MADIA DISCUSSION PAPER 10

THE RURAL ROAD QUESTION AND NIGERIA'S AGRICULTURAL DEVELOPMENT

JUAN GAVIRIA · VISHVA BINDLISH · UMA LELE

MANAGING AGRICULTURAL DEVELOPMENT IN AFRICA

FOREWORD

The MADIA study and the papers comprising this MADIA Discussion Paper Series are important both for their content and the process of diagnosis and analysis that was used in the conduct of the study. The MADIA research project has been consultative, nonideological, and based on the collection and analysis of a substantial amount of concrete information on specific topics to draw policy lessons; it represents a unique blend of country-oriented analysis with a cross-country perspective. The conclusions of the studies emphasize the fundamental importance of a sound macroeconomic environment for ensuring the broad-based development of agriculture, and at the same time stress the need for achieving several difficult balances: among macroeconomic, sectoral, and location-specific factors that determine the growth of agricultural output; between the development of food and export crops; and between the immediate impact and long-run development of human and institutional capital. The papers also highlight the complementarity of and the need to maintain a balance between the private and public sectors; and further the need to recognize that both price and nonprice incentives are critical to achieving sustainable growth in output.

The findings of the MADIA study presented in the papers were discussed at a symposium of senior African and donor policymakers and analysts funded by USAID in June 1989 at Annapolis, Maryland. The participants recommended that donors and African governments should move expeditiously to implement many of the study's valuable lessons. The symposium also concluded that the process used in carrying out the MADIA study must continue if a stronger, more effective consensus among donors and governments is to be achieved on the ways to proceed in resuming broad-based growth in African agriculture. The World Bank is committed to assisting African countries in developing long-term strategies of agricultural development and in translating the MADIA findings into the Bank's operational programs.

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THE WORLD BANK
WASHINGTON, D.C.

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Contents

Abbreviations

ADF	Agricultural Development Fund
ADPs	Agricultural Development Projects
ADT	Average Daily Traffic
BSADP	Bauchi State Agricultural Development Project
DFRRI	Directorate of Food, Roads and Rural Infrastructure
FACU	Federal Agricultural Coordinating Unit
FHD	Federal Highway Department
km2	square kilometers
kms.	kilometers
KNARDA	Kano Agricultural Rural Development Authority
LGAs	Local Government Authorities
LGCs	Local Government Councils
MOW	Ministry of Works
MSADP	Multi-state Agricultural Development Project
N	Naira
NDE	National Directorate of Employment
N'000	Thousands of Nairas
PCRs	Project Completion Reports
PPARs	Project Performance Audit Reports
PPWP	Pilot Public Works Programme UNDP/ILO
SAR	Staff Appraisal Report
SARDA	Sokoto Agricultural Rural Development Authority
SFRP	Cameroon Second Feeder Roads Project
sq.	square
vpd	vehicles per day

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Introduction

The Government of Nigeria and the World Bank have long noted the poor condition and lack of all-weather roads in rural areas. Nigeria's Fourth National Plan (1981-85), for example, pointed out that one of the critical problems of Nigeria's agricultural sector is the inadequate or nonexistent supporting physical infrastructure such as rural roads, storage and marketing facilities, and water supply. In response, the government and the World Bank have dedicated large portions of rural investments to road construction and rehabilitation. Between 1976 and 1987, the Agricultural Development Projects (ADPs) constructed or rehabilitated 9,300 kilometers of rural roads, at the cost of approximately 300 million Naira.[1] While most projects have either fulfilled or exceeded the appraisal targets of road kilometers to rehabilitate, the maintenance achievements have fallen short of targets in all projects. Rapid road deterioration has decreased expected project benefits.

Construction and rehabilitation of *rural* roads is now undertaken in three ways: (1) by the Directorate of Food, Roads, and Rural Infrastructure (DFRRI) in the president's office which emphasizes new road construction, (2) by the second and third multistate ADPs (legally constituted as state level entities, financed by state and federal governments, and supervised by federal level units),[2] which have shifted emphasis from new construction, typical of earlier enclave and statewide projects, to rehabilitation and maintenance of existing roads, and (3) a few self-help projects initiated by local communities.[3] The establishment of the DFRRI at such a high level points to the fact that the lack of rural roads is seen as a very important constraint to agriculture and the response of the government is expected to have a positive impact on rural life. The lack of roads is so acute that the road construction output of the ADPs has been in many cases the single most appreciated result by the affected communities.[4]

This paper shows that insufficient work has been done to evaluate the indirect benefits of such investments (including but not limited to multiplier effects, increased marketed surplus, availability of inputs, and market integration) which have long been recognized to be of great importance. The recognition of such indirect benefits can be used in future rural road planning to address each region's economic potential, and each region's demand for and future growth of agricultural production.

The *maintenance* of both ADP and non-ADP rural roads is so poor generally that the problem of inadequate infrastructure remains. Until recently, for example, no ADP had succeeded in involving a single Local Government Authority (LGA) in maintenance of roads. This is due to the continual disregard of the need to build effective maintenance capacity at the LGA and state level governments. Indeed Lele et al. (1989) show that much of the institutional capacity built by the Bank has been at the federal level, and outside the existing governmental structures. Capacity at the state and local government levels continues to be very weak.

Since 1986 the federal government has allocated substantial amounts for *construction and rehabilitation* of rural roads. However, the very poor achievements of the state directorates of DFRRI have not matched expectations and have prompted major criticisms. This paper concludes by stressing the urgent need to search for effective mechanisms including reform, technical assistance, and coordination of federal directorates (DFRRI and NDE), state entities (including the rural road capacity of ADPs), and local government institutions (ultimately responsible for the administration of rural roads), to build institutional capacity at all levels but particularly in LGAs.

The paper comprises a discussion of the extent of the rural roads network and the consequences of its growth on Nigerian agriculture during the 1970 to 1988 period. Following, a review of the experience of construction and maintenance of rural roads in Bank projects is presented. Further, an assessment is made of future needs for rehabilitation and maintenance of the network, with calculations regarding the resources necessary to develop such a network. Finally, institutional aspects, sustainability, and reform are considered.

Rural Road Infrastructure in a Regional Context

The Role of Rural Transport[5]

The great importance attached to feeder roads by the Government of Nigeria is reflected in the establishment in 1986 of the Directorate of Food, Roads, and Rural Infrastructure (DFRRI) in the president's office. The budget allocations and actual expenditures for the directorate since 1986 have been substantial. As Table 1 shows, expenditures have exceeded 10 percent of all capital expenditures net of foreign financing.[6] As well-intentioned as the program is, the lasting effect of the DFRRI and the ADP approach to addressing the problem should be examined.

Table 1
Directorate of Food, Roads, and Rural Infrastructure Budget as a Percent of Nigeria's Capital Expenditures Net of Foreign Financing

	1986	1987	1988
Budget Allocation	10.2	18.0	9.5
Budget Outcome	11.2	10.8	NA

Source: EIU 1988; World Bank 1988a.

The Economic Context of Rural Transport

Basic transport infrastructure and services are needed in order to guarantee adequate freight transport of agricultural inputs and outputs and nonagricultural consumption goods. They are also essential to increase personal mobility of rural households (including that of agents who affect the information and incentives available to these households) and attract investments to rural areas (for agricultural and nonagricultural activities). All increase their demands for transport as economic development takes place.

As in most of Sub-Saharan Africa, Nigeria's public investments in rural transport have concentrated on improving road infrastructure, mainly highways and not feeder roads. Few projects have attempted approaches that focus on increasing the availability of adequate means of transport or improving the efficiency of institutions.[7] At present, efforts in rural areas focus on the rehabilitation and maintenance of existing rural road networks. These improvements are expected to reduce transport costs which will modify the relative returns to labor and land, and therefore affect the demand and supply of agricultural products and consumer goods.

In Nigeria as elsewhere, rural road improvements have long been associated with improvements in productivity, increased communication and administrative control, and an enhancement of rural life (Ogundana 1973). Numerous inquiries in other countries have also recurrently documented, among others, the following effects: increase in specialization (Mitchell 1977),[8] increase in trading activities (Moerman 1968),[9] promotion of migratory movements (Airey 1980; Hegen 1966; Okada 1978),[10] improved market operation (Lele 1968), and promotion of the development of towns and urban areas maintained with surplus from the rural areas (Blaikie 1977; Carnemark 1979).[11] (See Rural Road Benefits review—Annex I.)

In this line, ex-post studies in various countries have demonstrated the following:

1. Infrastructure affects agricultural production through prices, diffusion of technology, and the use of inputs (Ahmed and Hossain 1988; Anderson 1982; Binswanger 1989; Richards 1984).
2. The degree of commercialization of agriculture measured as the ratio of marketed agricultural output to total agricultural output is inversely related to transport costs to and from regional centers, other things remaining constant (Airey 1980).
3. Agricultural supply of cash crops responds positively to a reduction in transportation costs as the net producer price increases, other things remaining constant (Carnemark 1984).
4. Agricultural supply increases are larger in areas with a timely supply of agricultural inputs and credit available, other things remaining constant.
5. With unequal land distribution, most benefits are accrued by larger farmers who are able to increase production according to the new modified relative prices of factors of production, which result from changes in transport costs. Further inequality in asset distribution will occur but lowest income groups might have greater employment opportunities if production is increased, other things remaining constant (Narayana et al. 1988).
6. Infrastructural development improves access to institutional credit and contributes positively to shift the allocation of credit from nonproductive to productive activities and increases demand for credit in nonagricultural activities (Ahmed and Hossain 1988; Binswanger 1989).
7. Interregional transport subsidies (e.g., panterritorial pricing of agricultural products) results in increases in agricultural supply in distant areas, taxing areas which are closer to the regional markets, and subsidizing distant ones (which might have lower costs than transporting food to them)(Ndulu 1979).

