better matched to their education than others. Third, secondary vocational curricula are highly expensive and the question is raised whether there are less expensive alternatives to providing diversified vocational programs in secondary schools as a form of preparation for employment. Even though the experience with vocational secondary education of other countries such as Japan, South Korea, Thailand, West Germany has proved more successful, it is often overlooked that regular secondary education, with its emphasis on basic academic and intellectual development, is itself a foundation for successful performance in employment; it may help to reduce the costs of on-the-job training; and it is a considerable advantage when it comes to new assignments in the working environment.

3.37 Planning Vocational Education in Gansu. In the case of Gansu, the emphasis on three year vocational programs (or longer) at the secondary level may be misplaced. This approach is essentially to apply to Gansu national policy on the development of vocational education without taking into account distinctive economic and social conditions. Policy for the development of nine-year basic education is posited on a strategy that distinguishes among regions by underlying economic conditions and prevailing levels of educational development. The case for a similar differentiated response in vocational education is at least as strong. There are, of course, shortages in technical and professional manpower in Gansu, persons trained at the level of specialized secondary and higher. But the ratio of annual requests for technical

---

<sup>17/</sup> See for example: Block, F. Evaluating Manpower Training Program, JAI Press, Greenwich Conn. 1979; Drake, K. "The Cost-Effectiveness of Vocational Training: A Survey of British Studies," Economics of Education Review, Vol. 2, No. 2, 1982, pp. 103-125; Hu, T. "Studies of the Cost-Efficiency and Cost-Effectiveness of Vocational Education," Information Series No. 202, National Center for Research in Vocational Education, Ohio State University, Columbus, Ohio 1980; Metcalf, D.H. The Economics of Vocational Training: Past Guidance and Future Evaluations, World Bank Education and Training Department, Washington, D.C. 1984; and Psacharopoulos, G. and Loxley, W. Diversified Secondary Education and Development: A Report on the Diversified Secondary Curriculum Study, World Bank Education and Training Department, Washington, D.C., 1984.

manpower from responsible departments to available graduates averaging about three to one, as reported by the Gansu Bureau of Labor, does not differ significantly from the national reported average or the experience of other provinces. What is remarkable in the case of Gansu is that demand for semi-skilled workers and operatives is increasing very rapidly both within and outside agriculture. Positions at this level can be filled very well by persons with less than 12 full years of schooling (nine years of basic and three years of vocational secondary). Moreover, as noted, only about 11% of the age group in Gansu currently enroll in upper secondary, so that programs of study designed for that level will reach only a fraction of youth.

3.38 Specialization has increased within agriculture as a result of the responsibility system. Farm workers are required increasingly to use and manage complementary inputs of fertilizers, pesticides and handle and repair equipment for pumps and other farm machinery. Production in rural industries (which includes mining and all types of manufacturing at the village and township level) has increased about 30% a year since 1983. Employment in these activities has grown by about 40% over the same period. Growth is also reported, but at a much lower pace, in urban crafts and simple trades either in collectives or as self-employment in services. Visits by the mission to rural industries in numerous counties confirm the judgment that a complete upper secondary education is not required for most of these new positions. Rather a solid basic education combined with a relatively short-term exposure to selected job-related skills either prior to job entry or as part of employment would be sufficient. The target groups for such training would be primary and lower secondary school leavers as well as lower secondary graduates, both male and female, choosing to enter the labor force. The direct cost of skill training in three to six month courses is perhaps 10% to 20% that of the full secondary program and, of course, the indirect cost for the trainee is much less in that employment can begin sooner. Not surprisingly, given the relatively low levels of enrollment in upper secondary education, interviews by the mission with industry managers at village and township levels indicated that students who have completed upper secondary are, in any case, not likely to settle for employment in farming or rural industry.

3.39 In sum, the research literature tends to confirm that the high costs of formal vocational education are not necessarily associated with increased worker productivity, by comparison, say, with general education or on-the-job training. However, the findings are not easily generalized across all countries because of differences in educational and employment systems, and level and pattern of economic development. What could be stressed, rather, is that Gansu should not automatically adopt approaches appropriate for more developed regions of China that emphasize three year vocational programs at the level of upper secondary. Rather Gansu should consider more localized, short-term and lower cost alternatives. Moreover, policy to increase the study of vocational subjects should be implemented gradually. If implementation of a program can be phased, for example, the achievements of each phase could be evaluated as the program proceeds. Since in all countries a major constraint on the development of vocational education is the comparatively high cost, adjustments in the level, design and intensity of programs have been made in order to reduce cost. Substantial cost saving has been achieved

-- for example in South Korea, Japan, Singapore and countries of Western Europe -- by means of a program design for vocational education that is short-term, three to six months or up to one year, rather than spread over a full three year cycle. Another innovation -- in Thailand, Philippines, United States -- has been to develop centralized physical facilities for training that can be shared by a relatively large number of students.

#### IV. MANAGEMENT AND FINANCING OF EDUCATION

##### Overview

4.01 A strategy for the improvement of education must address not only the central problems of low student completion, poor conditions of classrooms and other facilities, the backlog of unqualified teaching personnel, limitations on the provision of preservice and inservice teacher training, and the failure to provide appropriate vocational preparation for school leavers. It must also take account of the constraints on institutions to manage programs of educational change. In addition, it must be based on an understanding of the financial conditions, including levels of expenditure, balance of resource use, and sources of finance. The educational problem areas identified in Chapter III represent the targets for change. Constraints on management and finance set the boundaries within which a strategy can be implemented with reasonable prospects for success.

##### Sectoral Organization and Management

4.02 Four levels of administration are responsible for managing education in Gansu province: the Provincial Bureau of Education, the Prefectural Bureau of Education, the County Bureau of Education and Culture, and the Township Education Office. Figure 4.1 is a description of the division of responsibility for management of education by level of administration.

4.03 The Provincial Bureau of Education is under the dual leadership of the provincial government and the central SEDC. The former is chiefly responsible for specific strategies and targets; the latter for broad academic and management policy. As shown in Figure 4.2, the Provincial Bureau of Education comprises a number of divisions set up in correspondence with the functional departments of the SEDC. The Gansu Provincial Bureau of Education employs a total of about 100 persons. In addition to the Provincial Bureau of Education, other bureaus at the provincial level are involved in education activities. These include the Provincial Bureau of Public Health, which runs schools for nurses and paramedics; and the Provincial Bureau of Agriculture, Animal Husbandry and Fishery, which runs specialized agricultural secondary schools and adult education courses. Education departments of technical ministries and industrial agencies also administer educational activities such as upgrading the education level of the workers and staff. Some state enterprises run primary and general secondary schools, accounting for about 5% of enrollments.

4.04 The Prefectural Bureau of Education is an intermediate administration between the provincial level and the county level. Gansu province is divided into 13 geographic regions, which are known as prefectures, municipalities and zhou (municipalities are major cities and their surrounding areas; zhou are autonomous regions within provinces). A Prefectural Bureau of Education is organized along the same general pattern as the Provincial Education Bureau, except that at this lower level not all functions are retained. Each bureau has only some 10-20 staff members. The main functions cover organizing inservice and preservice training for teachers of both prim-

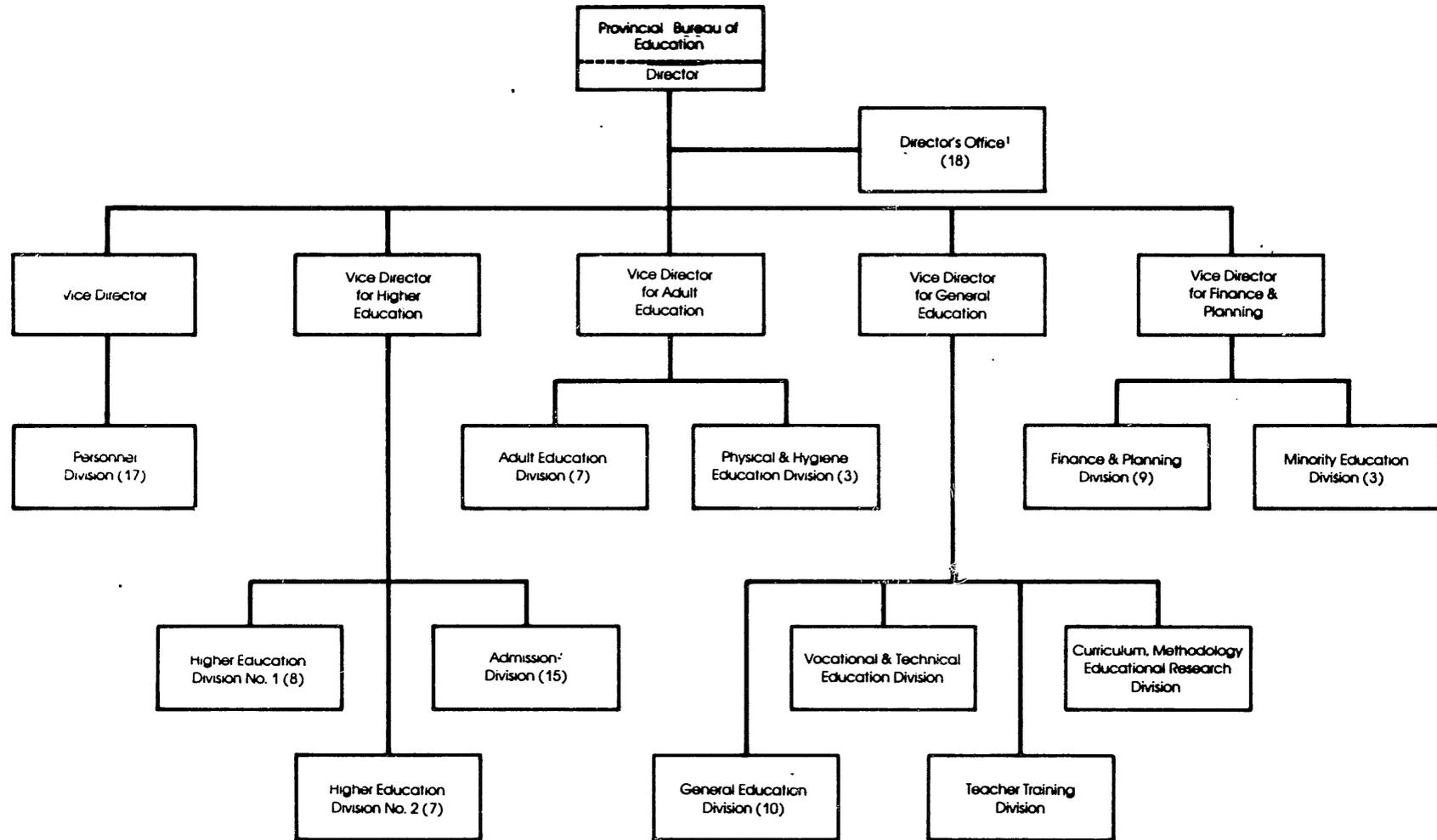
Figure 4.1

## Allocation of Management Responsibility in Gansu Province

	Primary Education	Lower Secondary Schools	Upper Secondary Schools	Higher Education
<b>PROVINCE</b>	<ul style="list-style-type: none"> <li>. implementing government policy and making provincial wide planning.</li> <li>. allocating public funds and mobilizing provincial resources.</li> <li>. collecting and analysing data on primary schools.</li> <li>. supervising and inspecting primary education system.</li> </ul>	<ul style="list-style-type: none"> <li>. implementing central government policy and making provincial wide plans.</li> <li>. allocating public funds and mobilizing provincial funds.</li> <li>. collecting and analysing data on lower middle schools.</li> <li>. offering inservice and preservice teacher training.</li> <li>. supervising and inspecting the school system.</li> </ul>	<ul style="list-style-type: none"> <li>. implementing central government policy and making provincial wide plans.</li> <li>. allocating state funds and mobilizing provincial funds.</li> <li>. offering inservice and preservice teacher training programs.</li> <li>. supervising and inspecting the school system.</li> <li>. collecting and analysing data on upper middle schools.</li> </ul>	<ul style="list-style-type: none"> <li>. implementing national policy, managing universities, planning new public institutions.</li> <li>. allocating funds.</li> <li>. organizing entrance examinations.</li> <li>. assigning jobs for graduates.</li> <li>. financing research projects.</li> <li>. collecting and analysing data on universities and colleges.</li> </ul>
<b>MUNICIPALITY</b>	<ul style="list-style-type: none"> <li>. further allocating public funds to counties.</li> <li>. deciding personnel matters for key schools.</li> <li>. running some key schools.</li> <li>. offering inservice and preservice teacher training programs.</li> </ul>	<ul style="list-style-type: none"> <li>. allocating public funds and financing from municipal or prefectural budgets.</li> <li>. deciding on personnel matters for key schools.</li> <li>. running key schools.</li> <li>. organizing graduation and entrance examinations for lower secondary graduates.</li> <li>. offering inservice and preservice teacher training programs.</li> </ul>	<ul style="list-style-type: none"> <li>. allocating public funds and financing from municipal or prefectural budget.</li> <li>. deciding on personnel matters for schools.</li> <li>. running schools.</li> <li>. planning new schools and enrollments.</li> <li>. organizing graduation examinations.</li> <li>. maintaining school buildings.</li> <li>. offering inservice and preservice teacher training programs.</li> </ul>	<ul style="list-style-type: none"> <li>. allocating public funds and approving university budget.</li> <li>. administering municipal colleges or two-year teacher training institutions.</li> <li>. maintaining school buildings.</li> </ul>
<b>PREFECTURE</b>				
<b>COUNTY</b>	<ul style="list-style-type: none"> <li>. allocating and managing public funds and subsidizing MINBAN teachers from local budget.</li> <li>. planning new state complete schools.</li> <li>. running some key schools.</li> <li>. deciding on personnel matters for public schools.</li> <li>. maintaining school buildings.</li> <li>. organizing graduation examinations.</li> <li>. inspecting all schools.</li> <li>. offering inservice and preservice teacher training programs.</li> </ul>	<ul style="list-style-type: none"> <li>. allocating and managing public funds and subsidizing MINBAN teachers from local budget.</li> <li>. planning new schools and deciding enrollments.</li> <li>. deciding personnel matters for schools.</li> <li>. offering inservice and preservice teacher training programs.</li> <li>. organizing graduation examinations.</li> <li>. inspecting schools.</li> <li>. maintaining school buildings.</li> </ul>	<ul style="list-style-type: none"> <li>. allocating and managing public funds and financing schools from county budgets.</li> <li>. planning new schools and deciding enrollments.</li> <li>. deciding on personnel matters for schools.</li> <li>. inspecting schools.</li> </ul>	
<b>TOWNSHIP</b>	<ul style="list-style-type: none"> <li>. allocating public funds to schools and subsidizing MINBAN teachers from township budget.</li> <li>. planning village schools and appointing school masters.</li> <li>. hiring MINBAN teachers.</li> <li>. inspecting village schools.</li> <li>. enforcing enrolment targets and school attendance.</li> <li>. maintaining school buildings.</li> </ul>	<ul style="list-style-type: none"> <li>. allocating and managing public funds to schools.</li> <li>. hiring MINBAN teachers.</li> <li>. inspecting schools.*</li> </ul>	<ul style="list-style-type: none"> <li>. allocating and managing public funds.</li> <li>. inspecting schools.</li> </ul>	

\* pattern differs between townships.

CHINA  
Gansu Province  
Provincial Educational Administration  
Organization Chart



includes drivers, messengers, clerks, etc.  
handles examinations

Figure 4.2

ary and lower secondary schools, operating prefectural primary and secondary schools which are almost always key schools, and monitoring the performance of county level administrations. In addition, the prefectures have their own revenue to be allocated to education programs. Although the functions of the prefectural administration are increasing, the division of responsibility between this level of administration and provincial and county governments is not yet entirely clear.

4.05 In terms of delivery of basic education, the most critical level of education administration is the county, 86 in all according to the 1985 classification. In many counties, the responsible bureau is a Bureau of Education and Culture which has responsibility for both educational and cultural activities. The County Bureau of Education and Culture is under the dual leadership of the county government and the Prefectural Bureau of Education. The latter supervises the implementation of the educational plans in the primary and secondary subsectors.

4.06 The organization of a County Bureau of Education and Culture is illustrated in Figure 4.3. Under the Director of the County Bureau of Education and Culture, the most important sections are: (a) the Education Section which is responsible for preparing and supervising implementation of the educational plans in the county; (b) the Personnel Section which is responsible for public teachers in the county, e.g., promotion decisions, salary scales, teacher transfers, and the issuance of teacher certificates to minban teachers who have passed their examinations, and thus become qualified as regular state teachers; (c) the Finance and Planning Section which is in charge of teachers' salaries, expenditure on school equipment and facilities; and (d) the Cultural Section which handles the cultural activities such as the county's ensembles, cinemas and theaters. Each county bureau employs about 20-25 staff members.

4.07 The county bureaus execute educational policies and directives of the province and the Central Government. In most cases, the county bureau of education delegates direct responsibility for managing primary schools to the townships. Nevertheless, the administration of secondary schools, the enrollment of primary teachers for both inservice and preservice teacher training, supervision and evaluation, and financial planning remain the county's responsibilities.

4.08 The lowest echelon in educational administration is the Township Education Office. The townships are the former commune administration which has been separated from agricultural production in Gansu since about 1980. As the smallest administrative unit, the Township Education Office usually consists of two or at most three staff. Their functions are to recruit and supervise minban teachers. It is also the responsibility of the township education office to subsidize the minban teachers with local resources and to motivate parents to enroll and maintain children in school. In some counties, the County Bureau of Education and Culture has signed a responsibility agreement with the Township Education Office specifying targets and responsibilities for basic education in the township in a given year. These agreements have been quite successful in guiding action at the township level, in mobilizing community and township support, and formalizing corresponding obligations of the county (para. 4.41).