The Evaluation of Benefits

How to evaluate the benefits listed above in practice and how to let these influence the choice of investments has been an important problem. For instance, the evaluation of rural road benefits has been a major cause of concern and inquiry in the World Bank. Following the Bank's advice, rural roads in many countries have been prescreened using social and political factors, with the *final* selection made on the basis of economic criteria (Beenhakker 1983). In this line, most ex-ante evaluations of Bank road projects in recent years have been done at the micro level with an appraisal of consumer or producer surplus, or a combination of both.[12]

In the first case, producer surplus is estimated as a function of expected increases in production. This method

is used in evaluations of low volume traffic roads (below 100 vehicles per day) when most benefits are expected to be in the form of increased output and increased access to the transportation system. Second, the consumer surplus method quantifies savings in user costs in the form of reduced vehicle operating costs, a method used in particular for roads with traffic volumes over 100 vehicles per day.

These two methods, however, do not capture the indirect nature of most benefits described in the previous section. This is in part due to the limitations of the methods, and also because "in practice, the data required to carry out the evaluation would probably require more man-days than that required to build the roads themselves" (Edmonds 1983).

In the early ADPs, no rigorous ex-ante evaluation of roads took place. A recent supervision states, for example, that:

> ...none of the northern ADPs [statewide ADPs] employs any system for appraisal of road investment. Road programs generally are compiled from agricultural and LGA [Local Government Area] recommendations with little or no estimation of financial benefit or ranking.[13]

For the recent multistate ADPs, however, a road selection exercise required by the Bank for each ADP has been carried out, with assistance from the Federal Agricultural Coordinating Unit (FACU) and with a combination of both consumer and producer surplus methods. The cost-benefit analysis employed by FACU quantifies a stream of costs that includes rehabilitation costs, construction costs, increases in extension service costs,[14] and increases in commercial service costs.[15] The stream of benefits include vehicle operating cost savings for nonagricultural traffic, benefits to farmers from producer surplus, and benefits to truckers from reduced transport cost for the incremental crop production and fertilizer tonnage. The ranking of roads is done by net present value (with 12 percent discount rate) and with benefit cost ratios. For the two latest multistate ADPs (MSADPs) the Bank has required that economic rates of return be calculated, and that only those roads with an economic rate of return (ERR) above 15 percent be accepted.

A simplified and uniform procedure was developed by FACU using a simple spreadsheet. However, its use has only slightly improved the actual selection process over previous ADPs in the first MSADP. A recent evaluation states, for example, that:

> In [the first] MSADP states, FACU has introduced a formal appraisal system which is ineffective, incorporating empirical assumptions and insufficient factual data.[16]

The ubiquitous use of assumptions in the calculation of benefits has made the whole exercise trivial. For example, in absence of adequate traffic counts, the exercise uses a fixed traffic generation rate of one vehicle per 750 families in the area of influence. Furthermore, incremental production is estimated using fixed crop elasticities equal for all regions. No changes in farm gate prices are used in the evaluations, even though as the Lafia and Ayangba Project Completion Report (PCR) suggested, producers received higher prices after the roads were improved. Finally, the benefits to transporters are calculated as the margin obtained over incremental crop output, fixing the margins at 30 percent for every crop in all regions.

The ex-ante exercises were supposed to be refined over time. This has not happened in part because the ex-post evaluations have been very deficient. After completion of the ADPs most reports have evaluated program success by the number of kilometers rehabilitated and the average costs per kilometer, and have not considered indirect effects. Regardless of who conducts the exercise, the ex-post evaluation should be complete since it sets a precedence by which future road projects can improve the selection of investments.

The evaluation of the road component in the ADPs has been a source of debate between the Bank and the Nigerian government.[17] In a 1985 letter, the Head of FACU addressed the methodology used by the Bank to compute economic rates of return for the ADPs, noting that "...the infrastructure programme can support itself in terms of financial and economic costs and benefits (through producer surplus, road user cost savings and secondary multiplier effects in processing and marketing). The infrastructure programme could therefore be left to stand on its own and therefore be excluded from the overall cost-benefit analysis."

Lele has argued elsewhere that there is a need for greater coordination between the development of agricultural potential and that of rural road infrastructure. The absence of such coordination in many instances results from a lack of appreciation of the fundamental importance of rural roads in the early stages of agricultural development, including that:

- many of the benefits of rural roads tend to be indirect (resulting from multiplier effects) and are difficult to quantify, although there are frequently substantial direct benefits;
- there is relatively little recognition of the importance of feeder roads for *developing* markets. There is a strong (albeit undocumented) general belief either that markets in developing countries are already competitive or that if they are not, that infrastructure does not affect mobility, information, or entry of actors into trading, fundamentally;
- given the centralized nature of developing country governments, employment possibilities provided in agricultural services by central or state governments have greater political payoff, and are therefore more appealing than the maintenance and construction of roads by local governments (Lele 1987);
- the emphasis has been on the provision of roads only (rather than on provision of means of transport and institutional development); while road links do enhance the accessibility of locations, they do not guarantee personal accessibility and therefore fall short of the full realization of an investment's benefits (Ikporukpo 1987).

For example, the Project Performance Audit Report (PPAR) for Gusau, Funtua, and Gombe ADPs points to evidence that "road and dam construction had considerable benefits beyond their contribution to production. Many previously-remote villages were made accessible, with the result that consumer prices were reduced and new transport businesses sprung up. Increased use of fertilizer and other inputs has come about as a result of their increased availability, made possible by the network of feeder roads established by the project." The PPAR for Lafia and Ayangba also establishes the importance of

indirect benefits of feeder roads, especially in terms of leading to higher producer prices and incentives. This evidence is in line with that provided for other countries in the earlier section.[18]

The difficulties encountered in the process of quantifying such indirect benefits as well as the deficient maintenance of ADP roads after project completion has prevented more Bank projects from focusing on the development of rural transport in Nigeria. The Bank's transportation department has not been engaged in any significant feeder road development, and has concentrated only on the main roads. Between 1960 and 1988 the Bank committed eight loans amounting to US$470 million for the highway sector. In contrast, rural road development has largely been relegated to the Bank's agricultural staff, which have allocated approximately US$380 million for the rural road components of ADPs in sixteen states.[19]

Regional Context

The bulk of rural transport in Nigeria is carried by motorized vehicles on rural roads, with the possible exception of the Southern Coast and the Niger Delta where river transport replaces roads. In all instances, when products are transported from the farm to the road or nearest markets, human porterage is common practice on foot paths and roads. The use of draught animals is only significant in some portions of the Middle Belt and Northern states.

The importance of rural roads in every region is affected by the region's ability to produce and consume, as well as by the size and distribution of its towns and cities under a regional competitive environment. This regional context has been broadly examined in Lele et al. (1989), which points out three salient features of agriculture as it relates to demand for rural roads. First, the size of the urban sector and overall population densities in the Southern states are much larger than those in the Middle Belt or Northern states (see Table 2). Even the densities of rural populations, which we do not have numbers for, but which are affected directly by feeder roads, are likely to be much higher in the South, despite its higher degree of urbanization.

Second, existing data suggests that, except for Borno and Kano, the Northern states have food surpluses, while the Middle Belt and the South, except for Benue, Plateau, and Bendel, seem to incur deficits. Third, the Middle Belt states have the lowest population densities per hectare of arable land compared to the rest of the country, and have a large potential for area expansion. But Middle Belt states have much higher rural road densities (per hectare and per capita) than the North. The lower level of rural road densities in the North—in terms of kilometers of rural roads per capita and also per square kilometer as Table 3 shows—has important implications. It is by far the largest producer of food among the three regions with high rural population densities, second only to those in the Southern region.

Assessment of Existing Rural Road Densities

The actual length of *all-weather* rural roads is difficult to obtain accurately given that rural roads can be washed away during the first rainy season if no proper maintenance is executed. With this in mind, two types of statistics are presented: (1) total existing rural roads regardless of condition, and (2) usable or all-weather rural roads. The latter is a better indicator of infrastructure available all-year round but is rarely available. The importance of all-weather roads is particularly relevant in the southern rain forest zone where it rains much of the year.

The current density of rural roads in Nigeria, including all-weather and others, is almost equal to that of India in 1951, at a time when India had the same population density that Nigeria has at present (see Table 2). The density in Nigeria of total feeder roads in 1980 amounted to 83 meters per square kilometer compared to 80 meters in India in

Table 2
Comparative Road Indicators
Countries with Population Densities Similar to Those of Nigeria in 1985

				Rural Roads		
					Densities	
Developing Country	Population Density (persons per sq.km.)	Total Road Network (km)	Main and Secondary Network (km)	Rural Road Network (km)[a]	Length (meters/ sq.km.)	Meters per U$ of GNP (mt./GNP)
Low-Income						
Nepal	120	4,700	3,096	1,604	11	0.63
China	110	915,100	254,300	660,800	69	2.09
Pakistan	123	107,673	38,830	68,843	87	1.98
India (1950)	109	399,942	137,108	262,834	80	4.81
Lower-Middle Income						
Nigeria	106	128,174	53,209	74,965	83	1.13
Thailand	102	150,000	44,534	105,466	205	2.47
Upper-Middle Income						
Hungary	108	138,185	24,000	114,185	1227	5.33
Portugal	109	52,031	19,031	33,000	358	1.44
Yugoslavia	90	130,000	48,880	81,120	317	1.51
Rumania	96	73,500	14,700	58,800	247	NA

Notes:
[a] Includes all rural roads, regardless of state, accounted for in national books.

Sources: Derkota 1980; Kingdom of Thailand 1980; Nairn 1981; Government of India 1981; Idachaba 1981; World Bank 1985.

1951. Among all countries with similar population densities, rural road densities in Nigeria contrast favorably only with countries that have lower incomes per capita, and with India in 1950 only if total road lengths are considered. The danger with international comparisons is that road lengths have to be related to the proportion of total roads maintained regularly (all-weather). Nigeria and India (1950), for example, had the same road densities, however, the proportion of all-weather roads in India (1950) was at least 6 times that of Nigeria.[20] In any case, even counting all roads, the rural road density in Nigeria is by far lower than that in Thailand or other upper-middle income countries. If one compares the meters of rural road per dollar of GNP, the figures for Nigeria and Nepal are lowest among these countries with similar population densities.

The poor condition of the feeder road system in Nigeria was emphasized in the 1980 report of the joint Government of Nigeria—World Bank food strategy mission. The report noted that "whilst the country's primary and secondary roads are being gradually improved to acceptable standards, the feeder road system has suffered from years of neglect and represents the most serious constraint to agricultural development in Nigeria today" (Idachaba 1980).

A survey of roads conducted in several states found that in most cases the existing all-weather network was 10 percent of the Local Government Area (LGA) road network presented in Table 3 (Idachaba 1980).[21] Taking into consideration improvements made by the ADPs and for the purposes of this paper, the existing all-weather network is calculated as the sum of the kilometers of road rehabilitated and maintained as part of the ADPs until 1985 for each state (enclave plus statewide ADPs), and one-tenth of the remaining network. This gives an all-weather rural road density of 19 meters per square kilometer, which means that as much as 77 percent of the roads are difficult to negotiate during the rainy season (see Table 4). As a proportion of rural roads, the Northern states are found to have 50 percent all-weather roads, while in the Southern states only 13 percent of roads are all-weather. Suffice it to say that this is an undesirable situation, especially given that it rains from 8-12 months of the year in the Southern region and parts of the Middle Belt. Densities of all-weather rural roads even in the South, where they are highest, remain at very low levels compared, for example, with the average for India in 1950 of 72 kilometers of road per square kilometer (calculated as 90 percent of the density reported in Table 2).

Table 3
Main Road and Feeder Road Densities in Nigeria 1985

	Total Land (sq-km) (1)	Estimated Population ('000) (2)	Roads: Federal and State Length (km) (3)	Roads: Federal and State Density (m/km2) (4)	Roads: Total LGA Roads[a] (km) (5)	LGA Road Densities with respect to Area (m/km2) (6)	LGA Road Densities with respect to Total Population (m/person) (7)
Northern States							
Bauchi	65,500	4,176	2,255	34	3,939	60	0.9
Borno[b]	119,100	5,149	4,049	34	900	8	0.2
Kaduna	69,400	7,039	2,933	42	1,818	26	0.3
Kano	43,700	9,945	2,818	64	3,989	91	0.4
Sokoto	92,000	7,796	3,315	36	3,084	34	0.4
Subtotal	389,700	34,105	15,370	39	13,729	35	0.4
Middle States							
Benue[b]	45,500	4,169	2,612	57	3,685	81	0.9
Gongola[b]	94,500	4,475	3,925	42	3,236	34	0.7
Kwara[b]	60,100	2,945	3,019	50	2,972	49	1.0
Niger[b]	67,300	2,052	2,360	35	7,160	106	3.5
Plateau	55,300	3,481	3,991	72	3,497	63	1.0
Subtotal	322,700	17,122	15,907	49	20,550	64	1.2
Southern States							
Anambra	17,100	6,178	2,287	134	811	47	0.1
Bendel	38,900	4,228	4,812	124	7,079	182	1.7
Cross-River	27,200	5,974	4,128	152	6,504	239	1.1
Imo	11,500	6,309	2,079	181	2,562	223	0.4
Rivers	17,700	2,954	1,058	60	4,000	226	1.4
Lagos	3,510	2,956	630	179	1,723	491	0.6
Ogun	17,200	2,663	1,181	69	6,438	374	2.4
Ondo	20,000	4,689	3,644	182	3,747	187	0.8
Oyo	36,900	8,947	2,113	57	7,821	212	0.9
Subtotal	190,010	44,898	21,932	115	40,685	214	0.9
Total	902,410	96,125	53,209	59	74,965	83	0.8

Notes:
[a]Includes all Local Government Area LGA Roads.
[b]In this case LGA road length from 1985 survey for second MSADP. Sources: (1) Rural Infrastructure Project Field Survey; (3),(4), and (5) Idachaba 1980.

Table 4
All-Weather Rural Roads in Nigeria 1985 (Km)

Region	Ten-percent of LGA	ADP Road Construction and Rehabilitation	All-Weather Total	Meters per square km
Northern States	1,400	5,622	7,022	18
Middle Belt States	2,050	3,026	5,076	16
Southern States	4,060	817	4,877	26
Total	7,510	9,465	16,975	19

Rural Roads, Population Densities, and Land Availability

Higher rural road densities (all-weather and total rural roads) in the Southern region are consistent with the high population densities in this region. As for the Middle Belt and the Northern region, their relative ordering in terms of rural road densities is inconsistent with their population densities with respect to total rural roads, and consistent only with all-weather road densities. Whereas the population density in the Northern region is over 50 percent higher than in the Middle Belt, the road density is higher in the Middle Belt by roughly the same margin. This further attests to the low level of social and infrastructural development in the Northern region relative to the other two regions, which was noted by Lele et al. (1989).

Evaluations of rural transport improvements in the future could be improved by taking into consideration the factors affecting the prospects for growth in production and consumption.[22] In the Southern region, for example, population densities are already very high, the poorer quality of the soils offers fewer technological solutions, and the region is expected to account for less than 10 percent of the area cultivated. These factors might point to the fact that future rural transport improvements in this region may consist mainly of rehabilitation and better maintenance practices. The large size of markets and heavy traffic in the region mean that maintenance operations should be very cost efficient in order to support future developments of agricultural marketing. Evaluations may emphasize the effects of better access and information, lower transport costs, and efficient maintenance arrangements in a region where rural consumption will grow fastest.

As Lele et al. (1989, chapter 3) point out, the scope for area expansion in Nigeria is largely confined to the Middle Belt states, and to a lesser extent to the Northern states. Also, there is a general consensus that soil fertility in the Middle Belt and Northern states can be maintained on the basis of organic and inorganic measures. This is because of the nature of the environment. High rainfall in the South detracts from the use of organic fertilizer. The maintenance of soil fertility requires vegetable cover; therefore the Middle Belt and Northern regions may become the main sources of increased agricultural production in the future, in order to meet growing demands in the Southern states which have a large food deficit.

In order to cope with this growth, the Northern states (which have almost the same all-weather road densities but lower total road densities than the Middle Belt) may concentrate on rehabilitation and moderate extensions of the network, to a different extent determined by the network in each state.[23] The Middle Belt, on the other hand, may have substantial increases in its rural road network along with continued maintenance of the existing inventory, if rural population densities increase substantially. However, there may be important constraints for population mobility in Nigeria including ethnic constraints, about which little is known through documents and studies.[24] In addition, given that both technological changes and area expansion are more promising in these two regions, future evaluation of roads should emphasize the analysis of projected conditions of production.

Rural Infrastructure and Market Integration

In his study of market integration in the Southern state of Ogun, Durohaiye (1988) finds that contrary to what is expected, the markets for cowpeas, gari, maize, and rice are integrated over space (Durojaiye and Aihonso 1988). The data used for twelve towns in the state only finds a nonintegrated market for yams, explaining most of the price variation between markets by commodity arbitrage (transport and storage).

However, an analysis using the same methodology based on data from the Kaduna State ADP in Lele et al. (1989) shows that in this Northern state, the markets over space for food crops[25] are not integrated, leaving wide margins explained by factors other than transport and commodity arbitrage. Another study with data from the first three Northern ADPs shows that markets were not integrated across space.[26] The above points to the fact that food crop markets in the North are not integrated. However, it cannot be said that the same is true for markets in other regions. Without attempting to generalize, the above leads one to state that the Northern states in particular lack the minimum infrastructure to improve the flow of price information, and the movement of goods and people, which ensure market development. Therefore, as stated earlier, there is still a need for network expansion in addition to rehabilitation of the existing roads.

Construction and Maintenance of Rural Road Infrastructure in Bank Projects in Nigeria

This section looks at how the questions of road construction and maintenance have been addressed in Bank projects, focusing primarily on rural road components of ADPs. It argues that while in the early projects the emphasis was placed on construction, the most recent projects are focusing mainly on rehabilitation and maintenance because experience has shown that the local authorities lack the capacity to carry out maintenance. Also the implementation of road construction and maintenance in the earlier ADPs by force account units did not strengthen the development of local implementation capacity, and hence, the more recent multistate ADPs have required the use of contractors "in general" for rehabilitation and maintenance that requires the use of mechanical equipment (i.e., rehabilitation, regravelling, and grading operations).

While this latter emphasis is essential, and therefore undisputable, it also reflects the lack of emphasis in the Bank to date on the broader and deeper administrative and financial issues at the LGA level in particular, which have a fundamental bearing not simply on maintenance, but on the expansion of the feeder network which is so critical for expansion of agricultural sector productivity in Nigeria.

The above problem has been accentuated by the division of responsibility for rural road projects within the Bank. The transport division has participated in eight highway-related projects, concerning federal and state roads, while the agricultural staff have included rural road components in all the ADP projects affecting Local Government Council (LGA) roads.

Experience with Main Road Network Projects

The *main* road network has been subject to a substantial improvement effort in the last 15 years. However, the unexpectedly high increase in traffic of about 30 percent per year,[27] as well as the high axle loads and light construction,[28] have led to rapid deterioration of portions of the main network. The rehabilitation and strengthening of the federal network has thus been the focus of the latest Bank loans to the highway sector. Early road projects had important force account components particularly for maintenance. In the most recent projects, construction and maintenance was done by contract. In these instances, routine maintenance was not performed well by contractors and the present Highway Sector Loan is including a study comparing routine maintenance by contract and force account.

> In general, the physical construction components of projects have been completed satisfactorily, although often behind schedule. Institution building components have been less successful. The major problem encountered... was the recruitment of experts to help develop the Federal Highway Department (FHD) ..., which under the proposed Program will be supplied mostly through local consulting firms (World Bank 1988b).

Since the main road network handles large volumes of traffic, the evaluation of benefits is carried out based only on savings in vehicle operating and maintenance costs, rather than with producer surplus methods which are appropriate for low volume roads.