**CHINA**  
**Gansu Province**  
**County Educational Administration**  
**Organization Chart**

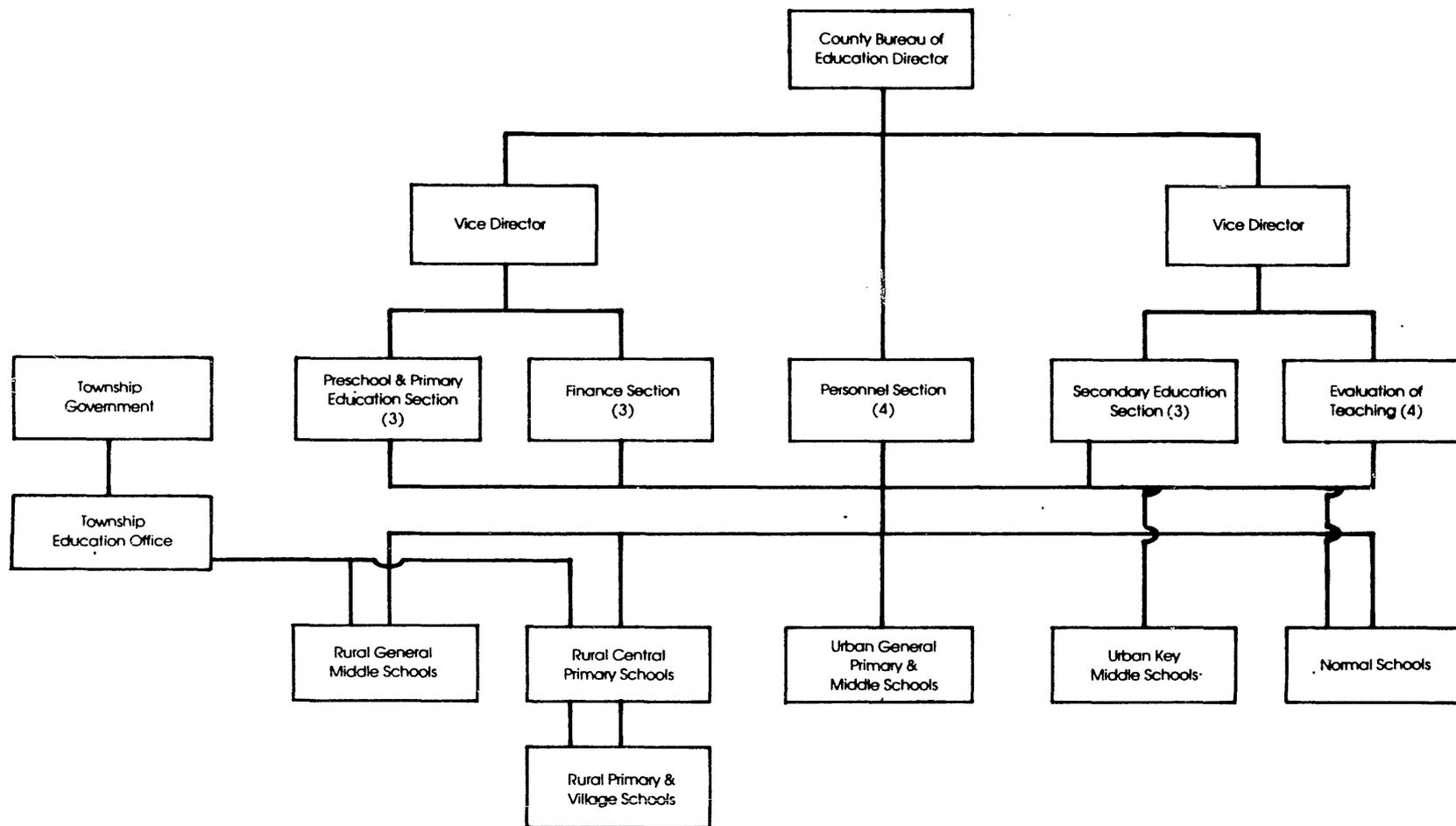


Figure 4.3

4.09 The Decision on the Education Reform, announced May 1985, emphasizes that nine years of basic education will be compulsory within a framework of localized responsibility. Management of basic education resides, first of all, with local authorities. This announcement recognizes, in effect, that throughout rural China local villages, townships and counties are the principal providers of primary education. At the same time, it affirms that locally provided education must satisfy overall national and provincial plans and meet standards of coverage and quality. There is, therefore, a new delegation of authority proposed in the announcement, that combines decentralization with accountability of results. The experience of other countries with similar strategies may be instructive.

4.10 The recognition of local responsibility for basic education combined with accountability of results is a pattern common to many countries. The Canadian system organizes education under overall provincial control with the operation of municipal or county school systems subject to standards and supervision of each province. Locally elected boards of education are authorized to hire teachers, build schools, and conduct school programs. But the syllabus of studies, the certification of teachers, and the inspection of teachers and schools is a provincial matter. Financing is raised at the municipal or county level. The province provides complementary financial assistance for assurance of minimal standards in poorer districts. This approach is similar in many respects to state and county responsibilities within the United States. Western European countries have traditionally held a more central or national control over education, as have most of the developing countries of Latin America and Africa. In recent years, however, there has been a decisive movement in various countries to decentralize management of basic education as part of a policy to raise enrollment and completion rates. The 1980 constitution of the Federal Republic of Nigeria placed basic education under control of the federated states within national education policy and curriculum guidelines and under arrangements for cost-sharing between national and state jurisdictions. Pakistan has also recently strengthened provincial control over primary education as part of a policy to raise enrollment and completion rates. Since 1972 the administration of education in Brazil has been decentralized, with authority distributed among three levels of government, federal, state and municipal. Although the Brazilian states are responsible for the administration of urban basic education, municipalities, that is local governmental units, have assumed responsibility for rural basic education. In these arrangements, patterns for delegation of management responsibility may or may not conform to patterns of finance. In the economically more advanced countries, local responsibility for managing education tends to go together with local responsibility for financing education. In the developing countries, this approach is less common, chiefly because of the limited fiscal resources of local governmental units. In Nigeria, Pakistan and Brazil, for example, financing of basic education is shared between states or provinces and local government; basic education under local administration may even receive transfers from the central government.

4.11 According to a World Bank review of policies to decentralize management of education, in many countries significant progress has

resulted.<sup>18/</sup> The decentralization of educational control has enabled provincial and local authorities to strengthen local planning, training and supervision (Ethiopia, Madagascar, Papua New Guinea). Administrative infrastructure for delivery of basic education has been strengthened by establishing a separate tier for close supervision of schools (Nicaragua, Paraguay and Guatemala). Specialized institutions have been created to train local administrative personnel (Malaysia and Kenya). But policies to decentralize administration have also confronted common obstacles. These include: a weak management apparatus at the local level, due to lack of trained and experienced personnel; the absence in some cases of an intermediate level of management between, say, the provincial level and the local administration that may provide technical assistance and supervision; or, in contrast, a proliferation of agencies with overlapping responsibilities that waste resources and neutralize local initiative; and a tendency for divergence in quality and standards because of differential access to resources among richer and poorer districts.

#### Issues in the Management of Basic Education

4.12 The management of education in Gansu province is structured in parallel to the state political and economic organization. This strengthens the multisectoral and multilevel linkages to education of other agencies and different levels of the state. It also helps to mobilize the additional financial resources of state agencies and of different levels of administration for education. This high degree of penetration of responsibility for education within the state administration promotes the execution of education policies established at the higher levels. It also reinforces the implementation capacity at each level in the structure and creates a vehicle for accountability in the achievement of educational goals. At the same time, a review of the management of education in Gansu reveals several weaknesses: a degree of compartmentalization combined with some duplication or overlap of functions; inadequate performance of supervision and inspection to support and monitor policy implementation; and an information system of limited scope and usefulness for planning and evaluation.

4.13 Division of Responsibilities. Compartmentalization and duplication of functions occur between different echelons in the hierarchy and also between different sectors in the same department or between different departments. The delineation of responsibility, between county and prefecture or between township and county, is not consistently clear with the result that decision making is delayed or pushed up to a higher level than is strictly necessary. Also the operation by each level of administration of its own primary and secondary schools, for example, provincial, prefecture and county

---

<sup>18/</sup> For reference see, Strengthening Educational Management: A Review of World Bank Assistance, 1963-1985; World Bank Staff Appraisal Reports, Philippines, Sector Program of Elementary Education, May 1981; Islamic Republic of Pakistan, Second Primary Education Project, May 1985; Brazil, Northeast Basic Education Project, April 1980; and Colombia, Subsector Program for Rural Basic Education, July 1982.

key and central schools, results in less than optimal distribution of educational resources within a county. Likewise, inservice and preservice teacher training are managed by separate divisions and are generally carried out within different institutions. Inservice training is provided by educational institutions classified as nonformal adult training, while preservice training is conducted by teacher colleges or normal schools. In terms of secondary agricultural education, the provincial Bureau of Agriculture is responsible for agricultural specialized education, peasant specialized education and agricultural radio and TV education, leaving the Bureau of Education responsible for agricultural vocational education. Education departments of other central ministries and corresponding provincial bureaus implement and finance their own specialized secondary programs to fulfill their own manpower requirements. These programs are typically not accessible to students not entering these sectors. Nor is planning of these schools evidently tied to actions proposed in other sectors. A result is that these schools, with average enrollment about 300 students, operate on a relatively small scale, at least by comparison with other countries. And, also, collectively the technical ministries tend to emphasize technician education and leave a gap in training services for young workers who enter collectives or the unorganized subsectors in agriculture, rural industry and services. To some extent, compartmentalization of educational services, typical of China, may be mitigated by the recent elevation of central responsibility for education to the level of a state commission, and the corresponding enhancement at the provincial level of the role of the provincial education bureau in overseeing education activities of all agencies within a province. Likewise, as proposed in the Decision on Education Reform, greater delegation of management responsibility from provincial and prefectural level down to county level (average population, 230,000) and township level (average population, 15,000) should allow for greater integration of public education activities at the local level. Indeed, the average size of a county in Gansu is roughly equivalent to the size of a rural school district in North America or Western Europe.

4.14 Supervision. The experience of industrialized countries that have achieved UPE in the last 50 to 75 years clearly demonstrates the need for supervision of student enrollment and attendance and of the performance of teachers and schools. In Gansu, however, basic education is not yet supported by an effective system of supervision. Methods, procedures, and responsibility for assisting and monitoring the performance of schools, teachers and administrators are not yet clearly established. Even where the rudiments of a supervision system exist, for example at the county level education bureau or the township office, the lack of means of transportation and the scattering of the schools make implementation difficult. Teachers are not provided supervision beyond the administrative support of a principal, and rural schools, in particular, are not regularly inspected. The subjective impressions of the administrators and the summary report submitted by the schools themselves at the end of each semester constitute the only performance record. The quality of schools is judged by the transition rate from one cycle to the next. Other factors in assessment of teacher and school effectiveness, such as principal's relations with the local community, student enrollment targets, school organization, maintenance of buildings and grounds, or supervision of teachers, are taken less into account.

4.15 A well-functioning supervision system depends on several factors. There must be, first of all, agreement as to the authority and responsibility of supervisors. This could be codified in administrative manuals after formal recognition of this function by the provincial government. Since supervision of education is closely associated with compulsory education in other countries, there is a case for formalizing the supervisory function in official documents relating to the development of compulsory basic education in China. Second, a supervisors' service is required along with a reporting system and understanding of responsibility for required action in response to supervisors' reports. The supervisors' service would be composed of individuals who have acquired experience as teachers and administrators, who are employed at the county, prefecture and provincial level, who have been trained in supervisory functions and are supported by administrative and logistical staff. Finally, the terms of reference for supervisors would include training and support for lower level administrators. Educational administrators at the county, township or schools levels have seldom received specialized training for their positions. Many schools, particularly rural primary schools, are poorly managed by untrained principals whose management skills are limited to prior knowledge and experience, quite possibly acquired only in the school that they direct. Supervisors should assume some obligations for on-the-job support and training for these personnel.

4.16 Management Information System. If decentralization of management of basic education is to occur, within a framework of accountability to higher levels of administration, the system of information available to educational administrators needs to be substantially improved. Both regular functions, such as budget planning and resource allocation, and implementation of new policies and specific objectives are inadequately supported by an education management information system. The usefulness of an information system depends on its ability to supply timely, consistent, and reliable information to its users. Provincial and prefectural level officers require relatively aggregate data covering a year or longer. County level management requires more precise data with the ability to aggregate and disaggregate data over multiple operating units and programs. Lower levels of educational administration, township and individual schools, require information to support implementation of tasks on a day-to-day basis. For the implementation of UPE at the county level, for example, the statistical yearbooks edited by the planning unit generally include information about the aggregate numbers of students enrolled, number of teachers employed, and recurrent and capital expenditure by types of schools and year. But information on enrollment by age and sex, by urban and rural areas, and corresponding promotion rates, dropout rates, repetition rates, as well as information on student achievement, teachers' qualifications, revenues and expenditure and so on are generally not available. A redesign of data requirements and an intensification of data collection and processing are necessary for an improved system of educational management information.

4.17 A related weakness in the educational information system is the paucity of data on basic education in Gansu of direct applicability for assessment or evaluation. Statistical information available to the mission was largely a descriptive accounting of the educational inputs, that is those factors -- numbers and description of teachers, schools, materials and

supplies -- that account for education. Very little, if any, substantive information was provided that would allow for assessment or evaluation of the quality or standards of schooling. How well do children in Gansu read at the completion of the primary cycle, say, by comparison with children in other provinces? How well do they perform in arithmetic, in knowledge of history, politics, Chinese language? How well do they write? Even within Gansu, what can be said about the differential performance of children in urban schools, rural schools, and locally-run schools? Are the differences in levels of achievement closely related to differences in resource availability or in resource mix -- the particular combination of teachers, facilities, materials? Beyond the internal evaluation of educational achievement, how well do graduates perform in jobs and other roles in society as a consequence of their schooling? The evidence that can be cited in answer to these questions is largely anecdotal. There appears to be little effort systematically to collect information that could then be used to assess educational achievement and evaluate the result of school programs. This is, of course, a difficult area but one in which much progress has been made in other countries. The starting point in most cases has been analysis of common examinations such as used in Gansu for completion of or entry to all education levels above the primary level. Careful use of this source would allow the educational authorities to identify areas (counties, townships, etc.) where performance is well below the average, or below an acceptable standard, and where remedial action is required. Another approach, particularly useful at the secondary level, would be to follow graduates into the work place, and by means of surveys carried out to compare performance and experience of students with different educational backgrounds, evaluate the effectiveness of educational programs. Work of this kind could be supported by the Gansu Education Bureau and performed by faculty of some of the leading higher education institutions in the province.

#### Educational Costs and Financing

4.18 In China, as in other countries, the investments necessary for rapid economic and social development require high rates of both savings and government revenue-raising. To achieve long-term educational goals for Gansu province alone will ultimately require increased expenditure on education. To mobilize the required resources, and to do so in ways that promote efficiency and equity, demands the participation of the national, provincial and local levels of government as well as considerable administrative will. This section examines the costs and financing of education in Gansu. It analyzes the balance of education resource use by type of education and class of beneficiary, and it assesses, in particular, the balance between public funds and local resources required for basic education in poor rural areas. It concludes that, although public expenditure on education is weighted in favor of students at the upper levels of the education system, public resources are allocated reasonably equitably across prefectures and municipalities that divide the province. A major source of inequality remains in the balance of public expenditure between publicly run and locally supported schools. In a poor province like Gansu, therefore, a commitment to achieve UPE will require allocating additional public resources to village schools in rural areas. This would include an increase in public subsidies for minban teachers and, ultimately, the transfer of minban teachers, on qualifying, to the public

sector, as well as reduction in fees and charges in poor counties and townships with large numbers of households least able to finance the direct costs of schooling for children.

4.19 Estimates of Public Expenditure. Public finance of education can be viewed both in terms of the magnitude of expenditure and in terms of the distribution of expenditure by levels of government and across regional jurisdictions. The most recent data available are for 1984. They indicate that consolidated state budget expenditure for all purposes was Y 2,115 million in 1984, an increase of 36% over 1983. Consolidated public revenue was Y 1,323 million in 1984, up 21% from 1983. This large (and growing) gap was filled with subsidies from the Central Government of the order of Y 757 million or about 36% of public expenditure in Gansu.<sup>19/</sup> The share of education expenditure in total public expenditure was about Y 321 million, or 15.1% in 1984. This is composed of Y 261 million in recurrent expenditure (which according to Chinese practice contains a certain amount of equipment and furniture, less than 5% of the total, that could logically be classified as capital expenditure) and an estimated public expenditure on capital construction in education of about Y 60 million.<sup>20/</sup>

4.20 The spending share on education in Gansu province is somewhat higher than corresponding shares nation-wide. For 1983, for example, the World Bank estimated that consolidated public expenditure on education in China was 7.1%

---

<sup>19/</sup> In 1984, these payments were composed of a special fund for Hexi/Dingxi of Y 160 million; a special fund for backward areas, Y 55 million; block grants, estimated at Y 199 million; and a large number of other subsidies adding to about Y 343 million.

<sup>20/</sup> There are small differences in the totals for recurrent expenditure reported by the Bureau of Education (Y 257 million) and the Bureau of Finance (Y 261 million). This report uses the Bureau of Finance figures for purposes of estimating percentage shares. Undoubtedly the difference is explained by the Bureau of Finance reporting expenditure in support of some academic institutions directly financed by the Central Government or reported under technical ministries. Moreover, without a more detailed breakdown of expenditure under technical ministries or state enterprises, it is not possible to verify the figures given by the Bureau of Education and Bureau of Finance or add to them additional expenditures on education which are reported under other categories. The agriculture sector reported, for example, about Y 2.6 million on agricultural secondary schools in 1984. About 5% of primary and secondary enrollment is in schools under factories or enterprises. Actual public capital expenditure on education is more difficult to estimate. It is usually reported under state budget investment within the category of culture, education, science and health. But care must also be taken to include that share in the central government budget which is executed in Gansu, but not transferred to provincial government accounts, as well as that reported by levels of public administration within the province. The definition used here excludes capital expenditure on education in Gansu reported by state enterprises.

of total public expenditure; public recurrent expenditure on education as a percent of total public recurrent expenditure was 8.9%; and public capital expenditure on education as a percent of total public capital expenditure was 4.5%.<sup>21/</sup> The World Bank does not have estimates of these shares for other provinces of China, but indirect evidence indicates the level of public expenditure on education in Gansu as a share of provincial expenditure is within the range of other provinces. It is also reasonable to assume that the share of public educational expenditure in Gansu, and other comparatively low income provinces, is higher than in the higher income provinces. Altogether the levels of public expenditure on education in Gansu and in China are on the low side by comparison with a set of developed and developing countries as revealed in Appendix A (para. 4.38).

4.21 Distribution of Public Educational Expenditure. Revenues are raised by all levels of government, the province itself, the prefectures, counties and (more recently as they are gradually incorporated into the state structure) townships. The two major sources of revenue in state budgets are enterprise receipts and taxes. Enterprise receipts consist of the after-tax profits of industrial and commercial enterprises. In broad terms, in 1983 a formal large-scale substitution of profit remittance by tax payment was introduced. Under this scheme, a state enterprise pays a profits tax to the level of government owning the enterprise, and retains virtually all of the remaining revenue. Until the introduction of the profits-tax system, the most important tax payable by the state enterprises was the unified industrial and commercial tax, which includes product taxes, a value added tax in some sectors, and a business tax. Apart from these enterprise taxes, there are a variety of other taxes, and some of these accrue to specific levels of government. Provincial taxes include all resource taxes on central and provincial enterprises and a construction tax on self-financed fixed investment. Agriculture and animal husbandry taxes, urban protection and maintenance tax, taxes on free-market trade and certain license fees accrue to the prefectural and county levels of government. As townships gradually become the lowest level of government, they too will receive revenue-raising authority. The principal revenues of townships are enterprise receipts from township-run collective enterprises and supply and marketing enterprises, and certain taxes -- agricultural produce taxes handed in by individuals, income taxes of collective enterprises, slaughter taxes and livestock grazing and trading taxes. Townships can also raise finance from surcharges which may be levied on some of these taxes. In addition, townships may collect either a proportion of the profits of collective enterprises (that are not township-run) or a proportion of total income. The practice, in this regard, varies widely.