Institutional Arrangements for Feeder Roads

In addition to the ADPs financed by the federal and state governments, and the World Bank, there are three institutions involved directly in the provision and maintenance of feeder roads in Nigeria, the LGAs (10 to 25 in each state), DFRRI, and the National Directorate for Employment (NDE). Both directorates— NDE and DFRRI—were created in 1986 as special task forces by the Office of the President, and have until recently acted on different fronts. The State Ministry of Works and Transport (MOW) also occasionally leases equipment to the LGAs for emergency repair work.

The different levels of intervention pose problems in the planning process because of difficult coordination, particularly with the myriad of institutions involved in agricultural development.[29] Still it is possible to differentiate between interventions by the choice of technology. The equipment-intensive technology can be administered at the state level (and federal level programs through the states), while the LGAs can focus on the more rewarding labor-based methods which are appropriate for routine maintenance of low volume roads. In any case, the coordination between the various levels, which is weak at present for rural roads, will need to be properly developed to ensure the appropriate transfer of technology to the LGAs based on standards recognized by the federal and state level authorities.

Since ADPs have been established or are being established in all states, every state has an ADP rural road office. The Bank has been studying alternative scenarios for transfer of responsibilities, in an attempt to establish permanent institutional capacity at the state and local government authority level for planning, implementation, and maintenance of rural infrastructure. The proposed Nigeria Rural Infrastructure Project, for example, includes a proposal by which the state ADPs will retain overall direction and monitoring, while the state MOW will be in charge of planning and implementation of rehabilitation, mechanical maintenance, and training programs for the LGAs, while the LGAs will continue having the responsibility for routine maintenance. This setup guarantees that the selection exercise has the participation of the agricultural authorities in the ADPs.

The main problems with this arrangement are the coordination at the federal level, the implementation at the state and LGA level, and the impact of creating a new institution within a weak MOW. With respect to the federal level coordination, until now the Federal Department of Rural Development has coordinated ADPs, and gives regular advice. Apart from DFRRI and FACU (which have coordinated the road selection exercises for the ADPs), there is no federal agency for rural roads that provides guidelines for planning and implementation of rehabilitation and maintenance of rural roads.

Rural Road Interventions

The paper now examines how the questions of rural road construction and maintenance have been addressed in the road components of ADP projects in Nigeria. The experience is reviewed on the basis of project appraisal, completion, mid-term review, and supervision reports. The Bank's views at appraisal on construction and maintenance are compared with the project implementation experience. In the case of the most recent projects, for which there is little information on the implementation experience, the discussion is confined to the appraisal aspect.

When the Bank's project experience is considered in its entirety, covering all ADPs implemented during the past 13 years, the discussion below shows that the Bank's views on the relative emphasis placed on road construction and maintenance have been reversed.

The increased focus on rehabilitation and maintenance that has dominated the multistate projects began in 1986. With the establishment at about the same time of the Directorate for Food, Roads, and Rural Infrastructure (DFRRI) in the president's office, with counterpart institutions in the state governments, the focus of the ADPs on rehabilitation and maintenance was further narrowed. Judging from early supervision mission reports for the first multistate ADP, there is a clear division of functions between the project and the DFRRI inasmuch as the former will undertake only rehabilitation and maintenance work and the latter only the construction of new roads. Lately, however, some ADPs have constructed roads under contract for DFRRI in areas of low priority for agriculture. In some of these, the State Directorates have intervened and directed that priority should be given to DFRRI programs with the consequent delay in the original ADP program. The problem is exacerbated by serious delays in payments.[30]

Bank's Perception of the Need for Rural Roads

Bank reports have noted the lack and poor condition of feeder roads in the rural areas of Nigeria. The 1973 Agricultural Sector Survey, for instance, argued that "at some point in time, greater attention will have to be paid to feeder roads" (p.33). It further observed that "where there are feeder roads, their poor condition in many areas restricts the ability of farmers to meet growing demands for food and export crops and to reduce the cost of marketing" (p.33). Thus the survey advised that production programs for each crop should include provision for feeder road surveys and construction.

Rural road construction and maintenance has since been incorporated in all the ADP projects, becoming an important complement to the goal of increasing food production. The Agricultural Sector Review of 1979 stated that "concomitant to the economic benefit of the ADP feeder road programs there has been a tremendous psychological boost to their farming communities in the ADP areas who begin to feel that farming is receiving the attention due to it" (p.31). The review noted that in contrast, "development of rural infrastructure has received little attention during the current development plan period (1975-1980) in the Nigerian Government priorities" (p.31).

Nonetheless, because of the inability of local governments to keep up with road maintenance, the Bank is no longer undertaking construction of new feeder roads as part of the ADPs, and is instead focusing on the maintenance of the existing roads within ADPs. In this vein, by contrast to the Bank reports cited above which had criticized the Government of Nigeria for not paying adequate attention to rural road development, the 1987 Agricultural Sector Review has criticized the government for the inadequate "institutional arrangements for selecting, designing, building, maintaining and financing these structures" (p.32). According to the review, "the objective now should be to combine maintenance with construction in the new projects, and to establish and/or strengthen maintenance capability to preserve physical assets already built in the completed projects" (p. 24).

This rhetoric is not new. The lack of financial and institutional capacity has long been recognized in the Bank. Almost every appraisal report has mentioned it but not much changed until the three multistate ADP projects, the first of which was approved in 1986.

Changing Views at Appraisal on Construction Targets

The World Bank's views on construction targets at appraisal have changed fundamentally in two ways: (1) the emphasis shifted from new road construction in the earlier ADPs to rehabilitation and maintenance of existing roads in the latest statewide ADPs and the three MSADPs, and (2) the implementation was originally done by force account units and is now being done "in general" by contractors. (See complete review in Annex 2.)

Reflecting these concerns, road construction densities have also decreased substantially at appraisal from densities of over 100 meters per square kilometer in the earlier ADPs to densities between 20-30 meters per square kilometer (see Table 5). The higher initial densities were not associated with needs but rather with the number of kilometers that could be built with one road unit or with 40 percent of the budget allocation. The lower densities were later adopted to establish rehabilitation (rather than

Table 5
Actual and Targeted Construction of Rural Roads in Selected Bank Projects in Nigeria

	Target		Actual	
	Kms.	Meters/Km2 Project Area	Kms.	Meters/Km2 Project Area
Early Enclave Projects				
Funtua	750	100	521	69
Gombe	500	97	706	77
Gusau	750	197	750	197
Lafia	600	64	807	86
Ayangba	1,300	66	1,667	127
Late Enclave Projects				
Bida	620	36	429	25
Ilorin	300	25		
Oyo North	800	65		
Ekiti Akoko	500	101	258	50
Statewide ADPs				
Bauchi	1,200	18		
Kano	1,400	33		
Sokoto	1,700	18		
Kaduna	1,400	21		

Source: Project Appraisal and Project Completion Reports.

construction) targets in the three MSADPs. Only the second multistate ADP adopted very low densities between 5-9 meters per square kilometer, for no apparent reason (see Table 6). Moreover, Table 3 suggests that the three states included in the second MSADP have different road densities; while Niger has a relatively high density of rural roads, Gongola and Kwara have low densities.

Table 6
Targeted Rehabilitation and Periodic Maintenance of Rural Roads in Multi-State ADP Projects in Nigeria

	Rehabilitation Kms.	Rehabilitation Target Meters per Sq. Km. of Project Area	Routine Maintenance Kms.	Maintenance Target as percent of all state LGA roads
First Multistate ADP				
Anambra	600	35	1,000	100
Bendel	600	15	1,000	14
Benue	600	13	1,000	27
Cross River	600	22	1,000	15
Imo	600	52	1,000	39
Ogun	600	35	1,000	16
Plateau	600	11	1,000	29
Second Multistate ADP				
Kwara	550	9	1,760	59
Niger	410	6	1,830	25
Gongola	500	5	950	29
Third Multistate ADP				
Lagos	200	57	540	31
Ondo	750	38	2,400	64
Oyo	880	24	3,050	39
Rivers	50	3	4,000	100

Increased Attention to Maintenance at Appraisal

The importance attached to maintenance of rural roads has increased over the years as Bank staff realized that any new construction without proper maintenance was not a permanent investment. (See complete review of maintenance at appraisal in Annex 2.)

At appraisal the earlier projects were supposed to transfer the responsibility for the roads (as soon as they were finished) to the Local Government Councils (LGCs). The LGCs were reluctant and unable to perform any effective maintenance given their shortage of financial resources. The later enclave ADPs and statewide projects began incorporating at appraisal a road maintenance unit that will maintain the roads during the project's life.[31] It is only the SARs for the multistate ADPs where the need for more action in this respect is recognized. The Staff Appraisal Reports (SARs) for the multistate ADPs adequately divide the responsibility for maintenance operations according to type of operation and to financial capacity. The SARs assign the responsibility for implementation of maintenance with mechanical equipment, and partial funding of routine maintenance to the ADPs, while the LGCs are responsible for the implementation of routine maintenance with technical assistance from the ADP. The ADP finances initial training of LGC engineering staff and provide each LGC with necessary hand tools for routine maintenance. Routine operations might be manual and carried out with the lengthman system, where one lengthman is assigned for each three to four kilometers of road, with a headman for every eight lengthmen. The LGCs will pay the lengthmen and headmen and be reimbursed for the work done after supervision from each ADP. The case for the use of labor-based methods for routine maintenance is not made strongly enough. Even though its use in projects appraised by transport divisions in Kenya and Malawi have rendered good results and proven cost effective, no rural roads in projects appraised by agricultural divisions have so far employed these methods.

Construction Achievements are Only Measured in Kilometers

To analyze achievements in road construction, data are needed on lengths constructed, quality of construction, costs incurred for construction and rehabilitation, and benefits observed (vehicle operating costs, increases in productivity, and indirect benefits discussed earlier). Available completion and supervision reports do not allow a complete evaluation of the roads component. Most only contain aggregate information on the total number of kilometers constructed during the project period, main changes in road specifications compared to appraisal, an average cost per kilometer, and offer vague references to increases in traffic due to the road improvements.