4.22 Up to 1979, the bulk of budgetary revenues collected at lower levels of government was submitted to the next higher level of government. A certain amount would then be handed down to each level of government in accordance with its assessed needs. Since 1979, the scope for the retention of a certain

---

21/ China: Long-Term Issues and Options, Annex A: Issues and Prospects in Education, op. cit.

portion of revenue by each level of government has increased, but the system for raising revenues remains essentially unitary in the sense that lower levels of government have as yet essentially no discretion over the determination of taxable bases or the setting of tax rates. Under this system targets for both revenues and expenditure are formulated for each level of government with its immediate superior. These targets are arrived at through a process of negotiation. If planned revenue exceeds expenditure, a portion of the difference is transferred upwards. If, in contrast, revenue is less than expenditure, a fixed subsidy is paid to that level of government. (In addition to budgetary flows, fiscal flows among levels of government also include extra budgetary funds of each level of government and loans through the banking system. These other sources have virtually no impact on educational expenditure.)

4.23 The basis on which revenue is now shared between different levels of government varies not only by level, but also from one case to another. In the absence of clear guidelines for the division there appears to be considerable scope for negotiation. Prior to 1982 the revenue-sharing arrangement that operated between Gansu and the Central Government was based on the total receipts of the industrial-commercial tax, 46% of these receipts were handed over to the center. This proportion varied considerably across provinces, as may be expected, and was based not only on the average income of a province but also on other considerations, such as the number and profitability of centrally-run state enterprises in the province. Since 1982 Gansu's revenue-sharing arrangement with the center has been based more on a total revenue arrangement with Gansu retaining about 80%. Special subsidies received by Gansu are negotiated annually by each provincial bureau and by the provincial government. In a similar way, special provincial allocations, particularly of fixed investment funds, are earmarked for and routed to individual projects or enterprises. For broad areas of need, such as education and health, sums are set aside for each prefecture -- and the prefecture then determines their distribution across counties, after approval from the provincial government in the case of larger amounts. The actual practice in sharing between province and prefecture is highly variable. Eleven of thirteen prefectures in Gansu are deficit prefectures and the province provides varying levels of subsidy. Unplanned deficits may be partially covered by the province, but in this case prefectures are also left to adjust by cutting expenditure in the following years. Surpluses may be retained and spent with considerable autonomy. Revenue-sharing between the prefecture and county levels also appears to have considerable variation based on different agreements established over time with respect to levels and shares of transfers. In some cases, a fixed sum is negotiated; in others a percentage of county surplus is agreed for annual transfer over, say, five years to the prefecture. As with prefectures so at the county level, there is a move to oblige the spending level to absorb any unplanned deficits.

4.24 The establishment of townships adds potentially another stratum in the decentralization of administration underway since 1979 and provides expectation that public financing for local-level services can be secured and stabilized. Certain taxes and other receipts once submitted to the county level are now submitted to the township instead. Critically, townships are gaining the right to keep a share of revenues collected and use these for their own

purposes. On the expenditure side, townships are gaining responsibility for education, culture and health expenditure, assistance to agricultural development and relief, and township administrative expenditure. Expenditure responsibilities are almost entirely recurrent costs of expenses under these headings. Since the bulk of education expenditures fall into this category, the township may assume a significant role in educational expenditure. Typically the largest single item in the township budget is education. In 1985, there were 1,532 townships in Gansu. The revenue gathering and expenditure functions were adopted by those townships which had financial units and thus have incorporated to the government system. By October 1985, 180 such incorporated townships existed. With a rapid increase in the number of incorporated townships to about 100% by 1990, a stronger basis will exist for raising and channelling resources to schools in rural areas heretofore largely financed by village-level contributions.

4.25 In reference to this system for revenue raising and sharing, two questions are raised of relevance to education: what are the relative responsibilities of different levels of government in allocating public resources for expenditure on education in Gansu; and what is the resulting pattern in distribution of educational resources by level of education and geographic region.

4.26 With respect to the allocation of resources for education by level of government, the basic pattern for recurrent expenditure on education is shown in Table 4.1. Not surprisingly, in 1984 prefectures and lower levels of government (no finer breakdown is possible with available data) accounted for 74.4% of public recurrent expenditure in 1984; provincial level, 23.6%; and the Central Government (mostly in higher educational institutions under the Central Government) about 2.0%. There is no discernible shift in this pattern between 1980 and 1984. Altogether this distribution underscores the major role of prefectures and counties and, (increasingly township administration) in educational expenditure.

4.27 The mission obtained some data on budgetary shares for education at prefecture and lower levels. For four (out of 13) prefectures, the average share of expenditure on education is 18.0% of budget with little variation among the four prefectures. For 10 counties providing data, the average share of educational expenditure was 25.0%; the highest reported, 33.0%; and the lowest, 13.7%.

4.28 The result of this pattern of public expenditure on education by level of government can be viewed in terms of levels of education. According to information provided by the Provincial Bureau of Finance, the ratio of unit public recurrent expenditure by level is 2.3 to 1 for regular secondary school over primary; 21 to 1 for specialized secondary over primary; and 61 to 1 for post-secondary education over primary. These ratios are roughly comparable to the corresponding figures at the national level. Based on these estimates of unit expenditure, Table 4.2 indicates the allocation of recurrent expenditure in 1984 to each level of education relative to the proportion of students at that level. Even though only 0.6% of students are in post-secondary education, they absorb over 18% of total annual recurrent expenditure. At the other extreme, about 75% of students are in primary education. They benefit

Table 4.1: PUBLIC RECURRENT EXPENDITURE ON EDUCATION IN GANSU  
BY LEVEL OF GOVERNMENT  
(Y'000)

Source of finance	1979	1980/a	1981	1982	1983	1984
Central government	131,987	-	-	300	4,270	5,000
Provincial government	-	23,159	31,665	35,210	46,014	60,692
Prefecture (or zhou) municipality and county	-	127,693	129,479	154,986	147,840	190,984
<u>Total</u>	<u>131,987</u>	<u>150,852</u>	<u>161,144</u>	<u>190,496</u>	<u>198,124</u>	<u>256,676</u>

/a After 1980, provinces (and lower levels of government) prepared their own budgets and retained required funds or obtained allocations from the next higher level to balance the accounts.

Source: Bureau of Education, Gansu Province.

Table 4.2: DISTRIBUTION OF STUDENTS AND DISTRIBUTION OF PUBLIC RECURRENT EXPENDITURE BY LEVEL OF EDUCATION, 1984 /a

Level of education	Average per student expenditure (Y)	No. of students	%	Public recurrent expenditure (Y mln)	%
Primary	43	2,647,200	74.6	113.8	42.2
Secondary school	99	858,800	24.2	85.0	31.5
Specialized secondary	902	24,700	0.7	22.2	8.2
Post-secondary education	2,630	18,500	0.6	48.7	18.1

/a Average public recurrent expenditure per full-time student is reported by the Bureau of Finance, Gansu Province.

Source: Bureau of Finance and Bureau of Education, Gansu Province.

from about 42% of total annual recurrent expenditure. Unit expenditure on capital construction by level of education can also be estimated. According to standards set by the central government for unit areas of space and estimates by the Gansu Education Bureau of average cost per square meter, the approximate average cost per student place is: at the primary level, Y 450 (although this standard for urban schools would be much higher than the common standard among rural primary schools); regular secondary school, Y 775 (Y 700 lower secondary, Y 850 upper secondary); specialized secondary (for example, secondary normal or teacher in-service training), Y 3,250; and for post-secondary education, an average of about Y 8,000. The ratio of capital expenditure per student place in post-secondary education to the corresponding capital expenditure for (urban) primary education is about 18 to 1.

4.29 One way to assess the geographic distribution of public expenditure on education is by looking at per capita public recurrent expenditure on education across prefectures and compare this with revenue raised per capita within the same jurisdictions. This would provide some indication of inequality in the distribution of per capita revenues and per capita public expenditure on education across regions. For this exercise data are available from 1983 and the results are shown in Table 4.3. There is not a great difference in average per capita public expenditure on education across prefectures. The average is Y 10.0; the maximum, Y 15.2 in Lanzhou (where higher education is concentrated); and the lowest, Y 6.3 in Wudu -- a range of about 2.4 times. A simple measure of inequality in this distribution has a value of  $I = .11$ .<sup>22/</sup> The coefficient of variation is 0.27. There is a much greater variance in per

---

<sup>22/</sup> This indicator is computed as 
$$I = \frac{\sum_{j=1}^n |x_j - \bar{x}|}{2(n-1) \frac{\bar{x}}{x}}$$
,  $0 \leq I \leq 1$ ,

where  $x_j$ ,  $j = 1, \dots, n$ , are the values among  $n$  points of reference and  $\bar{x}$  is the average value. In this statistic  $I = 0$  if the distribution is perfectly equal (all values are identical) or  $I = 1$  if the distribution is perfectly unequal (the entire distribution is concentrated in a single observation and all other observations are zero). Thus, the higher the value of  $I$ , the greater the degree of inequality or, the higher the dispersion of the distributions. Another, more common estimate of the degree of inequality is  $\sigma/\bar{x}$ , where  $\sigma$  is the simple measure of variance. An advantage in the case of  $I$  over the coefficient of variation is the intuitive appeal of an indicator that ranges between 0 and 1. The coefficient of variation is not similarly scaled.

TABLE 4.3: PER CAPITA PUBLIC RECURRENT EXPENDITURE ON EDUCATION  
BY PREFECTURE OR MUNICIPALITY, 1983

PREFECTURE	PUBLIC RECURRENT EXPENDITURE ON EDUCATION PER CAPITA (Y)	PUBLIC REVENUE PER CAPITA (Y)
JIUQUAN	12.4	83.40
ZHANGYE	9.5	27.33
WUMEI	9.1	20.55
DINGXI	7.7	15.30
TIANSHUI	7.0	17.93
WUDU	6.3	11.91
PINGLIANG	8.9	13.15
QING YANG	8.1	15.09
LINXIA	7.6	42.67
GANNAN	15.2	20.95
LANZHOU	10.0	178.91
JIAYUGUAN	6.4	162.69
JINCHANG	7.2	115.83
AVERAGE	8.9	55.82

SOURCE: Bureau of Education and Statistical Bureau,  
Gansu Province

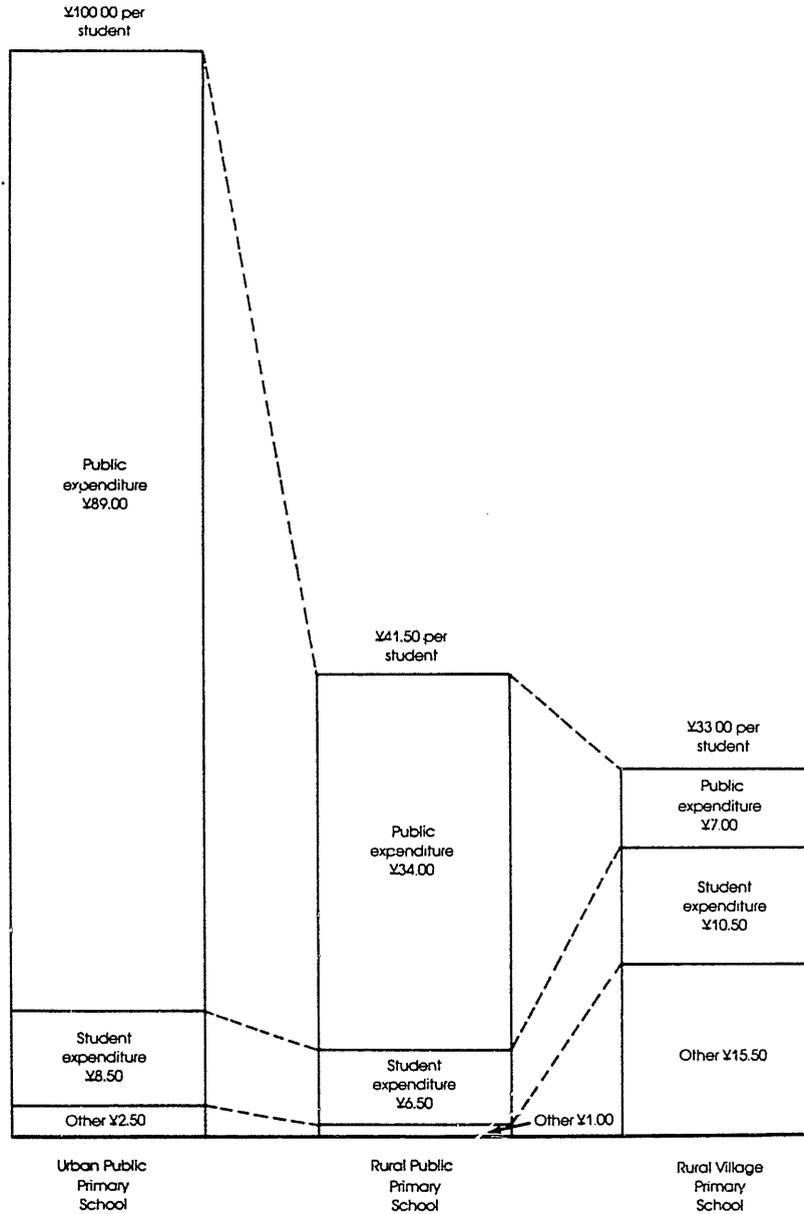
capita revenue in 1983. The average is Y 54.8 per capita. In terms of range the largest case, Lanzhou, is about 15 times greater than the smallest, Wudu. The measure of inequality in revenue raising is  $I = 0.46$ . The coefficient of variation is 1.03. The extension of this analysis to a set of 10 counties for which accounts have been made available to the mission leads to the same general observation of a modest smoothing of per capita public expenditure on education relative to per capita income or some indicator of the resource base.

4.30 The comparison of the distribution of per capita public expenditure on education with that of revenue raised indicates then that the province has fairly successfully undertaken a measure of internal redistribution. Although there is scope for further gains, resources raised within each prefecture of the province, for example, have been allocated more equitably to education than the revenue of each prefecture would allow alone. The annual budgetary cycle of planning and negotiation has tended to reduce inequality in per capita public expenditure across prefectures -- and in a sample of counties -- rather than widen it. Of course, what is not uncovered by this analysis is the next step: the distribution of per student expenditure for education by, for example, categories of schools. And, because, the system of education, particularly at the primary level, is highly stratified -- between schools financed by government and those financed largely by villages; and within the system of public schools, by favored key and central schools versus other public schools, largely in rural areas -- a pattern of quite high inequality ultimately emerges at the school level.

4.31 In order to assess expenditure at the school level, in April 1985, the mission carried out a survey of per student recurrent expenditure for 17 primary schools and 14 secondary schools in Lanzhou and four counties. The findings are reported in Appendix E, Tables E.1 and E.2, and have been checked for consistency with information on average per student expenditure provided by the Bureau of Finance. The survey found that at the primary level urban public schools incur much greater expenditure per student than rural public schools, about 2.5 times as great. Per student expenditures in urban public primary schools is about three times that in locally-run rural primary schools. At the secondary level disparities exist, though strict comparisons are not as applicable because of the different mix of types of secondary schools in urban and rural areas in the sample of schools visited.

4.32 One way to compare resource input and financing profiles per student at the primary level is to contrast per student recurrent expenditure across three categories of primary schools defined according to different arrangements for financing: urban public primary schools, rural public primary schools, and rural village schools and complete rural schools -- which for simplicity are referred to as village schools because both are largely financed by local sources. (In the survey, enterprise-run schools, the other category of primary school, are financed on about the same level as urban public schools.) This comparison is contained in Figure 4.4 that uses per student expenditure and financing profiles of three schools visited by the mission. (In these three cases, the average recurrent expenditure per student has been increased to include annual average expenditure per student household on textbooks and materials.) In the case of the village school, the estimate

Urban-Rural and Public School Versus Village School Differentials in Per Student Recurrent Expenditure on Primary Education 1984<sup>1</sup>



<sup>1</sup> Estimates of average recurrent expenditure are based on school accounts of income (that exclude fees & charges to students) & expenditure plus estimated average expenditure by each student on texts & educational materials.

Source: Mission estimates based on school expenditure surveys in Lanzhou & four counties

also includes average value of payment in kind (typically grain) to minban teachers.

4.33 The level of unit recurrent expenditure varies from Y 100 per student in an urban (Lanzhou) public primary school, to Y 41.50 per student in an average rural public primary school to Y 33.00 per student in a village primary school. The change in the balance of sources of finance is even sharper. In the urban public primary school, public expenditure represents about Y 89.00 or 89% of total; family contributions, about 8.5%; and other inputs, such as donations or self-accumulated funds, about 2.5%. In the rural public primary school, the government finances about Y 34.00 or 82%; students' households, about Y 6.50 or 16%; and other sources, about Y 1.00 or 2%. In the case of the village primary school, the county provides only Y 7.00 or 21.2%; students' households, about Y 10.50 or 32%; and others, which in this case is largely village contributions of grain or cash payments to teachers, about Y 14.50 or 44%. The government contribution to village schools is a payment of Y 22.5 per month on behalf of minban teachers. In the absence of contributions of grain or cash on the part of parents and villages, this payment is only about 25% of the average earnings of a public teacher. Lower pay for minban teachers at the primary level, averaging about Y 55 per month (public subsidy plus estimated average value of village contribution), is a major factor in the low qualifications and low stability of employment among minban teachers (para. 3.20).

4.34 Although a standard government allowance for teachers in village schools has undoubtedly served to establish primary and lower secondary schools where there would otherwise be none, this pattern of use of public funds for primary education remains sharply regressive. These funds, which are distributed reasonably equitably across prefectures, are allocated to schools in a manner that concentrates them, in terms of expenditure per student, in urban public schools, assigns them on a lower scale per student to rural public schools, and, then, disposes of the remainder with a sharp decrease in scale per student in underfinanced rural village schools. By the same token, expenditure by students' families and other sources is highest in the village schools, the bulk of which is village contribution to minban teachers and other school operating expenses. This pattern indicates that rural children -- particularly those in locally-financed schools -- receive considerably less in public resource input for primary education than urban children or those in public rural schools and pay considerably more for primary schooling than do their counterparts.