Based on these limited records, this section presents the construction achievements of various projects as regards road specifications, reported traffic increases, kilometers constructed, and indirect benefits. Clearly future supervision reports need to focus on the road component (as the latest thematic supervision of February 1989) emphasizing the quality of road rehabilitated against the SARs design standards, and making a systematic analysis of the traffic and production changes related to the road improvements in order to evaluate them properly.

Road specifications

Divergent standards for acceptance of rural roads constructed and rehabilitated have always been a matter of concern in the Bank, however, very little information is available on this subject. Actual road specifications have varied from standards at appraisal, but generally roads constructed by the ADPs have been regarded as having high standards. These roads have usually complied with and in some cases exceeded the requirements of the Ministry of Works. (See the complete review of standards in Annex 2.)

Targets against actual construction

As shown earlier, the ADPs have substantially increased the network of all- weather rural roads in Nigeria. As Table 7 shows, the total kilometers of road constructed by all ADPs increased until 1986, after which time most of the construction of new roads was replaced by rehabilitation work in the multistate ADPs.

Each project has rendered mixed results. Of the ten projects that have data on completion or near completion, half seem to have been able to construct as many or more kilometers as the SAR target. However, as discussed in the next section, the maintenance achievements have not reached the target in any project, and this has accelerated road deterioration.

Table 7
Annual Rural Road Construction and Rehabilitation Undertaken by ADPs, 1976-871(kms)

ADP (Date of Approv.)	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987[a]	76-87 Total
Ayangba (77)			29	570	379	630	59						1,667
Bauchi (81)						0	179	429	177	272	223		1,280
Bida (79)						22	157	91	159	0	429		429
Borno (86)								35	10	0	15	60	120
Ekiti-Akoko (80)							0	62	106	35	54		257
Funtua (74)	24	151	99	139	108								521
Gombe (74)	24	131	199	85	66								406
Gusau (74)	145	259	181	53	112								750
Ilorin (79)						0	0	n.a.	20	52	n.a.		72
Kaduna (84)											118	285	403
Kano (81)								67	232	210	251	180	940
Lafia (77)					201	342	49	71	60	73			796
Oyo North (80)								15	81	125	141		362
Sokoto (82)								143	361	427	442	198	931
Total	193	541	508	847	866	994	444	913	1,206	1,194	1,673	723	8,934

Note
[a]Totals for 1987 do not include First MSADP achievements included in Table 9.
Source: Project Supervision and Completion Reports (several years).

The targets of road construction in the three early enclave ADPs were met in Gusau only. The PPAR suggested that the better performance in Gusau, compared to Funtua and Gombe, was due to the employment of an expatriate full- time road engineer,[32] and to the integration of the road and dam construction program (which also took place in Gombe) (see Table 5). The road construction program turned out to be the most successful component of both Lafia and Ayangba, which were otherwise considered to be relative failures (with respect to agricultural production goals).

The actual densities of roads achieved in these earlier projects were the highest achieved in any of the ADPs to date. These earlier projects also had a larger share of total costs allocated to road investments as a proportion of total project costs, as shown in Table 8. These high proportions of funds dedicated to roads appear again only in the second and third MSADP project appraisals. One reason project authorities may have emphasized road construction in the early enclave projects is because of both the fast disbursements and the urge to start projects at early stages of implementation as stated in the PPAR, and also because of the perceived need to improve communications infrastructure. Given the problems encountered with technological packages, the other important component—agricultural extension—had only a limited impact.[33]

Road construction achievements have varied widely in the subsequent projects for various reasons. The three statewide projects, Kano, Bauchi, and Sokoto ADPs, for example, were scheduled to close at the end of 1986, but due to slow implementation were extended to 1988. The mid-term review found that road construction had achieved 88 percent of the target in Bauchi, and only 50 percent in Kano and Sokoto. The main reasons for the shortfall were cited as the shortage of local funding and the emphasis on fadama roads (along the ridges of irrigation canals) in Kano and Sokoto which, in the case of Sokoto, proved to be 40 percent more expensive compared to appraisal estimates. Given the importance of irrigation in the Sudan zone, and the economic returns of irrigation, these fadama roads are likely to have high returns. The latest supervision reports from 1988 indicate that Bauchi completed the target in September 1986, and Sokoto was near completion in mid-1988. On the other hand, Kano was still behind due to the poor choice of equipment, lack of spare parts, and inadequate selection of spare parts inventory, all of which has reduced equipment availability.

Similar problems in implementation of road works are reported for the seven states of the first multistate ADP. As Table 9 indicates most projects have fallen behind schedule except for Cross River ADP. The implementation has

Table 8
Actual and Targeted Expenditures on Rural Roads and Their Shares in Total ADP Expenditures

	Target		Actual	
	N'000	Percent of Project Costs	N'000	Percent of Project Costs
Early Enclave Projects				
Funtua			5,500	17.3
Gombe			4,100	17.9
Gusau			4,900	19.0
Lafia			5,600	12.3
Ayangba			13,519	24.0
Late Enclave Projects				
Bida	4,500	10.8	5,642	10.8
Ilorin	3,200	8.7		
Oyo North	5,475	13.1		
Ekiti Akoko			2,400	8.4
Statewide ADPs				
Bauchi	24,681	12.8		
Kano	29,567	11.1		
Sokoto	25,514	9.3		
First MSADP	29,100	12.1		
Southern Borno	4,823	12.3		
Second MSADP	95,600	18.0		
Third MSADP	37,250	25.0		

Table 9
Road Construction and Maintenance
1987-88 Annual Targets and Achievements First MSADP

Agricultural Development Project	Rehabilitation Target	Rehabilitation Actual 1987	Rehabilitation Actual 1988	Recurrent Target	Recurrent Actual 1987	Recurrent Actual 1988	Routine Target	Routine Actual 1987	Routine Actual 1988
Benue	150	-	-	300	-	-	1,200	150	37
Cross River	150	160	NA	400	176	NA	1,000	-	NA
Imo	179	82	187	450	303	300	1,300	287	230
Ogun	no road program								
Plateau State	350	57	129	840	96	1025	180	-	-
Anambra	170	64	76	400	-	25	1,000	-	-
Bendel	150	32	NA	300	38	NA	1,000	-	NA

varied from disastrous (in the case of Benue ADP) to satisfactory in other states. The problems have been attributed to delays in hiring the roads engineer, and to lack of equipment and spare parts in the case of force account operations, while procedural complications have delayed implementation through contractors.

Traffic increases

Levels of traffic vary widely among the roads considered for rehabilitation in the ADP, with reported counts varying from 15 to 940 vehicles per day. Volumes critically determine the size of benefits. The wide variation in traffic volumes, therefore, calls for good monitoring of traffic volume changes before and after project implementation, since vehicle operating cost savings are substantial on roads with average daily traffic (ADT) of over 50 vehicles. Even in the case of roads with low-volume traffic, observed changes in agricultural traffic are indicators of changes in production and availability of transport services in rural areas.

The PCRs and PPARs, however, suggest that a systematic analysis of traffic changes has not been done either before or after project completion. Traffic counts before the project were performed on some roads in states where the first MSADP is being implemented, due to a special request by the Bank, but some counts were made on roads that were later not selected for improvements. (See review of traffic counts in Annex 2.) In a few cases the methodology used in the few traffic counts was inadequate.

Indirect benefits

As stated earlier, the road program component has been evaluated primarily in terms of the number of kilometers constructed and maintained, the standards of these roads, and in a few cases some observations in traffic change. Indirect benefits such as higher producer prices, lower prices of consumer goods, lower operating costs for passenger transport, and stimulus to trade of all kinds have been mentioned but not evaluated systematically, although some PPARs (e.g., Lafia and Ayangba), conclude that uncounted road benefits heve been large enough to offset the project's low rate of return. (See the review of indirect benefits in Annex 2.)

Very Poor Maintenance Achievements

Construction rather than maintenance has had much greater political appeal. Also in terms of project achievements, construction has greater appeal. In at least half of the ADPs, the targets for road construction and rehabilitation units were reached or exceeded, while in the rest the achievements were somewhere between 50 and 90 percent of the target. However, in no case to date has the target for maintenance been achieved, and in most cases maintenance has been well below the expectations at appraisal. Signs of road deterioration have become evident even before the ADPs end. (See the review of maintenance achievements in Annex 2.)

With respect to *mechanical maintenance*, the targets have been too ambitious (see Table 9). In the earlier projects, for example, the road construction force account unit usually concentrated on road construction, devoting very little time to maintenance. When counterpart funds were delayed, the maintenance program became a common target for cuts until funds became available. Meanwhile the roads constructed by the project have tended to deteriorate.

Labor-based methods in general were not considered attractive during the oil boom in Nigeria. When sufficient resources were available, equipment- intensive technologies were implemented. Therefore, the advantages of labor-based methods have yet to be tested convincingly. An important development in this field is that the National Directorate of Employment, UNDP, and ILO have recently started a labor-based demonstration project in Epe (Lagos State). The engineers from four states (Anambra, Kaduna, Katsina, and Oyo) are receiving training on the use of labor-based methods for road rehabilitation and maintenance. This is being done in preparation for the Pilot Public Works Programme (PPWP) that is expected to start next year in selected LGAs in the four states.

A recent visit to the project indicated that the doubts raised by engineers whose previous training favored equipment-intensive applications have been partly dissipated by two factors. First, the training includes a hands-on approach that allows engineers to participate in ongoing labor-based road construction and maintenance in Epe. Second, the trainees are receiving information on how and when it is appropriate to combine labor and equipment- intensive methods. The applicability of the labor-based schemes in other states is now being examined by the federal government in an effort to increase job creation in rural areas. This situation is in contrast with the experience of ADPs.