4.35 Fees and Private Costs. There is no doubt that fees and related expenditure on schooling by families are a barrier to school attendance in poor counties and rural areas. But the amount of private expenditure per student should first be viewed across different levels of education, as described in Table 4.4. These estimates are averages which, as we have seen, can vary at the level of primary schools (and secondary schools) by public schools or locally financed schools. At higher levels, specialized secondary and higher education, the charges for fees are nominal in relation to the total expenditure per student. Textbooks, materials and supplies that must be purchased by students are a comparatively larger item, ranging from Y 4 to 6 at the primary level to Y 15 to 20 at the higher level. Since many upper

**Table 4.4: PRIVATE EXPENDITURE PER STUDENT PER YEAR  
ON FEES, TEXTBOOKS AND MATERIALS, 1984  
(Y)**

	Total (1) + (2)	Fees <u>/a</u> (1)	Textbook and materials <u>/b</u> (2)	Expenditure for residential students
Primary	6-9	2-3	4-6	-
Lower secondary school	12-17	4-5	8-10	50-60 <u>/c</u>
Regular upper secondary school	17-21	5-6	12-15	(50-80) <u>/d</u>
Specialized upper second- ary school	17-21	5-6	12-15	(200-300) <u>/e</u>
Higher education	20-26	5-6	15-20	(200-300)

/a Fees vary by county and by schools within the country. They include both a tuition fee and a class fee, and occasionally fees for water and fuel.

/b Includes both prescribed textbooks, which are required for school attendance, and writing paper and materials, pencils, etc.

/c In village or township lower secondary schools with boarding, students are generally charged this amount.

/d In regular upper secondary schools, students may receive boarding allowances averaging Y 5 to 10 per month.

/e In specialized secondary schools (agriculture, technical or secondary normal schools) and in higher education institutions, students, all boarders, may receive subsidies or allowances of between Y 20 to 25 per month.

Source: Mission estimates.

secondary schools, and all higher level institutions in Gansu province, are organized only for residential students, public subsidies and allowances are provided to students to cover the cost of food and lodging. In some cases, these funds may be managed as a direct payment to students who may use them for food at their own discretion and level of need. In contrast to this relatively favorable treatment of boarders at upper secondary school and above, rural students who gain admission to (one of the few) locally-financed lower secondary schools, and must board by reason of distance from their home, themselves supply about Y 50 to 60 per school year for food. This pattern of relatively large public expenditure per student at upper secondary school and above, along with concentration of government resources for the primary level on urban areas and public schools, leaves rural children in village schools at a distinct disadvantage. The level of expenditure that their families must perforce assume, even for the low cost (and low quality) village schools, is, in consequence, burdensome.

4.36 The extent to which expenditure required of the family to finance village schools is a barrier to attendance can be judged by reference to estimates of per capita income in rural areas of Gansu. There are basically two sources of information to gauge the expenditure required on primary schooling as a share of per capita annual income. There are county level estimates of income per capita and surveys of total per capita consumption of peasant households based on urban and rural samples.<sup>23/</sup> From the county level estimates of per capita annual income, it was reported in 1983 that about half of the counties in Gansu province realized agricultural income per capita (including, by this definition, income from sideline activities) less than Y 100. Actual cash available per capita was, of course, much less and may be approximated by the ratio between grain consumption per capita and grain production per capita, suggesting a margin of about 5% to 10%. For rural incomes of Y 100 per capita, cash available for discretionary consumption could be as little as Y 5 to 10 per person. These admittedly crude estimates suggest that expenditure on fees, textbooks and educational materials of upwards of Y 6 to 9 per primary student are a barrier to schooling for children. In the poorest counties, with rural per capita annual income between Y 60 to Y 80, these costs may be an insurmountable barrier for most families.

---

23/ For further reference, see J. van der Gaag, Private Household Consumption in China: A Study of Peoples' Livelihood, World Bank Staff Working Paper, No. 701, Washington, 1985. This survey estimated that the average value of per capita private consumption of peasant households in China in 1982 was Y 220. Of this total food represented about 60% of total expenditures; clothing, housing and daily articles showed approximately equal budget shares of 10% to 12%. What is significant in this is that a certain proportion of consumption is in the form of in-kind income, on average about 40% of food for example is in kind. The surveys for Gansu province would undoubtedly report a lower total consumption figure per capita and a higher share for food and in-kind income. Altogether the evidence suggests limited resources available in the poorer households for expenditure on school fees, texts and materials.

4.37 It should also be recognized that in poor localities the direct costs of schooling are not the only obstacle to enrollment. Families' subsistence may require children's agricultural and household work. Thus enrollment of children in school holds an indirect cost to families. Children in agricultural settings in Gansu participate in farm work and household chores at an early age; many of them may also assist increasingly in side-line production. Even if, as is likely, the actual value of children's labor is small, for poor households its utility in terms of contribution to household income may be substantial.<sup>24/</sup> These factors, along with cultural traditions, may weigh most heavily in the decision of parents to keep girls out of school. Evidence from other countries suggests that considerations of this kind influence families' schooling decisions. In a study of children's work in a village in Bangladesh, Cain divided their activities into two categories: labor necessary for the maintenance and upkeep of the household, which is not directly productive in the sense of generating income or contributing to physical capital formation; and labor necessary for generating income and capital, called here productive work. This first category, which is difficult to measure in terms of value is called by Cain "enabling" labor insofar as it may free other (adult) household members to engage in activities that are directly productive. Viewed in this way, children of both sexes in Bangladesh, according to Cain, begin to work and put in relatively long hours at young ages. To lose this "output" by enrolling children in school and maintaining them there through the primary grades and beyond is, in cases of many poor families, an investment that they can ill-afford. In a survey in Karnataka, India, Caldwell *et al.* found that among a sample of parents who had terminated their children's schooling, nearly half cited cost factors -- including both direct and indirect costs -- as the primary reason for doing so.<sup>25/</sup> The direct costs to poor households of schooling for children can be reduced by policies to lower or suspend fees and charges by means of increased public subsidy for village schools. The indirect costs of children's schooling, however, are less easily changed. Adjustments can, of course, be made to shorten the school day and to change the school schedule to enable older children to assist parents during periods of peak activity in the seasonal cycle of agriculture. But to the extent that some parents in Gansu withhold

---

<sup>24/</sup> Low marginal product of labor is evident in the case of the household survey in Hui Country reported in Chapter II (paras. 2.07-2.08). Agriculture income is most heavily determined by land available. However, the number of workers in the household also has a significant effect on agricultural income. For off-farm income, in this sample the number of workers in the household tends not to affect significantly household income from sources other than agriculture.

<sup>25/</sup> Cain, M., "The Economic Activities of Children in a Village in Bangladesh", Population and Development Review, Volume 3, Number 3, September 1977, pp. 201-227. See also Caldwell, J. L., Reddy, P. H. and Caldwell, P., "Educational Transition in Rural South India," Population and Development Review, Volume 2, Number 1, March 1985, pp. 396-401; and De Tray, D., "Children's Work Activities in Malaysia", Population and Development Review, Volume 9, Number 3, September 1983, pp.437-455.

or withdraw their children from school because of children's possible economic contribution, the educational authorities in the province are faced with a classic paradox. Although it may be in a family's short-term interest to engage children on the farm, in household chores, or even in side-line production, both the family's and society's long-term interest would be better served -- particularly when a society enters a period of sustained economic growth -- if children were in school and achieved a basic education. To help ensure enrollment and continuing attendance of children is one function of a supervision system and of public laws for compulsory education now in preparation by the Central Government.

4.38 Financing of Basic Education in Gansu Province. The May 1985 Decision on Education Reform puts new parameters on the quest for financial resources for basic education. In addition to government appropriations, the Decision states that local, that is village and township, financial resources should be used with priority for education. Proposed arrangements for financing basic education in China should be viewed in comparison with practices of other low income countries. In Sub-Saharan Africa, high unit costs of education combined with heavy reliance on central government financing, have left many governments unable to sustain levels of real expenditure per student in primary school.<sup>26/</sup> In many parts of Latin America as well as in Africa, low economic growth during the 1970s and 1980s, in the face of high population growth rates, has added to the public financial burden of education. In consequence, privately financed education has expanded, and in some countries, policies to recoup part of the operating expenditures of secondary and higher education are in effect. In China, primary education in rural areas has never depended fully on financing by the government. Total public spending on all levels of education is, therefore, comparatively low. The World Bank estimates that public expenditure on all levels of education in China was about 2.2% of GNP in 1983.<sup>27/</sup> Corresponding levels for 1980 in other countries are somewhat higher. The average across countries of East Asia and the Pacific was about 4.0%; in Latin America, 5.0%; in West Africa, about 4.4%; in East Africa, 4.5%; in industrial market economies, 6.0%; and, in particular, in South Korea 4.3% and in Japan 6.0%. The World Bank has also estimated that in 1983 the share of primary education in total public recurrent expenditure on education in China was 38%.<sup>28/</sup> Elsewhere the share was as follows for 1980: average of countries in East Asia and the Pacific region, 46.6%; in Latin America, 50.8%; in West Africa 48.5%; in East Africa 54.3%; in industrial market economies 33.4%; in South Korea 42.1% and in Japan 35.3%. With relatively

---

26/ High unit costs of primary education in Sub-Saharan Africa are largely a result of relatively high public pay scales for teachers and inefficient use of teachers. The ratio of primary teachers salaries to per capita income is between 6 to 1 and 11 to 1 in Sub-Saharan Africa. In East Asia countries, including China, the average is about 2.5 to 1.

27/ China: Long-Term Issues and Options, Annex A: Issues and Prospects in Education, op. cit.

28/ World Development Report 1985, World Bank, Washington, D.C., 1985.

low levels of public expenditure, the average level of participation in primary education in China is high, again in comparison with other low-income countries -- estimated by the World Bank as an average 68% net enrollment in Sub-Saharan Africa and in other low-income countries, and about 77% in China. Undoubtedly, the combination of low levels of aggregate public spending on education and relatively high average net primary enrollment is a result of both comparatively low unit costs, in terms of shares of per capita income, and substantial local financing. For primary schools in rural areas local contributions have been in the form of village and family financing (essentially volunteer labor and construction materials) for capital construction; payment and allowances for minban teachers; and fees and charges for textbooks, materials and related school expenditure.

4.39 Local financing of rural education in China was developed largely under the commune system, but under the responsibility system, management of collectively-owned land is now contracted to households, usually in proportion to household size or labor force. The individual household has replaced the collective as the basic unit of farm management and production. The commune was renamed township and lost much of its direct control over production, while the brigade reverted to the designation of village and lost much of its managerial and technical staff. Under these arrangements, households are obligated to pay taxes, make contributions to collective welfare funds, provide a share of state procurement requirements, and contribute labor to maintain or construct public infrastructure. The World Bank has estimated that, on average, the transfer of control over resources to farm families has resulted in an increase in private rural savings which now are equal to about 20% of annual income.<sup>29/</sup> In less developed parts of the country, like Gansu, the impact on private savings, though positive, has undoubtedly been much lower.

4.40 In recognition of the need to strengthen the local revenue base, the Government of China is gradually bringing townships under the public administration and providing fiscal resources and expenditure responsibilities. It has been argued that total revenues collected from lower levels would be augmented by the establishment of townships, in part, because the township would act as a more efficient tax-collection point, and in part, because the revenue-sharing system gives the township a direct interest in raising total revenue. Other benefits noted are that the incentive to produce at lower levels has also been increased, because of revenue retention, and that this development will encourage self-reliance at the township level. Of course, the long-run financial implications of the establishment and incorporation of townships are not entirely clear at present. But the impact will depend on the balance between, on the one hand, the effect in raising total revenues (through the stimulation of revenue retention and production) and raising collected revenue (through more efficient local-level revenue and tax collection) and, on the other hand, the emphasis on local self-sufficiency.

---

29/ China: Long-Term Issues and Options, Annex B, Agriculture to the Year 2000, Prospects and Options, op. cit.

4.41 Even with strengthening the system of taxation and incorporation of townships to provide revenue for social services, however, in poor counties and townships it is unlikely that sufficient financing could be generated for social sector requirements like basic education. In counties with annual income per capita below Y 100, for example, the prospects for self-reliance in this sense are simply not realistic. In these cases the government will need to channel resources to cover an increased proportion of costs. These additional resources could be used to increase support for minban teachers; accelerate the transfer of qualified minban teachers to state-financed status; and allow for reduction or elimination of school fees and related charges. In line with the Decision on the Education Reform to combine local level financing with governmental support in poor areas, financial arrangements of this kind could take the form of negotiated transfers to, say, townships below a certain income level. These subsidies could be worked out under responsibility agreements that would also define corresponding contributions of townships in support of agreed educational targets. By means of such agreements, prospects could improve for narrowing the disparities between publicly-supported and locally-run schools and for reaching educational targets in rural areas. The notion of responsibility agreements for basic education has already been tested in some parts of China including Gansu. In addition to financial aspects, these agreements would encompass enrollment targets and commitments with respect to township and county operation of schools (see para. 5.11). If operated, with respect to financial requirements, in terms of annual marginal adjustments to ongoing commitments, these agreements could reduce the level of uncertainty inherent in the system of annual negotiations for revenue-sharing among all levels of government. They could also help improve balance in the quality of service provided at the local level, where there is considerable pressure for self-sufficiency of a kind that may leave the poorest counties and townships at a disadvantage in achieving educational targets.

## V. STRATEGY FOR BASIC AND VOCATIONAL EDUCATION

5.01 In line with national policy for the development of education in China, including the Decision on Education Reform, the Government of Gansu is formulating educational plans. These plans, that include proposals for the accelerated development of basic and vocational education, have already been the subject of wide consultation within the province and presented in national conferences organized by SEdC. The current task is primarily one of formalizing these plans in a clear and realistic strategy for educational intervention in accordance with institutional capabilities and availability of finance. In the light of the analysis of educational issues in Gansu and the comparisons with other countries presented in the foregoing chapters, this chapter organizes this strategy into three main categories. These include activities already planned and underway within the province as well as those on which more emphasis is required. They encompass: intervention with respect to educational targets and service delivery; institutional changes in educational organization and management; and adjustment in policy for financing education. The chapter concludes that these actions, particularly with respect to basic education should be implemented in stages. Implementation should begin with a selected set of counties and gradually expand to the entire province. For each county selected, a set of targets, measureable indicators, and a timetable would be agreed under each of the three categories. The scale and rate of implementation within counties, and ultimately for the province, would be a function of the development of institutional capabilities and of availability of finance.

### Education Action Program

5.02 Improve Full Access to Basic Education. As a move toward ultimate realization of nine-year basic education in Gansu, targeted counties should plan, first, to supply primary school places in accordance with the UPE objective, and, second, to increase access to the lower secondary schools. This would include, in particular, planning of school facilities to ensure access for children in incomplete schools to the upper years of primary school, and for primary school graduates to lower secondary school. For this purpose existing provincial guidelines are acceptable: one primary school per 1,000 population; a primary school for a radius of two to three kilometers; or a primary school for each natural village. Likewise, the plan for rural lower secondary schools should be in accordance with: one school per 10,000 people; or one school for every two townships (paras. 3.10 and 3.16).

5.03 Upgrade Existing School Facilities. Targeted counties should: organize, at the level of each township, a survey of the physical facilities and availability of equipment and educational materials for each primary and lower secondary school; develop an investment program for rehabilitation and repair of schools judged below the minimal acceptable standards and for provision of essential educational equipment and materials; and establish an annual system for reporting on school physical facilities, educational equipment and materials, and budget for on-going repair, maintenance, and replacement (paras. 3.15 and 3.17).

5.04 Improve the quality and coverage of preservice and inservice training. This action would focus on activities designed ultimately to improve the effectiveness of teachers in primary and lower secondary schools. These would include: a plan for coordinated development, upgrading and, wherever possible, consolidation of the institutions for preservice and inservice training of primary and lower secondary teachers. A major objective of this plan would be to increase sharply the scale of inservice training in order to accelerate the increase in the number of minban teachers reaching qualification standard. Another goal would be to establish the practise of ongoing inservice training in short courses for all teachers. Designed in view of the future demand for preservice and inservice training, this plan would also develop the physical facilities, upgrade faculty members, and improve educational equipment and materials in the teacher training institutions. Given the changing balance in demand for teachers of different level and specialization, new programs for teacher training should be flexible so that they can be easily modified in response to changing requirements. Recruitment of teachers for inservice courses would be based on county level plans for achieving six year primary education in rural areas and phased introduction of lower secondary schools (paras. 3.18-3.27).

5.05 Develop a more differentiated and cost-effective approach to meeting the vocational requirements of students. In support of the goal to increase the study of vocational (including agricultural and technical) fields, Gansu province has proposed to increase those who are enrolled in vocational programs to as high as 50% of all students in upper secondary. A major component of the plan is to create a network of regional vocational centers. In planning for the vocational requirements of youth, however, much greater emphasis should be assigned at this stage to the skill needs of primary and lower secondary school leavers as well as lower secondary graduates. This group represents the majority of youth in the province as well as the bulk of those who will obtain employment as workers or operatives on farms, in rural industry, in transport, commerce and so on. Their needs could be better satisfied by short-term intensive training courses. The plan to increase vocational education at the level of upper secondary should be more experimental. A set of regional vocational centers could be planned as a pilot program to be carefully monitored in implementation. In order to maintain per student costs at levels that are replicable elsewhere in the province, the vocational training centers should be developed with an emphasis on short term training and access for students from neighboring schools. An expansion of capacity for training vocational teachers is already justified. This may be accomplished by adding departments for vocational teaching training to selected institutions of higher education in the province. (paras. 3.28 to 3.39).

#### Changes in Organization and Management

5.06 Delineate management roles and responsibilities. The achievement of educational goals depends, among other things, on clear definition of responsibilities and authority at each level of educational administration in the province. For implementation of educational goals in targeted counties, delegation of authority to county and township level officers is desirable under a system of reporting to the county, prefecture and province. With an

average population of about 230,000, each county is large enough to build up a professional education staff charged with overall management of education within that jurisdiction, but each township could also designate an education officer to monitor school operations on a day-to-day basis. (paras. 4.13).

5.07 Develop an improved system for supervision and provide management training. Attainment of educational goals and targets for each county depends on a more professional and intensive system for school and teacher supervision. This system would have two purposes: first, technical assistance for townships and schools for development of educational plans and their implementation; and, second, monitoring of student enrollment and attendance, and teacher and school effectiveness, as well as early detection of problem areas with respect to management of schools, achievement of targets, and so on. The strengthening of this necessary management function requires: formal recognition and regulation of supervision as part of a plan for compulsory education; appointment of supervisory personnel at prefectural, county and township levels; specialized inservice training for supervisors; provision of support services, for example, bicycles or motorcycles for transportation; and preparation of an annual supervision and report program. A designated subset of teacher training institutions should also design and implement training courses for school principals and education officials at the township, county and prefectural levels (paras. 4.14 and 4.15).