No ADP has succeeded in transferring the roads to the LGA for *routine maintenance*.[34] In the past, LGA representation in the executive committees of projects was very limited, despite the emphasis in the project design at appraisal to involve local bodies. The recent appointment of Local Government Councils (LGCs) and an expected increase in

resources, however, seems to open a window of opportunity. In an effort to involve LGCs more in the maintenance activities, at the beginning of 1989 firm arrangements were made between the project managers of Anambra and Plateau and a few selected LGCs (ten in Plateau and two in Anambra) to undertake training and practice maintenance with labor-based methods, and to conduct routine maintenance. The agreements cover financing for six persons in each LGA, and the provision of the necessary hand tools for the maintenance of 10 to 15 kilometers in each LGA.

On the Issue of Contractors and Force Account

Despite much recent rhetoric about increased execution through contractors, at present it appears that local contractors are available for construction, rehabilitation, and *recurrent* maintenance which require *mechanical* equipment, but very little is known about the amount of contractor capacity available for *routine manual* maintenance of rural roads. The results of both the pilot agreements between the first MSADP and a few selected LGAs to conduct routine maintenance, and the ongoing labor-intensive UNDP/ILO project in selected states will improve knowledge on this matter.

The development of local contractor capacity for road construction, rehabilitation, and recurrent maintenance was not tackled explicitly until the MSADP projects were appraised. Even these latter have not dealt with the critical issue of developing *supervision* capacity. In the early enclave projects construction work was done by units within the project. In the three MSADP projects, however, the road rehabilitation component has been designed specifically to be performed by local contractors according to the current capacity. The SAR for the first MSADP (including Middle Belt and Northern states) reports that "a study [was] completed in Anambra State to establish the availability of contractors [for construction, rehabilitation, and recurrent maintenance]... and similar studies have been launched in other states" (p.21). Other Middle Belt and Southern states also appear to have sufficient contractor capacity, since the SARs for the recent second and third MSADPs indicate that "there are an adequate number of interested contractors, some with international affiliates, to provide a competitive environment."

> The contracting experience [for contruction, rehabilitation, and recurrent maintenance] of the MSADP I states is too recent and varied to draw firm conclusions on performance so far. Perhaps the most serious problem is the lack of experience in managing contract work of this nature... Local contractors also find difficulty in satisfying the terms and qualifications for bidding. Many follow old habits [from previous practice]. They believe they can avoid agreed bidding procedures,... including unreasonably low pricing with the expectation to vary the price during construction. Projects will have to develop the capability to derive the full benefits from competitive bidding.[35]

Reportedly, these practices and the lack of supervision capacity in some MSADP I states, have led to higher unit costs for rehabilitation using contractors than by force account.

The use of contractors is not that widespread for maintenance operations. Periodic and recurrent maintenance operations, which in most cases require mechanical equipment, have been assigned to force account units within the first MSADP, and depending on contractor availability "they will be executed by contract," in the second and third MSADPs.[36] Manual routine maintenance is assigned to the LGAs, with training and funding assistance from the ADPs. Only the last MSADP describes a routine maintenance program with the lengthman system that has proven cost effective in Malawi and Kenya (see the section on maintenance at appraisal). Nevertheless, the success of such a system in other countries has been attributed partly to the implementation of pilot demonstration projects, adequate technical assistance for the implementation of labor-based methods, long-term commitments from the government with respect to human and financial resources, and adequate task reporting and monitoring systems. None of these have been specified in the MSADP appraisal.

Drawing a comparison between the rural road sector and the main road sector, it can be seen that the development of local contractors for routine maintenance of rural roads is not an easy subject. This often includes two reasons: (1) the amount of contracts per kilometer is very low compared to other activities such as mechanical maintenance or rehabilitation (and therefore attracts different types of contractors), and (2) the costs of supervision are very high.

> It is possible to carry out routine and recurrent maintenance by contract, but the work can be more difficult to specify and monitor. For such operations, it may be necessary to specify total amounts of work per kilometer of road for each maintenance activity, with emergency repairs being paid for at daywork rates" (Robinson 1988).

The lengthman system has been proposed in the third MSADP, with the advantage that accountability exists within the community and not only for technical reasons. However, enough technical assistance has to be provided to ensure the necessary institutional setups and also in order for standards to be met. In order to encourage contractors to use labor-based methods at least in the maintenance, many changes have to be introduced beginning with the bidding process. The emphasis on equipment makes the qualification process biased toward those contractors with the most equipment. For example, most ADP invitations for prequalification indicate that rural roads contractors "must have experience in projects involving the construction of feeder roads using heavy machinery."[37] Rather, contractors could be encouraged to use labor-based methods (solely or in combination with equipment-intensive methods) by modifying the prequalification process. For example, provisions can be included to evaluate the capacity to mobilize local labor, previous or proposed training of foremans and gang leaders, as well as previous road contracts using labor-based methods.

Broad Assessment of Future Needs for Expansion, Rehabilitation, and Maintenance of the Rural Road Network in Nigeria

In line with the preceding arguments, this section calculates future needs in terms of expansion, rehabilitation, and maintenance of rural roads, within a regional context accounting for each region's economic potential. First, target road densities are obtained from a review of past experience, current project targets, and targets in other countries. Furthermore, needs in terms of kilometers to be constructed, rehabilitated, and maintained in the future are presented. Second, cost estimates from project experience are presented for construction, rehabilitation, and maintenance activities. Third, an assessment is made of the resources needed to develop the network according to the various methods presented to calculate target densities, and also priorities according to each region's potential. Finally, it is shown that needs can be fulfilled to a great extent with a more efficient use of present resources available for investment.

The results point to two major issues. If future investment is directed to improve a portion of the existing network (i.e., ADP targets), most of the rehabilitation work will be done in the Southern and Middle Belt states. However, if the upper bound target densities are used, and therefore population densities are the driving factor, a large amount of work and resources are required to develop the network in the Northern region.

In any case, the needed resources lie somewhere between the requirements for fulfilling the two targets. The total requirements estimated are as follows: (1) for new construction and rehabilitation, US$105 million for the Northern states, US$90 million for the Middle Belt states, and US$195 million for the Southern states; and (2) for annual maintenance an average of US$21 million in the Northern states, US$23 million in the Middle Belt states, and US$37 million in the Southern states. This amounts to a total of US$390 million for construction and rehabilitation and US$81 million every year for maintenance.

Calculation of Target Road Densities in Nigeria

Target densities are just one indicator of the development of the rural road network, which is a good proxy for the future investment and recurrent expenditure needs of rural roads. In other countries, e.g., India, target densities of rural roads are calculated as a function of the region's area, and the number of cities, towns, and villages of different sizes in that area. In India there are high correlations between the region's area and the length of main roads, and between the number of towns in the area by size and the length of rural roads. In Nigeria as well, the correlation between area and main road length is very high as expected.[38] However, data on the number of villages and towns by number of inhabitants is not available. Therefore, this section simply presents a methodology using comparisons with neighboring Cameroon and India.

Food Sector Report

In the report of the Food Strategy Mission, Idachaba (1980) argues that an ideal minimum density of roads for Nigeria would be 110 meters per square kilometer of area, however, large investments are needed to achieve such a target. The present report argues that investments should be concentrated in areas of high agricultural potential and high population densities, so that the desired feeder road densities would be an additional 40 to 80 meters per square kilometer, and hence the additional overall road target density would be 60 meters per square kilometer.

Bank Appraisal and Completion Reports

Target densities estimated at appraisal and achieved at completion reflect the capacity of one road construction unit, but are also measures for desired feeder road densities in Bank-related projects. Given the significance of the rural road component of the ADPs in Nigeria, these targets are a good proxy for possible levels of intensity of rural road infrastructure.

These densities were calculated earlier and are presented in Tables 5 and 6. From these tables, the state and regional target densities are derived, highlighting important differences as shown in Table 10. As Table 10 shows, the targets of the early enclaves were high. The targets for other projects are representative of targets used in the latest projects. Thus a pattern emerges at the regional level as follows: (1) 20-30 meters per square kilometer for the Northern region, (2) 40-50 meters per square kilometer for the Middle Belt region, and (3) 80-100 meters per square kilometer for the Southern region. The above compares favorably with a national target density of 60 meters per square kilometer estimated by Idachaba.[39]

Table 10
Regional Average Target Densities
Meters per square-kilometer

Project	Method (1)	Method (2)	Target
Northern States (Guinea Savanna)			
Funtua, Gombe, Gusau (Early)	169		169
Bauchi, Kano, Sokoto, Kaduna ADPs	21		21
Middle Belt States (Sudan Savanna)			
Lafia, Ayangba (Early Enclave)	84		84
Benue, Plateau (First MSADP)	20	40	40
Niger, Kwara, Gongola (Second MSADP)	22	15	22
Southern States (Tropical Rainforest)			
Cross River, Imo, Ogun, Anambra, Bendel (First MSADP)	47	46	47
Lagos, Ondo, Oyo, Rivers (Third MSADP)	128	56	128

Source: Staff Appraisal Reports.

Comparison With Existing Densities in Neighboring Cameroon

The rural road network in neighboring Cameroon is still expanding. Nevertheless, an examination of the target densities used in projects in Cameroon (see Annex 3) provides a good reference, since both countries have regions with comparable ecological characteristics. As seen in Table 11, the comparison reveals that projects developed in Cameroon in regions with comparable resource endowments have similar target road densities, even though they have significantly lower population densities. Therefore, for the analysis proposed, the targets calculated in the previous section can be regarded as appropriate lower bound targets.