5.08 Establish an educational management information system. Improved management depends not only on clarifying the division of responsibilities and developing a system for supervision; it also requires the design and implementation of an information system for planning, monitoring and evaluating educational goals and targets. Three aspects require attention: redesign of the statistical base and reporting system; introduction of appropriate equipment at each level of administration for information storage and processing; and training for and assignment of personnel responsible for statistical reporting. The Gansu Education Bureau should also undertake to support evaluation of educational achievement by sponsoring the analysis of results of various common examinations as well as surveys of graduates' success and performance in employment and other post-school activities. Some of this work could be carried out by research units in higher educational institutions in Gansu (paras. 4.16 and 4.17).

#### Changes in Financial Policy

5.09 Increase public financial support for minban teachers and transfer qualified teachers to the public sector. The low qualification and inferior economic position of minban teachers undoubtedly lies at the heart of the problems of basic education in Gansu province. In the absence of a major effort to raise the qualification of minban teachers and to improve their living standard, investments in other areas of basic education may be to no avail. In coordination with the development of inservice training for minban teachers and the provincial plan for achievement of UPE in stages, minban teachers should receive increased state support and ultimately be transferred to the public sector (paras. 4.32-4.34).

5.10 Reduce school fees and related charges to poorer families. Although public resources for education are distributed quite evenly across prefectures, and by extension, across counties, the public financing of basic education remains sharply regressive, balanced in favor of urban residents and students in public schools. These conditions work counter to the improvement of basic education in rural areas and poor counties in at least two ways: the quality of education in locally supported schools is undoubtedly inferior to that in urban and public (or in enterprise-financed) schools; and local financing, as well as fees and charges on students' families, stands as an obstacle in poor counties to parent's enrolling and maintaining children in school through completion of primary grades. For these reasons, a reduction in direct fees and charges in counties and townships with large numbers of families least able to finance the direct costs of schooling is a precondition for achievement of UPE. Under provincial leadership, targeted counties should develop criteria for waiving financial requirements (paras. 4.35-4.37).

5.11 Adopt a system of responsibility agreements for cost-sharing. The sharing of management and of financial responsibility for UPE between county and townships administrations should be specified in formal, annual agreements. Agreements between, for example, a County Bureau of Education and Culture and a Township Education Office would cover the following terms: enrollment targets for the year by school, and by population in the school's catchment area by age, sex and grade of enrollment; inservice training targets for teachers and principals; plan for school facilities repair and maintenance; plan for provision of educational materials and supplies; and financial commitment of county and corresponding financial obligation of townships. These financial commitments, worked out in the annual negotiations for revenue-sharing between county and townships would concentrate on marginal adjustments with a view to ensuring stability in financing and improving balance in locally supplied social services like basic education. Each township, in turn, would reach similar formal understandings with village committees and schools. This model, that has been practiced in a variety of ways in Gansu province (and elsewhere in China) has demonstrated certain advantages: it may be the basis for village-level campaigns to encourage families to enroll children in school; it engenders a sense of solidarity within villages and townships and competition in realizing educational targets; and it establishes obligations on each level and serves as an objective basis for evaluation. Most important, it would tend to narrow the distinction between public (or enterprise) and village schools as all are brought under a system of agreements that encompasses, for the village schools, a greater share of public financing (para. 4.38-4.41).

### Conclusion

5.12 This strategy represents a first step in the next stage of a comprehensive program for developing basic and vocational education in Gansu. By focusing on required educational interventions, along with strengthening of educational management and adjustment of financing policy, it represents an agenda for reaching UPE goals and for restructuring secondary education. While none of these actions is entirely new -- and all have been discussed by education leaders in Gansu -- what is most significant in their presentation here is their interdependence. Action on one front, for example,

upgrading school facilities through a repair and maintenance program, in the absence of concurrent action on another front, for example, development of a system for supervision, is unlikely to achieve its purpose. And in the absence of financial adjustments, resources may be used in socially unproductive ways. The key to the strategy for implementation of this action program would seem, thus, to be selection of target counties and implementation phased across these counties in function of management capabilities and availability of finance. This approach may force some choices with respect to the timetable for realization of the full range of educational goals. The analysis of alternative scenarios in terms of components, timetable for implementation, and cost and financing is contained in Chapter VI.

## VI. COST AND FINANCING OF BASIC AND VOCATIONAL EDUCATION

### Introduction

6.01 Reports in 1981 and 1985 on the Chinese economy by the World Bank analyzed the costs and financing of education in China.<sup>30/</sup> These studies concluded that, given the relatively high levels of primary and secondary education for a low-income country, the Government of China had spent less on education than could have been expected. Major reasons for relatively low educational expenditures were low teacher salaries and limited outlays for educational materials and buildings. Local communities, enterprises and, to some extent, parents had borne a fairly large proportion of costs at the primary and secondary level. Their ability to bear these costs had varied, however, and differences in enrollment and completion, as well as in the quality of primary and secondary education exist across the country.

6.02 In further exploration of regional disparities in educational development in China, this report has examined the conditions of basic and vocational education in Gansu, one of the poorest provinces of China. It has documented with available information the degree to which education in Gansu lags behind. And it has organized, in line with national policy and provincial plans, a set of actions that together constitute a strategy for improving basic and vocational education in Gansu. The task of this chapter is to assess these plans and actions in terms of resource requirements and prospects for financing.

6.03 The approach adopted for this purpose is as follows: first, two alternative scenarios of policies and targets are formulated for the development of basic and vocational education to the year 2000; second, using mission estimates for population by age, by year and characteristics of student flow based on actual performance from 1980 to 1984, for each scenario enrollment patterns by year and level of education are projected to the year 2000; and, finally, by building on unit cost estimates and the two patterns of student flow, resources required of each of the principal participants -- the state budget, enterprises and local finance -- are estimated for each scenario. This approach allows for assessment of possible enrollment trends and patterns, and financing implications as Gansu pursues a strategy of developing basic and vocational education.

6.04 The assumptions employed in this exercise to quantify targets, estimate unit costs, trace student flow and balance resource requirements among competing levels of education and by different sources of funds are manifold. The estimates for economic growth are those used by the Provincial Planning Commission and, though reasonable, are subject to change in future years. Because of the weak statistical base, the possible error of estimation of educational and expenditure data, even for the historical period, 1980-

---

30/ China: Socialist Economic Development Annex G: Education Sector, World Bank, Washington, D.C., 1981; and China: Long-Term Issues and Options, Annex A: Issues and Prospects in Education, op. cit.

1984, is large, and estimates used here of the future changes in student flow characteristics as a result of management improvement and different factor mix in resource input cannot be tested empirically. Accordingly it should be recognized that projections are not predictions. The testing of these alternative scenarios has a more didactic than prescriptive purpose. The objective is to contribute to discussion and debate on planning for basic and vocational education in Gansu -- in full recognition of the uncertainty in any method of analysis.

6.05 From this perspective and in recognition of these limitations, this chapter reaches several conclusions for planning basic and vocational education in Gansu. The principal conclusion is that, based on assumptions regarding fertility, mortality, migration, and age and sex distributions obtained from the 1982 census, the current and future rate of natural growth of population in Gansu is and will remain low, about 1.17% in 1985, falling to 1.05% in 1990, and 0.88% in 2000. This situation opens up an unprecedented decline in the school-age population. This prospect -- which is only subject to significant possible error in the later years of this period since those who will enter school as late as 1993 are already born -- then suggests further conclusions. The accelerating decline in the school age population should allow for both an increase in unit resource input and an improved mix of inputs at the primary level to combat low completion rates. It should also allow for a shift in public resources to rural areas and village schools in order to raise the quality of education in the most sub-standard educational conditions in the province and reduce the direct costs of schooling to poor families for whom outlays for schooling represent a barrier to enrolling children. Finally, under the assumption that such public investments are made to improve basic education, the squeeze on public resources for education is greatest only in the later years of the period to 2000. The sharp increase in public resource requirements in that period, is, in large measure, a result of the late expansion of upper secondary and, in particular, the high cost component of vocational secondary. This reinforces the argument that programs of vocational education should be more diverse with a greater effort devoted to short-term training courses for primary and lower secondary school leavers and for lower secondary graduates. Vocational programs at the upper secondary level should emphasize cost-effectiveness in the provision of skills, particularly by the use of centralized facilities.

#### Prospects to the Year 2000

6.06 The mission has projected resource requirements for basic and vocational education to the year 2000 in constant prices of 1983, the most recent year for which educational expenditure, both recurrent and capital, is available by level of education. These estimates of requirements are built around two alternative scenarios. The main features of each scenario are presented in Table 6.1 describing main policies and targets. Scenario I is essentially a scenario of status quo. Under this scenario, the system will continue to operate at existing levels of internal efficiency as determined by current repetition and drop-out rates. The number of overage students drawn into primary school will, however, gradually decline until a steady state is reached by about 1988. Apart from an expected decline in enrollment --

TABLE 6.1: ALTERNATIVE SCENARIOS FOR THE DEVELOPMENT OF BASIC AND VOCATIONAL EDUCATION

SCENARIO I (Status Quo)	SCENARIO II
1. Existing levels of efficiency with current repetition and drop-out rates.	Higher levels of efficiency as a result of improvement in management and provision of educational materials.
2. Achievement of a six year primary system (from five years in rural areas) by 1990.	Achievement of a six year primary system (from five years in rural areas) by 1990.
3. Share of minban teachers and village and locally financed schools at current level of about 60%.	Share of minban teachers and village and locally financed schools reduced to 30% by 1990 and 0% by 1995.
4. Lower Secondary enrollment at current level of 30%.	Lower Secondary enrollment at about 60% by 1990 and 90% by 2000.
5. Upper Secondary enrollment at current 10%.	Upper Secondary enrollment reaches 30% by 1990 and 60% by 2000.
6. Share of Vocational in Upper Secondary at current level of 20%.	Share of Vocational in Upper Secondary rises to 50% by 1990.

because of a drop in the proportion of overage students and the demographically determined fall in school-age population -- little else will change. The Government will shift to a six year primary system in rural areas by 1990, by adding one more year where this is required. But no changes will be made in management and in resource input at the school level (other than in teacher salaries which will be assumed in both scenarios to grow at the same rate as overall growth in per capita income). Primary school completion will remain at around one third; the share of minban teachers will remain at about 60%; lower secondary enrollment will stay at about 30%; upper secondary enrollment will remain at about 10%; and the share of vocational (defined for this purpose as all non-general formal education at the upper secondary level) will remain at 20% of total upper secondary enrollment.

6.07 In Scenario II, the full set of measures in official plans to develop basic and vocational education are introduced along with specific policies to improve educational management, resource factor mix, and financing arrangements. A policy gradually to eliminate the distinction between publicly and locally-financed schools is included. This is accomplished by reducing the share of students and minban teachers in locally financed schools from 60% in 1983 to 30% by 1990 and 0% by 1995. This would be achieved by using public funds to raise gradually the income and qualifications of all minban teachers to the level of public teachers and to increase unit resource input for students in these schools to average levels in the public schools. Such a policy would also enable locally set fees for village primary schools gradually to be eliminated, as the higher unit expenditure in public schools could absorb expenditures covered by fees and related charges in locally-run schools. There is also an increase of 50% in the non-personnel component of unit recurrent cost at each level. This increment is based on estimates of higher standards for educational materials and supplies in, say, average key or central schools. There is an intensification of inservice teacher training and a strengthening in the management system. Also, enrollment in lower secondary reaches 60% by 1990 and approximately 90% by 2000; enrollment in upper secondary reaches 30% by 1990 and 60% by 2000; and the share of vocational students in total in upper secondary enrollment rises to 50% by 1990 and is held at that level. It is also assumed here that characteristics of student flow, including repetition, dropout and completion rates, will more closely approximate those of countries with these levels of enrollment. The result is that more students stay longer in school requiring, therefore, more resources. However, the improvement in student flow rates results in an actual lowering of the cost per graduate at the primary level of about 50%, and at the lower secondary level of about 25% by, for example, 1990.

6.08 The policy changes in Scenarios I and II are consistent with objectives and plans set by the province and are supported by findings of this report. The actual quantitative targets including increases in real unit cost chosen for this simulation are, of course, only judgments by the mission of what may be reasonable. With respect to growth in incomes, the assumptions are those associated with quadrupling GVIAO between 1980 and 2000. This can be approximated as an increase of 6% per annum in income per capita. In both scenarios real unit personnel costs have thus been incremented at 6% per annum to the year 2000. A 7% rate of increase has been applied to estimates of real annual growth in state budget expenditure. Another set of projections was

made for the possibility of real growth rates not being achieved. In this case, it was assumed that real GVIAO would increase only by 3.5% per annum to 2000, that is one half of the rate of the provincial plan, and equivalent to a growth in income per capita of about 3% per annum. In this case, personnel costs were also increased at 3% per annum. If, in this case of lower growth, state budget expenditure also averaged a 3.5% per annum real increase, the picture does not differ substantially from that presented here for the province's higher growth plan. For that reason, the results are not reported.

6.09 Unit recurrent and capital costs by level and type of education are mission estimates based on data provided by the Provincial Bureau of Education, mission survey of school expenditure, and unit cost norms, particularly for capital costs, provided by SEdC. Recurrent costs are broken down into personnel costs and other costs such as those for educational materials and supplies. Capital costs for 1983 are actual reported expenditure plus estimates by the Bureau of Education of the value of self-accumulated funds for capital construction, that is payments out of income from work-study programs, enterprise donations, or sales at the school level. It also includes Bureau of Education estimates of the value of collective labor provided for school construction at the local level. For future years, unit capital costs are annualized capital costs that are based on estimates of requirements for new classrooms, for repair of existing classrooms, for new furniture and equipment, and replacement of existing furniture and equipment by each level.

6.10 The results of this analysis of the scenarios are quite instructive. They are reported in Tables 6.2 and 6.3. (These summary tables are obtained from tables reported in Appendix F.) Under Scenario I, which assumes continuing relatively high repetition and dropout rates, the level of real resources required for public education in Gansu actually drops by 23% between 1983 and 1990, and then rises gradually by 2000 to about 22% above the 1983 level. This phenomenon is largely explained by three considerations. First, between 1983 and 1990 the primary school age population will decline by 20%, lower secondary by 26%, and upper secondary by 15%. From 1990 to 2000, the primary age population will remain approximately constant; lower secondary age group will fall a further 8%; and upper secondary, about 15%. Second, given that the large volume of overage students that entered the primary level between 1980 and 1985 will begin to exit from the system, the level of actual enrollments will, in all likelihood, decline even faster to 1990 than age group population. Third, the rise in the level of public expenditure required later in the period is largely a result of the impact of increase in personnel costs in education, in accordance with assumptions stated earlier regarding projected increase in income per capita. It is also highly significant that under this scenario, the projected share of state budget expenditure on education in 1990 (7.9%) and 2000 (7.0%) would be only one half the share of 1983, about 15.3%.

6.11 Under Scenario II -- that considers a gradual raising of the financial conditions of village schools to the status of average public schools, that builds on a pattern of student flow with much lower grade repetition and student dropout, that incorporates higher enrollment rates at the lower and upper secondary level, including 50% of upper secondary enrollment in the vocational streams, and that allocates a 50% increase in per student

TABLE 6.2: ESTIMATES OF PUBLIC EDUCATIONAL EXPENDITURE IN  
GANSU PROVINCE  
(Y millions AT 1983 PRICES)

LEVEL	1983 ( '000s)	%	SCENARIO I				SCENARIO II				
			1990	%	2000	%	1990	%	2000	%	
PRIMARY											
MINBAN	26,622		33		55		25		0		
GONGBAN	60,243		49		82		128		298		
SUB-TOTAL	86,865	44	82	51	137	52	153	43	298	42	
LOWER SECONDARY	52,770	27	30	a/ 19	50	19	76	21	134	19	
UPPER SECONDARY GENERAL	15,847	8	10	6	17	6	27	8	68	10	
UPPER SECONDARY VOCATIONAL b/	7,612	4	6	4	9	3	66	18	149	21	
PROGRAM SUB-TOTAL	163,094		128		213		322		649		
IN-SERVICE TEACHER TRAINING c/	2,300	1	2	1	3	1	5	1	10	1	
OTHER d/	32,606	16	30	19	50	19	30	8	50	7	
TOTAL PUBLIC RECURRENT EXPENDITURE ON EDUCATION	198,000	100	160	100	266	100	357	100	709	100	
TOTAL PUBLIC CAPITAL EXPENDITURE ON EDUCATION	40,000		24		24		48		57		
TOTAL PUBLIC EXPENDITURE ON EDUCATION	238,000		184		290		405		766		
STATE BUDGET EXPENDITURE	1,552,560		2,334		4,181		2,334		4,181		
% OF STATE BUDGET EXPENDITURE IN EDUCATION	15.3		7.9		6.9		17.4		18.3		
TOTAL AID FROM CENTRAL GOVERNMENT	641,650										

- a/ Sharp decline in lower secondary in this case is partly a result of additional year, sixth grade for rural primary, across the province by 1990.
- b/ Secondary vocational is defined as all non-general secondary. It includes secondary agriculture and vocational (under the Provincial Education Bureau) and specialized secondary.
- c/ The category "inservice teacher training" is actual reported for 1983. For future years estimates are based on teacher training requirements under each scenario.
- d/ The category "other" education is a residual that includes higher education, non-formal higher education, general non-formal education, special education and other education as reported by the Provincial Education Bureau. The figure for 1983 is actual expenditure. Under each scenario estimates for future years are based on a fixed share of 20% for 1983 applied to the status quo scenario, Scenario I. These values are also used in Scenario II.

TABLE 6.3: ESTIMATES OF EDUCATIONAL RESOURCE REQUIREMENTS FOR  
GANSU PROVINCE, BY SOURCE OF FINANCE  
(Y millions AT 1983 PRICES)

LEVEL	1983		SCENARIO I				SCENARIO II			
	('000s)	%	1990	%	2000	%	1990	%	2000	%
RECURRENT EXPENDITURE FOR PRIMARY AND SECONDARY										
Public	163,094		128		212		323		649	
Enterprise	8,535		7		11		19		40	
Other a/	34,983		28		46		21		0	
Sub-total	206,612		153		269		363		689	
PUBLIC RECURRENT EXPENDITURE ON OTHER EDUCATION b/										
In-service Teacher Training	2,300		2		3		5		10	
Other	32,606		30		50		30		50	
Sub-total	34,906		32		53		35		60	
TOTAL RECURRENT EXPENDITURE ON EDUCATION										
Public	198,000		160		265		358		709	
Enterprise	8,535		7		11		19		40	
Other	34,983		28		46		21		0	
Sub-total	241,518		195		322		398		749	
TOTAL CAPITAL EXPENDITURE ON EDUCATION										
Public	40,000		24		24		48		57	
Enterprise	3,492		2		1		3		4	
Other	38,800		24		25		41		45	
Sub-total	82,292		50		50		92		106	
TOTAL EXPENDITURE ON EDUCATION										
Public	238,000	73	184	76	289	78	406	82	766	90
Enterprise	12,027	4	9	3	12	3	22	4	44	5
Other	73,783	23	52	21	71	19	62	13	45	5
Sub-total	323,810	100	245	100	371	100	490	100	855	100
STATE BUDGET EXPENDITURE	1,552,560		2,334		4,181		2,334		4,181	
% OF STATE BUDGET ON EXPENDITURE ON EDUCATION	15.3		7.9		6.9		17.4		18.3	

a/ "Other" source of expenditure refers to estimated value of resources provided collectively by village and townships for support of minben teachers and other recurrent expenditures in the operation of schools in rural areas.

b/ For definition of "other" category of education see Table 6.2.

expenditure on educational materials at each level -- the real public resource requirements rise sharply over 1983, a 70% increase by 1990 and up to 220% by 2000. In this case the share of total public recurrent expenditure devoted to primary education is 42%, the level of 1983. The greater share of additional resources has flowed into upper secondary vocational education, 21% of total by 2000, as contrasted with 3% in 2000 under Scenario I, and 3.8% in 1983. This massive shift in the allocation of resources for education is a consequence of both more students staying longer in school and progressing further, and the sharp expansion of enrollments, nine times the 1983 level, in upper secondary vocational education, the most expensive component of the primary and secondary program. It is worth noting, in the case of Scenario II, that by these assumptions, the estimate of public educational spending as a share of total state budget will be 17.4% in 1990 and 18.3% in 2000. The corresponding figure for 1983 was 15.3%.

6.12 These projected levels and distribution of future public expenditure on education can be viewed, in Table 6.3, in relation to the total resource requirements for education in Gansu. The three sources of finance for education are classified as follows: public, that is state budget expenditure; enterprise expenditure on education of children of workers in state enterprises; and "other" expenditure, that refers to the estimated level of resources provided collectively by villages and townships (but not within the state budget) for support of minban teachers and other recurrent expenditure for educational materials in the operation of village schools. Other expenditure also includes the cost of labor donated for capital construction and other self-accumulated funds (donations, village level contributions, income from sale of goods or services) as used for capital construction and for furniture and equipment. In 1983 according to Table 6.3, the public share of total resources used in education was 72%, 62% for recurrent, and 33% for capital expenditure. Enterprises accounted for an estimated 4% and "other" sources, 24%. Under Scenario I, the status quo, this picture remains approximately the same, although real expenditure by each source falls by 1990 and increases again by 2000 in the same proportions as that projected for public expenditure above. Under Scenario II, levels of total spending increase quite sharply over the case of Scenario I, especially by 2000. At the same time, the greater responsibility assumed by the government in gradually absorbing village schools into the public system occasions a rise in the public spending share to 80% of total in 1990 and 90% by 2000. The enterprise share is at 5%. Resources required from "other" sources decline to 0% by 2000 in terms of the share of recurrent expenditure. However, the use of village labor for school construction and repair is retained in this scenario. The increase in resources for capital expenditure required from "other" sources is by virtue of the larger educational system and the corresponding increase in local school construction and repair. That condition results, nevertheless, in a fall to 5% in the share of total resource requirement from "other" sources, and a level in 2000 approximately one-half that required in 1983. If even this policy -- which has certain inherent advantages in mobilizing local support and initiative for basic education and is of longstanding in China -- is reversed, and the full cost of local school construction and repair falls on the state budget, the additional burden is only about 6% of projected public requirements.

6.13 Although the education and finance policies imbedded in Scenario II incorporate a substantial increase in governmental responsibility for education, the projected share of public expenditure on education in terms of the state budget by 1990 and 2000 are projected to differ at most 3% from the level of 1983. According to these projections the policies to raise the public subsidy for minban teachers, to finance their inservice training, and ultimately to transfer them to the public payroll can be managed under growth in the state budget in line with projected overall economic growth. The same can be said for the proposal to absorb into the state budget and raise the level of spending in village schools in order both to improve the standards of these schools and lessen the burden of fees and other charges on households in poor counties. This condition is a result of the decline in the school age population that began to have an impact on enrollments in the early 1980s. Under these circumstances, as Scenario I has shown, in the absence of new policies, actual financial requirements for a system -- with relatively high student repetition and dropout, and approximately 46 counties well short of UPE -- would fall by 1990 and rise again only gradually by 2000. The share of state budget expenditure on education would be halved.

6.14 The decline in the school age population then holds significant opportunity for the development of education in Gansu. The challenge is to identify those investments that would provide the highest social return. To the extent that there is a tradeoff implicit in the policy prescriptions under Scenario II, it is between the achievement of goals for basic education and the policy to provide secondary vocational education on a much larger scale. Under Scenario II the most rapid rate of increase in expenditure among levels of education would be occasioned by the provincial policy for secondary vocational education. A slower rate of increase on that level and the design of vocational programs with lower unit costs would together reduce the level of annual expenditure requirements for the vocational program.

6.15 Analysis at this level of generalization cannot evaluate the impact of financing policies, say, for basic education at each county or township in Gansu. While the evidence suggests in the aggregate that declining school age population, combined with a sustained period of economic growth, should release resources sufficient for implementing the policies described above to the year 2000, the scope for such progress must be assessed in each locality. The proposed increase in public responsibility for expenditure on basic education in each township and county could be managed as part of the provincial plan for improving development prospects in the 46 backward counties. The timetable for plans to improve the remuneration and qualifications of minban teachers and to reduce fees and charges to households would then depend, in part, upon the annual budgetary negotiations between counties and townships and, in part, on resources for education available to the province from the various central subsidies or other provincial revenues. The proposal to build county and township educational development proposals around formal responsibility agreements should allow for stability in financing and sufficient concentration of actions that could together be mutually supportive and reinforcing.

6.16 In summary, subject to the imprecision inherent in this form of modeling of resource requirements and spending shares, several conclusions are

evident. China's population policy is resulting in a sharp decline in the school age population in Gansu. In this there is an opportunity for betterment of educational services at the primary level available to children largely in locally-financed schools in rural areas. By shifting greater resources to this segment of primary education, educational conditions in the schools can be improved at the same time as burdensome costs of education on local villages and families are lessened. Both adjustments should result in increased demand for primary schooling, and ultimately higher enrollment and completion rates. Improvements in the coverage and quality of basic and vocational education of the kind considered in the second scenario appear to be largely affordable. The major remaining question revolves around the plan for vocationalizing upper secondary. If government ultimately adopts an approach for Gansu that places less emphasis on a three-year vocational program at the level of upper secondary, but rather directs more resources to shorter term training for primary and lower secondary school leavers and lower secondary graduates, even the cost of the vocational education scheme could be restrained. At the same time unit costs of vocational education at the level of upper secondary could be further reduced by use of centralized facilities, to the degree feasible, offering courses for students from neighboring schools. This model could be tested in a pilot project covering two or three vocational training centers.

TABLE A.1  
COMPARATIVE EDUCATION INDICATORS

BASE YEAR	POP. MILLS. (1979) (1)	GMP/ CAPITA (US\$) (1979) (2)	% GMP DEVOTED TO EDUCATION (3)	CENTRAL GVT. EXPEN. ON EDUC. AS % TOTAL GVT. EXPEND. (4)	EDUCATION RECURRENT EXPENDITURES ALLOCATED TO :			ADULT LITERACY RATE (%) (1976) (6)	PRIMARY ENROLL. RATIO (%) (7)	COMPLETION RATE FOR PRIMARY SCHOOL CYCLE (%) (8)	PRIMARY STUDENTS PER TEACHER (9)	RECURRENT UNIT COST		PROGRESSION RATE FROM PRIMARY TO SECONDARY (%) (11)	SECONDARY ENROLL. RATIO (%) (12)	SECONDARY STUDENTS PER TEACHER (13)	HIGHER EDUCATION ENROLLMENT RATIO (14)
					PRI	SEC	HI					PRIMARY GMP/CAPITA (10)	SECONDARY GMP/CAPITA (10)				
CHINA/a	83	1,025	3.1	7.1	38	40	22	76	110	65	25	8	65	35	17	4.8	
GHANA/b	84	20	--	--	42	40	18	46	117	34	23	19.7	77	20	20	4	
JIANGSU/b	84	61/c	400/c	--	--	--	--	75/c	139	94	27	--	70	36	20	2	
JAPAN/c	82	118.4	10,080	--	--	--	--	--	100	--	--	--	--	92	--	30	
U.S.A/c	82	231.5	13,160	--	2.5	--	--	--	100	--	--	--	--	97	--	58	
W.GERMANY/a	79	61.2	12,200	4.6	9.9	--	--	99	89	100	--	--	100	94	--	30	
S. KOREA/a	82	39.3	1,636	7.7	20.8	34	34	31	96	99	98	43	19	98	84	38	24
MALAYSIA/a	84	15.2	1,870	5.6	22.7	39	44	17	70	97	97	26	13.3	90	72	22	5
PHILIPPINES/a	79	48.3	690	2.8	14.0	64	36	--	75	84	65	31	7.1	89	55	36	27
BRAZIL/a	79	116.5	1,770	3.8	6.2	51	--	14	76	73	--	23	4.5	61	15	14	12
MEXICO/a	80	55.5	1,880	4.7	17.0	46	39	15	92	98	53	44	9.5	86	56	17	15
INDIA/a	77	59.6	210	2.9	9.9	--	--	--	36	79	--	41	--	--	28	--	9
INDONESIA/a	81	150.5	520	2.1	9.3	70	24	6	32	98	61	37	11.0	74	27	26	4
TANZANIA/a	80	18.5	260	5.9	17.7	47	10	16	79	98	87	43	11	19	3	20	--
SOMALIA/a	81	4.5	280	1.5	10.5	50	44	6	50	22	80	29	9	80	12	22	1
BENIN/a	79	3.4	320	6.5	35.0	43	21	5	11	42	30	46	14	30	11	43	2
CAMEROON/a	78	8.2	590	2.9	16.0	33	43	20	--	74	45	50	11.8	20	14	26	2
NIGERIA/a	77	82.6	910	4.1	9.6	--	--	--	--	--	--	--	--	--	10	25	3

/a: Conventions used here are the same as official World Bank Comparative Education Indicators, May, 1985..

/b: Data gathered by mission in the field.

/c: Jiangsu data available for year 1985.

/d: All data from World Development Report, 1984.

CHINA

EDUCATION PERFORMANCE INDICATORS

1. Universal primary education (UPE) in China is officially defined by SEDC as the achievement of four rates, called (1) enrollment rate; (2) annual retention rate; (3) graduation rate; and (4) universalization rate. Each of these rates is assigned a specific target as shown in Table A.1.

2. Rate #1 is the familiar net enrollment rate. Rate #2 is a within-year retention rate, a reflection of the number of children who drop out during the school year. Rate #3 is a measure of the passing rate at the end of the primary cycle. Rate #4, the most complex of the four, is essentially a measure of the proportion of the 12 to 15 year old population that has acquired the equivalent of a primary education. The denominator is the number of children 12 to 15 years old who are not in primary school during the year under question. The numerator is the number of children in the age group who have completed primary school or its equivalent. While useful, the four rates have some shortcomings. First, a rate that is key to assessing the holding power of schools, the promotion rate -- the proportion of children who progress from one grade to the next -- or alternatively, the completion rate (see definition below) is not included in these rates. In comparison to the promotion or completion rate, the within year retention rate (#2) is of considerably less importance. Second, the rates do not highlight the overall efficiency with which students progress from Grade 1 to Grade 5. For example, the familiar 10-8-4 pattern, surely a matter of concern, is not strictly revealed by these rates (see para. 1.05). Finally student repetition and student dropout rates by grade would reveal patterns and problems requiring attention, but not easily recognized under the four rates.

Table B-1

Four Rates for Universal Primary Education Used in China

Rate	Target for UPE	Definition
1. Enrollment rate	90%	$\frac{\text{Number of 7-11 year olds in school}}{\text{Total 7-11 population}} \times 100$
2. Annual Retention rate	97%	$\frac{\text{Enrollment at start of school year}}{\text{Enrollment at end of school year}} \times 100$
3. Graduation Rate	95%	$\frac{\text{Number of students in last grade who pass exams}}{\text{Number of students in last grade}} \times 100$
4. Universalization Rate	95%	$\frac{\text{12-15 primary leavers } \frac{a}{b} + \text{12-15 year olds in secondary school} + \text{12-15 year olds with equivalent education } \frac{b}{c}}{\text{Number of 12-15 year olds} - \text{Number of 12-15 year olds in primary schools}} \times 100$

/a Not in school, but having completed all primary grades.

/b Education equivalent to primary school obtained through nonformal education

Student Flow Rates Commonly Used by the World Bank and UNESCO

The following are common definitions of student flow rates. In the case of repetition, dropout, promotion and net flow rates, separate rates for each grade may be calculated. But, in these cases, users may also compute average rates across all grades in a cycle.

Gross Enrollment Rate. Gross enrollment rate is the total number of students in school at the corresponding level of education as a percentage of the total population for that level of education.

Net Enrollment Rate. Net enrollment rate is the number of children enrolled in school of the age cohort that corresponds to that level of education as a percentage of the total population for that level of education.

Admission Rate: The number of new students who are admitted into the entry grade of a cycle or course (excluding repeaters) as a percentage of the most relevant body of clientele. Narrowly defined, the clientele may be the applicants only. More broadly, the clientele could be the age group designated for entry.

Repetition Rate: The number of students who repeat a given grade as a percentage of the enrollment in that grade in the previous school year.

Dropout Rate: For any grade, the number of students who leave school during or at the end of the school year as a percentage of enrollment in the previous school year. A distinction is sometimes made between so-called "voluntary" and "involuntary" dropout ("push out") especially where a squeeze on space and teacher supply exists in upper grades or in the case of incomplete schools.

Promotion Rate: The number of students who advance to the next higher grade at the start of the school year as a percentage of enrollment in the previous grade early in the previous school year.

Net Flow Rate: This is a compound or summary indicator of the combined effect of the system's three basic flow factors - repetition, dropout and promotion. The Net Flow Rate is the number of students promoted, minus the numbers of repeaters and dropouts, with the remainder as a percentage of the enrollment in the previous school year.

$$\frac{\text{Number Promoted} - (\text{Dropouts and Repeaters})}{\text{Enrollment}}$$

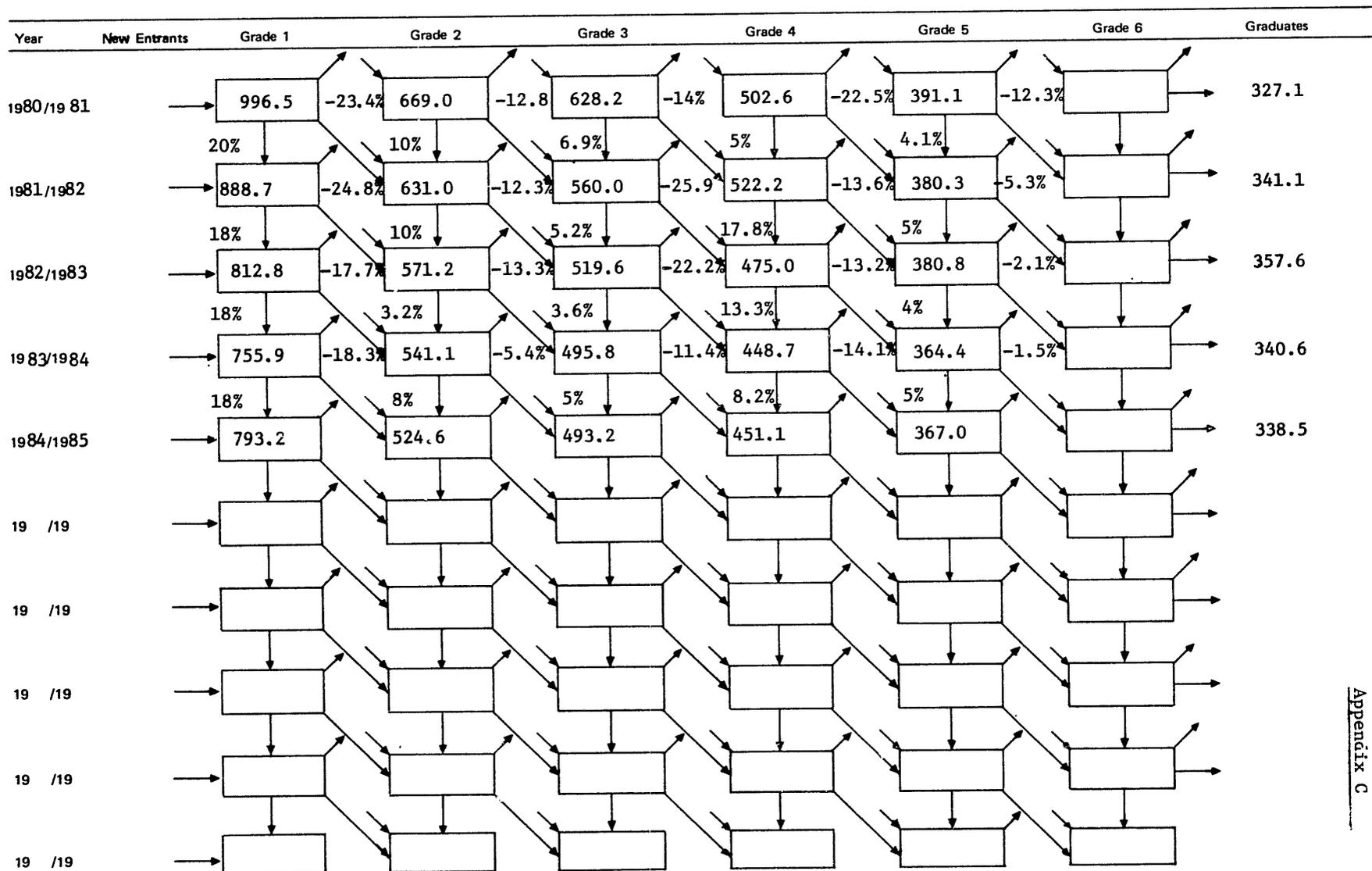
The index can range from + 100% (everyone promoted) through 0% (equal numbers promoted and "lost" by dropout or repetition) to -100% (none promoted).

Completion Rate: The number of students who complete a whole cycle or course as a percentage of the base number admitted in the entry grade, the same number of school years earlier as the length of the cycle. This rate does not generally separate out intermediate inflow and outflow (from repetition, dropout, reentry, etc.).