Table 11
Road Target Densities from Bank Projects in Nigeria and Cameroon

Region	Range of Densities: Population (p/km2)	Range of Densities: Target Road (m/km2)
Nigeria		
North	43 - 227	20 - 30
Middle Belt	30 - 92	40 - 50
South	109 - 842	80 - 100
Cameroon		
North	9 - 50	26 - 35
Central	7	8 - 20
W. Highlands	70 - 95	65 - 122
S.Rainforest	4 - 83	3 - 40

Comparison with India in 1960

India in 1960 had approximately 135 persons per square kilometer, which is the population density expected in Nigeria in the year 2000. Considering the high densities of maintained rural roads in India compared to Nigeria (6 times more in the earlier comparison), an upper bound for target densities can be calculated by looking at the densities of rural roads in India in 1960.[40]

Table 12 includes the densities for most states in India in 1961, ordered by population densities. Population densities of group 1 correspond to the estimated densities of Middle Belt states in the year 2000, group 2 to the Northern states, and group 3 to the Southern states. Other similarities in addition to population densities occur in the case of group 2 states, where extensive regions are dedicated to the production of crops similar to those in the Northern states in Nigeria. Therefore, as an upper boundary, the target densities from the comparison with India in 1961 are as follows: (1) 50-70 meters per square kilometer for the Northern states, (2) 40-60 for the Middle Belt, and (3) above 120 for the Southern states.

Table 12
Population and Road Densities India—1961
States Grouped by Population Densities

State	Persons per square kilometer	Meters per square kilometer
Group 1		
Jammu & Kashmir	16	23
Rajasthan	59	58
Madhya Pradesh	73	33
Group 2		
Assam	97	136
Gujarat	110	51
Orissa	113	88
Mysore	123	139
Maharashtra	128	58
Andra Pradesh	131	72
Group 3		
Punjab	166	121
Uttar Pradesh	251	174
Madras	259	141
Bihar	267	242
West Bengal	398	368
Kerala	434	189

Source: see Annex 4.

Selection of Rural Road Target Densities for Nigeria

The set of lower bound targets is obtained from the targets set for the ADPs, while the upper bound targets are set from a comparison with India in 1960. Recent estimates prepared for the future Agricultural Development Fund Project (ADF) of kilometers to be rehabilitated corroborate the validity of these ranges with data from several states (Kaduna, Bauchi, Anambra, and Plateau states). Further, the target densities used by DFRRI for the first phase of rural road construction are included in the ranges specified.[41]

The lower and upper bounds for targets, calculated with respect to past project densities and India's densities, coincide with calculating the higher road target densities in the Southern states. The same coincidence does not occur with the calculations for the other two regions. In the Northern states, the road densities targeted in the ADPs (lower bound) are less than those in the Middle Belt. However, the upper bound (from the comparison with India), sets higher rural road target densities in the Northern states than those for the Middle Belt states. The lack of correspondence is explained by the greater importance given to higher population densities in the calculation of target densities for India. This is likely given that the Northern states have a larger number of towns and villages compared to the Middle Belt. Also the roads would be used much more in the North because of higher production and greater population, which would imply higher maintenance requirements.

Finally, the economic potential of each region is considered here. The regional context described earlier called for extensions and rehabilitation of the rural road network in the North and Middle Belt to allow for increases in areas under cultivation, and at the same time an emphasis on rehabilitation in the Southern states to accommodate large increases particularly of consumption that will require

reduced costs of intermediation. It is assumed that the ranges calculated for road densities in each region will allow the realization of the potential in each region, since the same factors included in the estimation of each region's potential were included in the estimation of the target densities for the ADPs. In addition, increased population densities and village densities have been considered in the case of India. Therefore, these two sets of targets are considered appropriate for the exercise.

Rehabilitation and Maintenance Cost Estimates

Road construction and maintenance costs vary according to specifications, institutional arrangements, technology (labor- vs. equipment-intensive), and region (i.e., soil characteristics and topography), and of course to variations in exchange rates, and real costs of labor. This makes the comparison of these costs complex.[42] In order to calculate approximate costs for rehabilitation and maintenance operations, several sources were consulted, including DFRRI, UNDP/ILO Pilot Public Works Programme (PPWP), and Bank project files for Nigeria and neighboring Cameroon.

A survey of rural road specifications used in Nigeria indicates that three main standards prevail, including those used by the Bank ADPs (which conform to the Ministry of Works (MOW) standards), the DFRRI standards which in theory vary slightly from the MOW standards, and those of the Pilot Public Works Programme. Table 13 contains the main characteristics of the road section for design under the three sets of standards.

Table 13
Road Construction Specifications

		Bank Projects		
	DFRRI[a]	Feeder Road	Farm Road	PPWP
Average Daily Traffic		up to 100	up to 50	
Right of Way (m.)	10	13	10	13
Min. formation width (m.)		9.5	8	10
Carriageway width (m.)	6	6	6	6.5
Base thickness (mm.)	150	150	150	max. 300
Camber (%)		4	4	
Drainage	adequate	1.2 m. below grade level		
Min. culvert length (m.)	6	8	8	

[a]Not adhered to because of low allocations per kilometer.

With varying standards and terrain conditions, the cost of constructing and maintaining roads varies from state to state. Table 14 contains averages obtained from appraisal, completion reports, and project files for the various standards. If rehabilitation is considered to cost approximately half of what a new road costs, the construction cost calculated with ADP figures is US$20,940 per kilometer in 1987, which is the same as the figure obtained for the PPWP in the same year.[43] However, the difference between these two and the DFRRI is quite high, which calls attention to the fact that with lower standards (construction rather than design in this case), the DFRRI roads need much more maintenance. The work standards for the DFRRI roads have been low, and many of the roads constructed are unmaintainable just after completion.[44] While it is possible to be precise about road construction costs for Bank projects, it is not possible in the case of the Federal Directorate of Food, Roads, and Rural Infrastructure (DFRRI).[45]

The trade-off between construction and maintenance is important. If average daily traffic is less than 50 vehicles per day, with low construction standards and little maintenance, usually the road will have to be rehabilitated every two years. However, if the traffic is higher than 50 vehicles per day, and no maintenance is performed, an annual reconstruction has to be scheduled (which is actually happening). On the other hand, the ADP roads call for a 7-8 year interval between periodic maintenance, annual or biannual recurrent maintenance after the rains, and day-to-day routine maintenance. As an illustration, considering a hypothetical kilometer of road in the North, and using the ADP costs, the annual costs to have a road operational will be twice as high for DFRRI (with low construction standards and little maintenance) versus the current ADP (assuming adequate standards, appropriate maintenance during project life, and little maintenance thereafter). A word of caution about the usefulness of this comparison, however, is that after a few years of inadequate maintenance, rural roads are easily washed away, regardless of initial standards (as has been reported with ADP roads from the earlier enclave ADPs).

The costs in Table 14 are national averages. As pointed out before, however, regional variations are important. In order to obtain costs for the different regions in Cameroon, the costs used for appraisal of the Second Feeder Roads Project in Cameroon were examined (see Table 15). These regional data allow the calculation of variations in rehabilitation and maintenance costs with respect to similar regions in Nigeria.

Table 14
Average Costs per Kilometer in Nigeria

Institution	Year	Activity	Cost per Kilometer[a]				Foreign Costs %
DFRRI	1987	Construction	N	9-10,000	US$	2,330	
Second MSADP	1987	Rehabilitation	N	45,000	US$	10,470	80%
		Periodic Maintenance	N	20,000	US$	4,650	
		Recurrent Maintenance	N	2,600	US$	610	
		Routine Maintenance	N	1,500	US$	350	
PPWP	1987	Construction					
		Labor-Intensive	N	27,000	US$	6,350	20%
		Equipment-Intensive	N	87,200	US$	20,510	73%

Note: [a]Market exchange rates for 1987 from IMF (1987). Costs for DFRRI are not for standard shown in Table 14. Costs for second MSADP and PPWP are from appraisal documents.

Source: World Bank 1988c; UNDP/ILO 1988.

Table 15
Cameroon Second Feeder Roads Project (1988)
Construction and Maintenance Cost

Region	Activity	Cost per Km	
Northern Plains	Rehabilitation	US$	17,000
	Maintenance	US$	410
Central Savanna	Rehabilitation	US$	18,000
	Maintenance	US$	410
Western Highlands	Rehabilitation	US$	28,000
	Maintenance	US$	620
Tropical Rainforest	Rehabilitation	US$	26,000
	Maintenance	US$	620
Total	Rehabilitation	US$	24,000
	Maintenance	US$	500

Costs exclude design and contingencies.
Market exchange rate for 1988 from IMF(1988)

Rather than comparing the costs directly, it is interesting to extract the costs of rehabilitation, which are 60 percent higher in the tropical rainforest area compared to the Northern Plains. Also the maintenance costs are higher by about 50 percent in the South. The regions in Cameroon with terrain similar to that in the Middle Belt and Northern states in Nigeria have lower costs, given the lower rainfall, and better soils for roads. Mountainous terrain like that in the Western Highlands in Cameroon result in higher rehabilitation and maintenance costs. The estimated construction costs per kilometer for the three regions in Nigeria are shown in Table 16. The activities included in Table 16 have the periodicity indicated in Table 17, which varies by region (because of soil quality, rainfall, and average daily traffic).

Assessment of Investment Needs to Reach Target Densities

To calculate the investment needed to reach the desired road densities, the difference between the existing all-weather road density and the target densities is calculated for both the targets set for ADPs and the upper bound targets calculated earlier from comparison with other countries (see Table 18). The differences calculated in Table 18 represent additional kilometers of all-weather roads needed per unit area of each region specified. The proposed extensions to the network may be in the form of rehabilitation and new construction. Each is calculated using the information on existing all-weather roads and total roads presented earlier in Tables 3 and 4. All roads are assumed to be regularly maintained. The total length of the desired all-weather network is presented in Table 19. It should be noted that the length expected under the higher targets set is almost the length of the total existing network, which as stated before has only a small percentage of all-weather roads. The cost to rehabilitate the needed additional roads to meet the targets are included in Table 20.