**Table C.1: STUDENT FLOWCHART**  
**INTAKE, ENROLLMENT, REPETITION, DROPOUT, GRADUATION IN SCHOOLS AND COLLEGES**

Gansu Province: Student Flowchart

NAME OF SCHOOL (PROVINCE, COUNTRY): Primary Education 1980-84 (000s)



CHINA

GANSU PROVINCIAL STUDY

Education Annex

Under- and Overage Primary School Children

Hui County Primary Schools: Number of Students

Grade	Underage	At age	One year overage	More than one year overage	Total
<u>Urban</u>					
1	144	408	10	0	562
2	142	313	7	0	462
3	153	374	5	0	532
4	163	422	7	0	592
5	141	466	16	0	623
<u>Total</u>	<u>743</u>	<u>1,983</u>	<u>45</u>	<u>0</u>	<u>2,771</u>
<u>Rural</u>					
1	0	6,799	556	0	7,355
2	0	3,721	1,577	21	5,319
3	0	3,332	1,408	29	4,769
4	0	3,017	1,237	56	4,310
5	0	2,134	(986)/a	(44)/a	3,164
<u>Total</u>	<u>0</u>	<u>19,003</u>	<u>5,764</u>	<u>150</u>	<u>24,917</u>

/a Estimated.

Source: Mission estimates

CHINA

GANSU PROVINCIAL STUDY

Education Annex

Under- and Overage Primary School Children

Lintao County Primary Schools: Number of Students

Grade	Underage	At age	One year overage	More than one year overage	Total
<u>Urban</u>					
1	0	555	43	5	603
2	0	545	41	11	597
3	0	581	45	17	643
4	0	625	82	46	753
5	0	695	(36)/a	(17)/a	748
<u>Total</u>	<u>0</u>	<u>3,001</u>	<u>247</u>	<u>96</u>	<u>3,344</u>
<u>Rural</u>					
1	0	12,744	2,192	2,367	17,303
2	0	7,990	1,368	1,279	10,637
3	0	7,717	1,300	1,326	10,343
4	0	7,315	1,249	885	9,449
5	0	5,193	(1,378)/a	(918)/a	7,489
<u>Total</u>	<u>0</u>	<u>40,959</u>	<u>7,487</u>	<u>6,775</u>	<u>55,221</u>

/a Estimated.

Source: Mission estimates.

CHINA

GANSU PROVINCIAL STUDY

Education Annex

Under- and Overage Primary School Children

Xiahe County Primary Schools: Number of Students

<u>Grade</u>	<u>Underage</u>	<u>At age</u>	<u>One year overage</u>	<u>More than one year overage</u>	<u>Total</u>
<u>Urban</u>					
1		179	126	85	390
2	35	110	116	139	400
3	30	122	123	134	409
4	106	115	92	63	376
5	70	122	101	70	363
<u>Total</u>	<u>241</u>	<u>648</u>	<u>558</u>	<u>491</u>	<u>1,938</u>
<u>Rural</u>					
1	109	686	581	760	2,136
2	27	88	183	457	755
3	18	77	129	281	505
4	8	48	97	232	385
5	2	44	66	104	216
<u>Total</u>	<u>164</u>	<u>943</u>	<u>1,056</u>	<u>1,834</u>	<u>3,997</u>

Source: Mission estimates

CHINA

GANSU PROVINCIAL STUDY

Education Annex

Under- and Overage Primary School Children

Yongdeng County Primary Schools: Number of Students

Grade	Underage	At age	One year overage	More than one year overage	Total
<u>Urban</u>					
1	58	240	88	9	395
2	52	159	58	58	327
3	28	165	94	127	414
4	18	111	100	135	364
5	26	179	(145)/a	(193)/a	543
<u>Total</u>	<u>182</u>	<u>854</u>	<u>485</u>	<u>522</u>	<u>2,043</u>
<u>Rural</u>					
1	2,221	6,596	3,275	1,727	13,819
2	791	4,288	3,573	3,456	12,108
3	970	2,543	3,379	3,169	10,061
4	766	2,264	3,283	4,811	11,124
5	723	2,270	(3,257)/a	(4,774)/a	11,024
<u>Total</u>	<u>5,471</u>	<u>17,961</u>	<u>16,767</u>	<u>17,937</u>	<u>58,136</u>

/a Estimated.

Source: Mission estimates

CHINA

GANSU PROVINCIAL STUDY

Education Annex

Distribution of Students by Level and Sex

	Total enrollment	Female	% Female
Primary schools Gansu Province	2,647,188	993,500	37.5
Lower secondary schools Gansu Province	691,690	248,894	36
Yongdeng County			
Urban primary	2,376	969	40.8
Rural primary	58,400	22,384	38.3
Urban lower secondary schools	1,303	568	43.6
Rural lower secondary schools	17,171	6,522	38.0
Hui County			
Urban primary	2,908	1,380	47.5
Rural primary	24,917	11,183	44.9
Urban lower secondary schools	1,126	529	47
Rural lower secondary schools	4,787	1,980	41.4
Lintao County			
Urban primary	3,626	1,478	40.8
Rural primary	55,342	22,328	40.3
Urban lower secondary schools	5,309	1,481	27.9
Rural lower secondary schools	3,859	1,055	27.3
Xiahe County			
Urban primary	1,969	799	40.6
Rural primary	3,947	1,212	30.7
Urban lower secondary schools	994	463	46.6
Rural lower secondary schools	219	70	32

Source: Bureau of Education, Gansu Province and mission estimates.

CHINAGANSU PROVINCIAL STUDYEducation AnnexSummary of Visits to Primary Schools

School number	Location	Type	Per student recurrent expenditure (Y)
1	Lanzhou City/urban	Public	94.00
2	Xiahe County/urban	Key	60.50
3	Xiahe County/rural	Central	-
4	Lintau County/rural	Village	41.90
5	Lintau County/rural	Village	43.53
6	Lintau County/rural	Village	55.99
7	Lintau County/urban	Public	66.27
8	Hui County/rural	Enterprise	124.00
9	Hui County/urban	Key	82.11
10	Hui County/rural	8-year primary	30.72
11	Hui County/urban (rural students)	Public	43.06
12	Hui County/rural	Village	18.83
13	Hui County/rural	Public	39.75
14	Lintau County/rural	Village	25.00
15	Yongdeng County/urban	Public	81.00
16	Yongdeng County/urban (minority)	Public	49.24
17	Yongdeng County/rural	Public	31.00

Source: Mission estimates.

CHINAGANSU PROVINCIAL STUDYEducation AnnexSummary of Visits to Secondary Schools

School number	Location	Level	Type	Per student recurrent expenditure (Y)
1	Lanzhou/urban	Upper & lower secondary	Key	242.00
2	Lanzhou/urban	Lower secondary	Public	94.40
3	Lanzhou/urban	Upper vocational secondary	Public	1,380.00
4	Xiahe County/rural	Lower secondary	Public	-
5	Lintau County/rural	Lower secondary	Public	101.63
6	Lintau County/rural	Upper & lower secondary	Public	121.08
7	Lintau County/urban	Normal secondary	Public	779.05
8	Lintau County/urban	Agriculture technical	Public	960.16
9	Lintau County/urban	Upper & lower secondary	Public	129.42
10	Hui County/rural	Agriculture vocational upper (grades 1 and 2)	-	375.99
11	Hui County/urban	Upper secondary	Key	118.19
12	Yongdeng County/urban	Lower secondary	Public	81.00
13	Yongdeng County/urban	Upper & lower secondary	Key	86.33
14	Yongdeng County/rural	Lower secondary	Public	73.26

Source: Mission estimates.

Table F.1: Scenario I, BANGU PROVINCE ENROLLMENT PATTERN  
PRIMARY, LOWER AND UPPER SECONDARY

	DATA 1980	DATA 1981	DATA 1982	DATA 1983	DATA 1984	PROJ 1985	PROJ 1986	PROJ 1987	PROJ 1988	PROJ 1989	PROJ 1990	PROJ 1991	PROJ 1992	PROJ 1993	PROJ 1994	PROJ 1995	PROJ 1996	PROJ 1997	PROJ 1998	PROJ 1999	PROJ 2000
<b>PRIMARY</b>	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
7 yrs POP	4728	4514	4317	4096	3914	3714	3486	3240	4091	3929	3741	3518	3270	4043	3878	3687	3451	3187	3992	3866	3718
81/7 yrs	2.11	1.97	1.88	1.85	2.03	1.88	1.68	1.40	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
B1	9965	8887	8128	7359	7932	6485	5578	4536	4909	4715	4489	4222	3924	4852	4654	4424	4141	3824	4790	4639	4462
B2/B1	0.67	0.71	0.70	0.72	0.66	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
B2	4690	4510	5712	5411	5246	4680	3904	3175	3436	3300	3142	2935	2747	3396	3258	3097	2899	2677	3353	3247	3123
B3/B2	0.94	0.89	0.91	0.92	0.94	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
B3	4282	3660	5196	4958	4932	4305	3592	2921	3162	3036	2891	2719	2527	3124	2997	2849	2667	2463	3085	2988	2873
B4/B3	0.80	0.93	0.91	0.91	0.91	0.98	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
B4	5026	5222	4750	4487	4511	3875	3233	2629	2845	2733	2642	2447	2274	2812	2697	2544	2400	2217	2777	2689	2584
B5/B4	0.78	0.73	0.80	0.81	0.81	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
B5	3911	3803	3808	3644	3670	3061	2554	2077	2248	2159	2056	1933	1797	2221	2131	2026	1896	1751	2193	2124	2043
B6/B5	0.60	0.61	0.68	0.11	0.16	0.20	0.60	0.60	0.80	0.90	0.90	0.90	0.90	0.90	0.90	0.93	0.90	0.90	0.90	0.90	0.90
B6	0	54	294	612	580	612	1022	1266	1798	1943	1850	1740	1617	1999	1918	1823	1707	1576	1974	1912	1839
I GRADS	0.84	0.88	0.87	0.84	0.88	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PRI GRADS	3271	3411	3576	3406	3385	3366	2452	1952	2068	2188	1663	1566	1453	1799	1726	1641	1536	1418	1777	1721	1625
ENR. PRI.	31874	29876	27868	26471	26871	23218	19882	16585	18399	17886	17450	16015	14886	18405	17654	16784	15710	14508	18173	17599	16525
7-11 POP	23784	24700	23608	22517	21465	20424	21343	18333	18363	18382	18381	18409	18441	18425	18378	18299	18230	18151	18129	18119	18128
7-12 POP	31457	30251	28978	27675	26389	25121	25822	22612	22403	22258	22072	21871	21654	22464	22271	22020	21725	21397	22125	21966	21797
EMP/7-11	1.24	1.21	1.18	1.18	1.25	1.14	0.93	0.90	1.00	0.97	0.93	0.87	0.81	1.00	0.96	0.92	0.86	0.80	1.00	0.97	0.93
EMP/7-12	1.01	0.99	0.96	0.96	1.02	0.92	0.77	0.73	0.82	0.80	0.77	0.73	0.69	0.82	0.79	0.76	0.72	0.68	0.82	0.80	0.78
<b>LOWER SECONDARY</b>																					
12yrs POP	5673	5351	5370	5138	4924	4697	4479	4279	4040	3876	3691	3462	3213	4039	3893	3721	3495	3246	3996	3847	3669
13yrs POP	5734	5670	5548	5367	5161	4928	4695	4477	4277	4042	3878	3689	3460	3212	4043	3896	3720	3494	3245	3999	3849
LS1/PGRADS	0.92	0.86	0.75	0.80	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
LS1	3066	2719	2699	2723	2776	2711	2610	1601	1696	1788	1365	1284	1193	1476	1415	1346	1259	1163	1457	1411	1357
LS2/LS1	0.90	0.86	0.83	0.84	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
LS2	2701	2334	2239	2285	2387	2331	1729	1377	1458	1538	1174	1104	1026	1269	1217	1157	1083	1000	1253	1213	1167
LS3/LS2	0.85	0.92	0.84	0.83	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
LS3	2308	2154	1891	1982	2053	2005	1487	1184	1254	1322	1010	950	883	1091	1047	995	931	860	1078	1044	1004
I GRADS	0.10	0.95	0.92	0.84	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
LS GRADS	227	2041	1741	1599	1848	1884	1338	1066	1129	1190	999	855	794	982	942	896	838	774	970	939	903
LS. EN	8015	7307	6829	6910	7216	7047	5226	4162	4408	4648	3549	3338	3102	3836	3679	3498	3274	3024	3787	3668	3527
12-14 POP	17146	16953	16586	16071	15458	14791	14180	13429	12786	12193	11614	11068	10362	10711	11147	11663	11189	10459	10734	11090	11520
13-15 POP	17161	17137	16943	16577	16067	15455	14784	14092	13462	12789	12195	11609	11023	10359	10711	11150	11657	11185	10454	10734	11094
LSEN/12-14	0.47	0.43	0.41	0.43	0.47	0.48	0.37	0.31	0.34	0.38	0.31	0.30	0.30	0.34	0.33	0.30	0.29	0.29	0.35	0.33	0.31
LSEN/13-15	0.47	0.42	0.40	0.42	0.45	0.46	0.35	0.30	0.33	0.36	0.29	0.29	0.28	0.37	0.34	0.31	0.28	0.27	0.36	0.34	0.32
<b>UPPER SECONDARY</b>																					
15yrs POP	5670	5735	5727	5644	5542	5361	5163	4922	4690	4472	4272	4043	3874	3687	3457	3288	3043	2892	3716	3491	3243
16yrs POP	5438	5644	5728	5720	5656	5545	5337	5157	4916	4685	4466	4249	4039	3878	3683	3454	3266	3039	3889	3714	3488
US1/LSGRADS	1.64	0.44	0.46	0.49	0.35	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
US1	372	888	795	786	447	722	335	426	452	476	344	342	318	393	377	358	333	310	388	376	361
US2/US1	4.02	0.48	0.95	0.93	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
US2	1496	427	757	734	614	686	509	605	629	652	345	325	302	373	358	340	319	294	369	357	343
US3/US2	0.09	0.33	0.17	0.56	0.75	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
US3	132	141	131	366	584	651	483	365	497	430	328	309	287	335	340	323	303	279	358	339	326
I GRADS	1.02	1.00	1.22	1.42	0.62	0.48	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
US GRADS	134	141	160	521	364	316	411	327	346	345	279	262	244	301	289	275	257	238	298	288	277
US. EN	2090	1456	1683	1886	1845	2059	1527	1216	1288	1358	1037	975	906	1121	1075	1022	957	883	1166	1072	1031
U. USEN/USEN	0.83	0.84	0.86	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
U. US. EN	1660	1220	1444	1534	1474	1647	1222	973	1030	1086	830	780	725	897	860	818	763	707	885	857	824
VUSEN/USEN	0.17	0.16	0.14	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
V. US. ENR.	340	236	239	352	369	412	305	243	258	272	207	195	181	224	215	204	191	177	221	214	206
15-17 POP	16133	16830	17112	17104	16909	16533	16049	15430	14756	14066	13416	12774	12179	11591	11005	10340	10700	11135	11640	11089	10460
16-18 POP	14893	16112	16898	17089	17076	16892	16326	16038	15410	14733	14516	13848	13173	12593	11977	11346	10743	11164	10548	1162	

Table F.2: Scenario II, BAHU PROVINCE ENROLLMENT PATTERN  
PRIMARY, LOWER AND UPPER SECONDARY

	DATA 1980	DATA 1981	DATA 1982	DATA 1983	DATA 1984	PROJ 1985	PROJ 1986	PROJ 1987	PROJ 1988	PROJ 1989	PROJ 1990	PROJ 1991	PROJ 1992	PROJ 1993	PROJ 1994	PROJ 1995	PROJ 1996	PROJ 1997	PROJ 1998	PROJ 1999	PROJ 2000
<b>PRIMARY</b>	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
7 yrs POP	4728	4514	4317	4094	3914	3714	3484	3240	4091	3929	3741	3518	3270	4043	3878	3687	3451	3187	3992	3864	3728
81/7 yrs	2.11	1.97	1.88	1.85	2.03	1.86	1.60	1.48	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
81	9943	8687	8128	7539	7932	6685	5578	4534	4909	4715	4489	4222	3924	4852	4454	4424	4141	3824	4790	4439	4442
82/81	0.67	0.71	0.70	0.72	0.64	0.70	0.73	0.80	0.85	0.90	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
82	6490	6310	5712	5411	5244	4680	4183	3429	4173	4243	4245	4811	3728	4609	4421	4203	3934	3433	4531	4407	4239
83/82	0.94	0.89	0.91	0.92	0.94	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
83	6282	5400	5194	4958	4932	4305	3849	3338	3839	3904	4052	3810	3541	4379	4200	3993	3737	3432	4323	4187	4027
84/83	0.80	0.93	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
84	5024	5222	4750	4487	4511	3875	3444	3005	3453	3513	3849	3419	3344	4140	3990	3793	3351	3279	4107	3978	3825
85/84	0.78	0.73	0.80	0.81	0.81	0.79	0.79	0.79	0.79	0.79	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
85	3911	3803	3808	3444	3470	3041	2734	2374	2730	2774	3434	3194	3952	3790	3404	3173	3115	3902	3779	3434	3434
86/85	0.60	0.01	0.08	0.11	0.14	0.20	0.40	0.60	0.80	0.90	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
86	0	54	294	412	580	612	1095	1424	2184	2498	3474	3247	3034	3734	3401	3424	3204	2939	3707	3390	3432
I GRADS	0.84	0.88	0.87	0.84	0.88	0.90	0.90	0.90	0.90	0.90	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
PRI GRADS	3271	3411	3574	3404	3385	3304	2427	2231	2511	2803	3300	3103	2885	3544	3421	3252	3044	2811	3521	3410	3280
EN. PRI.	31874	29874	27886	24471	24871	23218	20904	18304	21289	21449	23785	22347	20790	24454	23441	21941	20242	25380	24579	23438	23438
7-11 POP	25784	24700	23408	22517	21445	20424	21343	18333	18343	18382	18381	18409	18441	18425	18378	18299	18230	18151	18129	18119	18128
7-12 POP	31457	30251	28978	27475	24389	25121	25822	22412	22403	22258	22072	21871	21654	22444	22271	22020	21725	21397	22125	21944	21797
EMP/7-11	1.24	1.21	1.18	1.18	1.25	1.14	0.98	1.00	1.14	1.18	1.29	1.21	1.13	1.40	1.34	1.28	1.20	1.12	1.40	1.34	1.30
EMP/7-12	1.01	0.99	0.94	0.94	1.02	0.92	0.81	0.81	0.95	0.97	1.08	1.02	0.94	1.14	1.11	1.04	1.01	0.95	1.15	1.12	1.08
<b>LOWER SECONDARY</b>																					
12yrs POP	5473	5351	5370	5158	4924	4697	4479	4279	4040	3874	3491	3442	3213	4039	3893	3721	3495	3244	3994	3847	3449
13yrs POP	5734	5470	5348	5347	5161	4928	4495	4477	4277	4042	3878	3489	3460	3212	4043	3894	3720	3494	3245	3998	3849
LS1/PORADS	0.92	0.80	0.75	0.80	0.82	0.82	0.84	0.84	0.88	0.90	0.90	0.90	0.90	0.92	0.94	0.94	0.94	0.94	0.94	0.98	0.98
LS1	3004	2719	2499	2723	2774	2711	2207	1919	2210	2523	2970	2793	2594	3210	3147	3057	2842	2499	3381	3342	3214
LS2/LS1	0.90	0.84	0.83	0.84	0.84	0.84	0.88	0.90	0.92	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
LS2	2701	2334	2239	2285	2387	2331	1942	1727	2033	2372	2821	2653	2444	3049	2990	2904	2718	2544	3212	3175	3053
LS3/LS2	0.85	0.92	0.84	0.83	0.84	0.84	0.88	0.90	0.92	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
LS3	2308	2154	1891	1902	2053	2005	1709	1554	1870	2229	2480	2521	2343	2897	2840	2759	2583	2434	3051	3014	2901
Z GRADS	0.10	0.95	0.92	0.84	0.90	0.90	0.91	0.92	0.93	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
LS GRADS	227	2041	1741	1599	1848	1804	1553	1430	1739	2094	2544	2395	2224	2752	2498	2421	2453	2314	2898	2845	2754
LS. EN	8015	7207	6829	4910	7214	7047	5857	5200	6113	7124	8472	7947	7405	9154	8977	8721	8142	7498	9443	9533	9148
12-14 POP	17144	14953	14584	14071	15450	14791	14100	13429	12784	12193	11814	11008	10362	10711	11147	11643	11109	10459	10734	11090	11320
13-15 POP	17141	17137	16943	14577	14647	13435	14784	14092	13442	12789	12195	11609	11023	10359	10711	11150	11457	11105	10454	10734	11094
LSEN/12-14	0.47	0.43	0.41	0.43	0.47	0.48	0.42	0.39	0.48	0.58	0.73	0.72	0.71	0.85	0.81	0.75	0.73	0.74	0.90	0.84	0.80
LSEN/13-15	0.47	0.42	0.40	0.42	0.45	0.44	0.40	0.37	0.45	0.54	0.69	0.69	0.67	0.88	0.84	0.78	0.70	0.69	0.92	0.89	0.83
<b>UPPER SECONDARY</b>																					
15yrs POP	5470	5735	5727	5444	5542	5341	5163	4922	4490	4472	4272	4043	3874	3487	3457	3208	4043	3892	3714	3491	3243
16yrs POP	5438	5444	5728	5720	5454	5345	5357	5157	4914	4485	4444	4249	3870	3483	3454	3204	4039	3889	3714	3498	3498
US1/USGRADS	1.44	0.44	0.44	0.49	0.35	0.40	0.40	0.45	0.45	0.50	0.55	0.55	0.60	0.60	0.65	0.65	0.70	0.70	0.75	0.75	0.80
US1	372	888	795	784	647	722	442	443	781	1048	1401	1317	1335	1651	1754	1704	1717	1620	2174	2149	2205
US2/US1	4.02	0.48	0.95	0.93	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
US2	1494	427	757	734	614	684	591	611	744	995	1330	1251	1249	1549	1444	1419	1432	1539	2043	2042	2094
US3/US2	0.09	0.33	0.17	0.50	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
US3	132	141	131	344	584	451	541	581	704	944	1244	1189	1205	1490	1583	1538	1550	1442	1942	1940	1990
I GRADS	1.02	1.00	1.22	1.42	0.42	0.48	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
US GRADS	134	141	140	521	344	314	477	494	480	804	1074	1010	1024	1345	1307	1317	1243	1448	1449	1491	1491
US. EN	2000	1454	1483	1884	1845	2059	1774	1834	2233	2989	3995	3757	3809	4710	5003	4840	4899	4620	4201	4130	4288
G. USEN/USEN	0.83	0.84	0.84	0.81	0.80	0.75	0.70	0.64	0.60	0.55	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
G. US. EN	1440	1220	1444	1534	1474	1544	1242	1211	1340	1444	1997	1878	1905	2355	2501	2430	2449	2310	3100	3045	3144
USEN/USEN	0.17	0.14	0.14	0.19	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
V. US. ENR.	340	234	239	352	349	515	532	442	893	1345	1997	1878	1905	2355	2501	2430	2449	2310	3100	3045	3144
15-17 POP	14133	14830	17112	17104	14909	14533	14049	14530	14754	14044	13414	12774	12179	11591	11005	10340	10700	11135	11440	11089	10440
16-18 POP	14893	14112	14808	17089	14892	14524	14030	15410	14735	14514	13										

TABLE F.3: ESTIMATES OF TOTAL RECURRENT EXPENDITURE ON PRIMARY AND SECONDARY EDUCATION IN  
 GANSU PROVINCE  
 (Y millions AT 1983 PRICES)

LEVEL	1983 ( '000s)	SCENARIO I		SCENARIO II	
		1990	2000	1990	2000
PRIMARY					
MINBAN	61,604	61	101	46	0
GONGBAN + ENTERPRISE	64,587	53	89	139	313
SUB-TOTAL	126,191	114	190	185	313
LOWER SECONDARY	55,409	31	52	80	141
UPPER SECONDARY GENERAL	16,639	11	18	29	71
UPPER SECONDARY VOCATIONAL a/	8,373	6	10	73	163
PROGRAM SUB-TOTAL	206,612	162	270	367	688

a/ In this table secondary vocational is defined as all non-general secondary. It includes secondary normal, agriculture and vocational schools (under the Provincial Education Bureau) and specialized secondary schools.

TABLE F.4: TEACHER REQUIREMENTS FOR PRIMARY AND SECONDARY EDUCATION IN GANSU PROVINCE

LEVEL	1983 NO. OF TEACHERS	SCENARIO I				SCENARIO III			
		1990 NO. OF TEACHERS	1990 NO. OF NEW TEACHERS	2000 NO. OF TEACHERS	2000 NO. OF NEW TEACHERS	1990 NO. OF TEACHERS	1990 NO. OF NEW TEACHERS	2000 NO. OF TEACHERS	2000 NO. OF NEW TEACHERS
PRIMARY a/									
MINBAN	69,700	43,900	0	43,600	0	30,600	0	0	0
GONGBAN	48,400	29,200	0	29,100	0	71,500	19,300	101,500	2,900
SUB-TOTAL	118,100	73,100	0	72,700	0	102,100	19,300	101,500	2,900
LOWER SECONDARY	35,300	18,700	1,900	14,200	100	31,800	6,600	36,800	400
UPPER SECONDARY GENERAL	9,100	4,400	0	4,400	0	10,600	2,400	16,600	1,200
UPPER SECONDARY VOCATIONAL	3,100	2,000	0	2,000	0	19,200	7,200	30,200	2,300
PROGRAM TOTAL	165,600	98,200	1,900	93,300	100	163,700	35,500	185,100	6,800

a/ At primary level, high demand for new gongban teachers under Scenario II can be largely satisfied by qualified minban teachers.

TABLE F.5: ESTIMATES OF CAPITAL EXPENDITURE REQUIREMENTS FOR PRIMARY AND SECONDARY EDUCATION IN  
GANSU PROVINCE  
(Y millions AT 1983 PRICES) a/

LEVEL	1983 ( '000s)	SCENARIO I		SCENARIO II	
		1990	2000	1990	2000
PRIMARY	43,376	28	28	39	39
LOWER SECONDARY	11,323	6	6	14	15
UPPER SECONDARY GENERAL	2,880	2	2	4	6
UPPER SECONDARY VOCATIONAL	1,503	1	1	9	13
PROGRAM SUB-TOTAL	59,082	37	37	66	73

a/ Figures for 1983 include imputed costs of labor donated for education capital construction, and expenditure by enterprises and self-accumulated funds. Figures for future years are estimates of annualized requirements for expenditure on capital construction for classrooms and other facilities, and for furniture and equipment.

TABLE F.6: ESTIMATES OF PUBLIC CAPITAL EXPENDITURE FOR EDUCATION IN  
GANSU PROVINCE BY SOURCE OF INPUT (Y'000s AT 1983 PRICES) a/

LEVEL	SCENARIO I			SCENARIO II	
	1983	1990	2000	1990	2000
PRIMARY b/	11,540	7,400	7,300	10,400	10,300
LOWER SECONDARY b/	3,010	1,500	1,500	4,000	4,000
UPPER SECONDARY GENERAL c/	1,500	800	800	2,000	3,000
UPPER SECONDARY VOCATIONAL d/	740	400	400	4,200	7,000
PROGRAM SUB-TOTAL	16,790	10,100	10,000	20,600	24,300
OTHER e/	23,210	13,600	13,600	27,800	32,800
TOTAL PUBLIC CAPITAL EXPENDITURE ON EDUCATION	40,000	23,700	23,600	48,400	57,100

a/ Figures for 1983 are actual expenditure, not including expenditure by enterprises, estimated value of labor donated, or self-accumulated funds. Figures for future years are estimates of annualized total public expenditure on capital construction for classrooms and other facilities and for furniture and equipment obtained by adjusting the total annualized requirements of Table F.5 based on information provided by the Provincial Education Bureau.

b/ Estimates are made from total annualized capital expenditure requirements, less 5% enterprise share, less 60% value of labor devoted, less 30% for self-accumulated funds.

c/ Estimates are made from total annualized capital expenditure requirements, less 5% enterprise share less 45% for self-accumulated funds.

d/ Estimates are made from total annualized capital expenditure requirements, less 10% enterprise share, less 45% for self-accumulated funds.

e/ The category "other" public capital expenditure on education is actual expenditure for 1983 on higher education and other education, including pre-school, special education and adult education. For future years, it is estimated as 135% of the program subtotal.

TABLE F.7: ESTIMATES OF CAPITAL EXPENDITURE REQUIREMENTS FOR PRIMARY AND SECONDARY EDUCATION IN GANSU PROVINCE BY SOURCE OF RESOURCES INPUT (Y'000s AT 1983 PRICES) a/

LEVEL	1983	SCENARIO I		SCENARIO II	
		1990	2000	1990	2000
<b>PRIMARY</b>					
Public	11,540	7,400	7,300	10,400	10,300
Enterprise	2,169	1,400	1,400	1,950	1,940
Other b/	29,667	19,100	19,000	26,630	26,500
Sub-total	43,376	27,900	27,700	38,980	38,740
<b>LOWER SECONDARY</b>					
Public	3,010	1,500	1,500	4,000	4,000
Enterprise	566	300	300	690	750
Other	7,747	4,000	4,000	9,190	10,270
Sub-total	11,323	5,800	5,800	13,880	15,020
<b>UPPER SECONDARY GENERAL</b>					
Public	1,500	800	800	2,000	3,000
Enterprise	144	80	80	190	300
Other	1,236	680	670	1,560	2,610
Sub-total	2,880	1,560	1,550	3,750	5,910
<b>UPPER SECONDARY VOCATIONAL</b>					
Public	740	400	400	4,200	7,000
Enterprise	613	40	40	430	670
Other	150	440	440	3,900	5,800
Sub-total	1,503	880	880	8,530	13,470
<b>PROGRAM SUB-TOTAL</b>					
Public	16,790	10,100	10,000	20,600	24,300
Enterprise	3,492	1,820	1,820	3,260	3,660
Other	38,800	24,220	24,110	41,280	45,180
TOTAL	59,082	36,140	35,930	65,140	73,140

a/ Figures for 1983 are actual expenditure plus estimated value of labor donated.

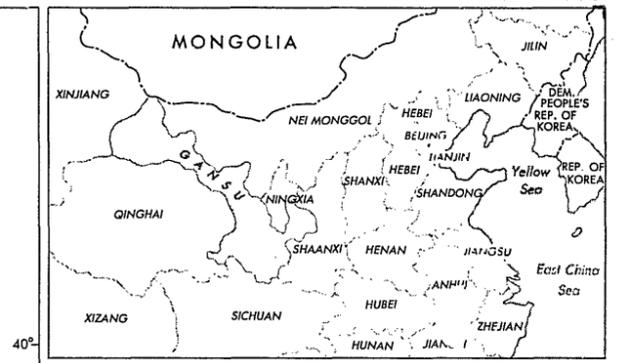
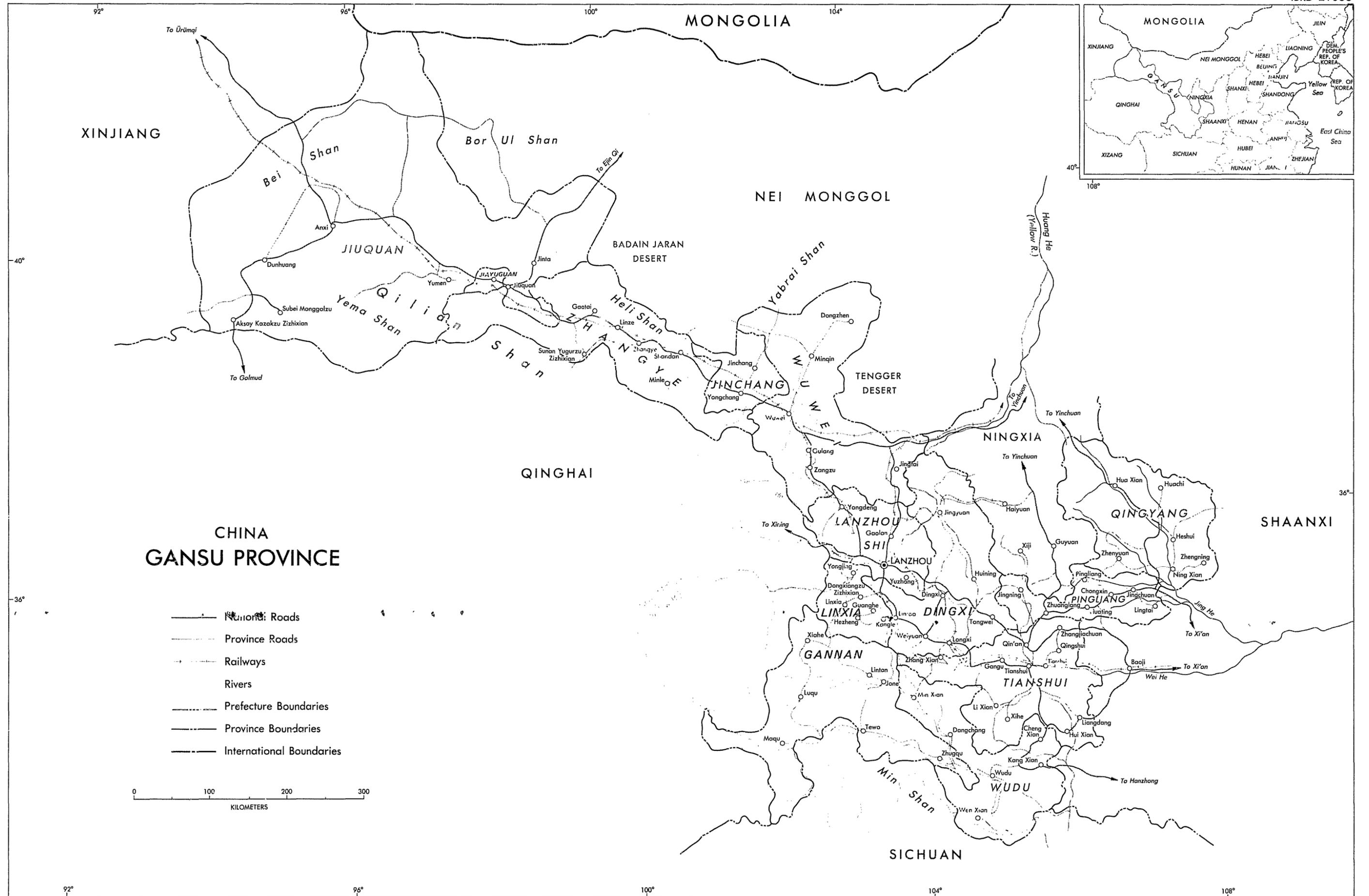
Figures for future years are estimates of annualized requirements for expenditure on capital construction, furniture and equipment.

b/ "Other" refers to estimated costs of labor donated for capital construction and self-accumulated funds (donations, village level contributions, income from sale of goods and services) used for capital construction and furniture and equipment.

TABLE F.8: ESTIMATES OF TOTAL RECURRENT EXPENDITURE ON PRIMARY AND SECONDARY EDUCATION IN GANSU PROVINCE BY SOURCE OF FINANCE (Y millions AT 1983 PRICES)

LEVEL	1983 ('000s)	SCENARIO I		SCENARIO II	
		1990	2000	1990	2000
<b>PRIMARY</b>					
Public	86,865	82	137	153	298
Enterprise	4,343	4	7	8	15
Other a/	34,983	28	46	21	0
Sub-total	126,191	114	190	182	313
<b>LOWER SECONDARY</b>					
Public	52,770	30	50	76	134
Enterprise	2,639	1	2	4	7
Other	0	0	0	0	0
Sub-total	55,409	31	52	80	141
<b>UPPER SECONDARY GENERAL</b>					
Public	15,847	10	17	27	68
Enterprise	792	1	1	1	3
Other	0	0	0	0	0
Sub-total	16,639	11	18	28	71
<b>UPPER SECONDARY VOCATIONAL</b>					
Public	7,612	6	9	66	149
Enterprise	761	1	1	7	15
Other	0	0	0	0	0
Sub-total	8,373	7	10	73	164
<b>PROGRAM SUB-TOTAL</b>					
Public	163,094	128	212	323	649
Enterprise	8,535	7	11	19	40
Other	34,983	28	46	21	0
<b>TOTAL</b>	206,612	163	269	364	689

a/ "Other" source of expenditure refers to estimated value of resources provided collectively by villages and townships for support of minban teachers and other recurrent expenditures in the operation of schools in rural areas.



## The World Bank

### Headquarters

1818 H Street, N.W.  
Washington, D.C. 20433, U.S.A.

Telephone: (202) 477-1234

Telex: WUI 64145 WORLDBANK

RCA 248423 WORLDBK

Cable Address: INTBAFRAD

WASHINGTONDC

### European Office

66, avenue d'Iéna  
75116 Paris, France

Telephone: (1) 47.23.54.21

Telex: 842-620628

### Tokyo Office

Kokusai Building  
1-1 Marunouchi 3-chome  
Chiyoda-ku, Tokyo 100, Japan

Telephone: (03) 214-5001

Telex: 781-26838