Table 16
Estimated Average Rehabilitation and Construction Costs per Region
Cost per Kilometer

Region	Construction	Rehabilitation	Maintenance Periodic	Maintenance Recurrent	Maintenance Routine
Northern	US$15,000	US$ 7,500	US$ 3,300	US$ 550	US$ 320
Middle Belt	US$17,000	US$ 8,500	US$ 3,800	US$ 580	US$ 350
Southern	US$25,000	US$12,800	US$ 5,000	US$ 630	US$ 380

Table 17
Periodicity of Maintenance Operations

Region	Periodic	Recurrent	Routine
Northern	7-8 years	annual	day-to-day
Middle Belt	7 years	annual	day-to-day
Southern	6 years	annual or biannual	day-to-day

Table 18
Difference Between Target and Existing Road Densities

	Road Densities (m/km2)				
				Differences	
Region	Existing	ADPs Targets	Upper Bound Targets	ADPs	Upper Bound
Northern States	18	25	60	7	42
Middle Belt States	15	45	50	30	35
Southern States	24	90	120	66	96

Table 19
Length of Target All-Weather Rural Road Network

	Region			
	Northern	Middle Belt	Southern	Total
Under ADPs Targets:				
Existing All-Weather	7,000	5,100	4,900	17,000
New Construction	-	-	-	-
Rehabilitation	2,700	9,700	12,500	24,900
Maintenance	9,700	14,800	17,400	41,900
Under Upper Bound Targets:				
Existing All-Weather	7,000	5,100	4,900	17,000
New Construction	9,700	-	-	9,700
Rehabilitation	6,700	11,300	18,200	36,200
Maintenance	23,400	16,400	23,100	62,900

Table 20
Costs to Upgrade and Maintain Network by Region (US$ '000)

	Region			
	Northern	Middle Belt	Southern	Total
Under ADPs Targets:				
New Construction	-	-	-	-
Rehabilitation	20,250	82,450	160,000	262,700
Maintenance (per year)	12,440	21,800	32,070	66,310
Under Upper Bound Targets:				
New Construction	145,500	-	-	145,500
Rehabilitation	50,250	96,050	232,960	379,260
Maintenance (per year)	30,010	24,160	42,570	96,740

Comparison of Needs and DFRRI Investments

The Federal Directorate of Food, Roads, and Rural Infrastructure (DFRRI) received N 500 million in each of the last two years (1987-88) for rural infrastructure programs—approximately US$120 million in 1987 and US$85 million in 1988—a large portion of which was dedicated to road construction. While the funds available approximate road construction and rehabilitation needs, the lack of funds for maintenance is still to be resolved. Thus, even if abundant resources are dedicated to extend and rehabilitate the rural road network, there would still be a compelling need to improve the maintenance capacity at the local level to ensure that such investments have a long-lasting effect. DFRRI's target is to construct 60,000 kilometers of rural roads in six years. If recent funding levels are maintained, a total of approximately US$708 million will be allocated to the directorate in the next six years.[46] Assuming that about 60 percent of these funds are allocated to *construction* of roads, which is in line with the present apportionment among rural infrastructure components, the total funds available for roads in the next five years will be US$425 million. This falls between the lower and upper bound needs calculated in the previous section *only* for construction and rehabilitation. In addition, the only funds for rural roads are the ADP road investments (which amount to approximately US$35 million for the next 4 years), and the LGA appropriations.

The colossal effort needed to build maintenance capacity at the LGA level will require more resources than those available from DFRRI, ADPs, and present appropriations to LGAs, if technical assistance and effective institution building is to materialize. Therefore, if the government's commitment to large construction of rural infrastructure is unaltered, *and* supplementary funds are made available to build local maintenance capacity, then investment levels would not be far from the ones estimated here for future needs.

Other points should be taken into account. The construction output and quality of the DFRRI roads has not been the best, and therefore the density of all-weather rural roads might not improve at all under the present arrangements. The low standards reported for the roads constructed have also adversely affected the *longevity of road improvements*. The state directorates of DFRRI are representatives at the level of the federal government. Once the roads are finished, as is the case of ADP roads, inadequate provisions are made for their upgrading and maintenance. LGAs with scarce resources are usually not able to take over and improve the roads to a "motorable" condition, particularly since this will absorb all local resources. Also, the wide scope of the DFRRI might imply that it has large overheads above that calculated for state-level projects (from the ADP data), which will largely increase the financial requirements to improve rural road availability.

Institutional Considerations and Sustainability

Since DFRRI is already a major federal level entity, the rural road planning capacity of the directorate might be bolstered through technical assistance. Some of FACU's experience with road selection exercises in the ADPs could be transferred as part of the technical assistance. With improved planning capacity at the federal level, the directorate could address some of the interregional resource allocation issues related to regional resource endowments and the potential sources of demand and production. Micro-level road selection exercises might furnish better results if performed by local level governments with assistance from FACU. Further, the regional character of rural road programs should be coordinated with the interregional agricultural strategies, which might only happen loosely under present conditions.

Increased coordination within the federal government between NDE *and* DFRRI *appears to have many potential benefits.* Both directorates are presently involved, to a different extent, in construction and rehabilitation of rural roads. Since NDE's participation in rural roads is just starting, the establishment of an interdirectorate committee could coordinate the road selection exercises, share some of DFRRI's previous experience, disseminate NDE's experience with the implementation of labor-based methods, and also organize joint training of DFRRI and ADP engineers.

The states have little experience with rural road infrastructure, and have plenty to worry about with state roads. Until recently, rural road infrastructure has been the concern of the ADPs and the LGAs, and meanwhile funds for rural roads have been channeled mostly through the ADPs. In a way these funds have bypassed the traditional state institutional structure. Since 1986 the funds available to the state directorates of DFRRI from the federal government, and the increased funds to LGCs have increased substantially the total funds available for investment in roads (the resources from ADPs were allocated for some states every year). Rural road investments have been more attractive to states when the funds were to be administered by them.

A setup proposed here might be one in which each state is involved in planning rural road activities through the ADPs giving advice to the LGAs in the selection and evaluation process. Every two years each LGA will select and evaluate those roads that need rehabilitation and periodic maintenance providing this information for approval to a new rural roads division in the state MOW. Upon approval, the LGAs will proceed with the rehabilitation and mechanical maintenance program by contract and the routine maintenance by the lengthman system. The main issue here will be the development of capacity at the LGA level in order to expect this to happen. Contractors will be selected from a pool of contractors prequalified by the rural roads division of the state MOW for this purpose. The contractor selection process will be subject to approval by the state MOW. Contractor supervision has to emphasized. LGAs and the state MOW will definitely need technical assistance in the various aspects regarding contractor supervision including costing, evaluation, and quantification of road works, qualification of contractors, bidding practices, and equipment comparison and evaluation.

Within each LGA, simplified road selection exercises may be conducted using systematic vehicle counts and agricultural data from the state ADPs. The evaluation exercise could also involve at least initially the local community, which to a certain extent can give an indication of the need for roads and the availability of local contractors and labor force for labor-intensive maintenance.

Finally, given that at present LGAs do not have either the technical or financial resources to do this, the implementation could be done progressively as stated in the Proposed Rural Infrastructure Project. A technical rural roads division could be created in each state MOW primarily in charge of technical supervision, technical advice to LGAs, and contractor prequalification. This division could be formed with some of the capacity of the state directorates of DFRRI and rural road divisions of ADPs. After this, two to three LGAs could be selected in each state to introduce this implementation scheme.

Unless some steps are taken soon with very explicit capacity building objectives, the problems of rural road maintenance and expansion might continue.

Notes

1. This includes the achievements and disbursements for the first multistate ADP as detailed in Tables 7-9.

2. The ADPs have had three major stages. Initially there were nine enclave projects which covered areas smaller in extension than a state. The early enclave projects (started between 1974-77) included Funtua, Gombe, Gusau, Lafia, and Ayangba ADP and the late enclave projects (started between 1979-80) included Bida, Ilorin, Oyo North, and Ekiti Akoko ADP. After 1981 statewide projects followed in the states of Bauchi, Sokoto, Kano, Kaduna, and Borno. Finally two multistate projects (MSADPs) have been implemented (in Southern and Middle Belt states), which along with the approved third MSADP (in Lagos, Ondo, Oyo, and Rivers states) will mean that each state has a statewide ADP. An Agricultural Development Fund project is being prepared to support the ADPs in the future.

3. For example the redesigned Borno State ADP has allocated resources to provide cost-free materials, loan tools, and give advice and supervision to villages for self-help installation of drifts and improvement of tracks. Communities have shown considerable enthusiasm to improve their access by providing free labor and local material.

4. "The road programme was the flagship of the project. . . It is always the first thing people mention when asked about the project" (Ayangba ADP PCR); "The agricultural services did not perform as expected. . . On the infrastructural side the project was more successful . . ."(Bida ADP PCR). "Project extension activities were the weakest element in the ADP strategy of roads, input distribution, and extension. . . Increased use of fertilizer and other inputsproject" (Gusau ADP PCR).

5. Types of Rural Transport

Rural transport will be divided in two broad categories: *primary* and *secondary* rural transport. Primary rural transport includes local level transport from the farm gate to or from primary markets, small villages, and small towns. Vehicles and pedestrians use in this case rural local roads and rural collector roads with average traffics of up to 50 vehicles per day. (The definitions of rural local roads, rural collector roads, and rural arterial roads are the result of the "Rural Roads Evaluation Conference," which convened in Harpers Ferry, West Virginia, in November 1980. In Nigeria they correspond to farm access roads, feeder roads, and Local Government Authority roads according to the Ministry of Works categories.) Rural local roads provide direct access from farms to primary markets and small villages, while rural collector roads connect villages to small towns with local markets and basic services. Local government and institutions are the ones usually concerned with the development and maintenance of this infrastructure.

Secondary rural transport connects small towns to the main road network (primary and secondary roads) and regional markets. Higher traffic volumes are common but not a rule, and in most cases transport is performed with the use of motorized vehicles on rural arterial roads. While primary transport costs are assumed directly by the producer, the secondary transport costs are usually larger and incurred by the marketing agent and therefore indirectly by the producer.

6. Approximately 19,000 kilometers of road were constructed between 1986 and 1987, which represents an estimated investment of N 190 million for the first two-year phase, or N 95 million per year. In 1986 the ADPs constructed approximately 1,602 kilometers, which at N 10,000 per kilometer (average cost from Bida ADP Project Completion Report) give a total of N 16 million in construction and rehabilitation only. Therefore, the investment in roads has augmented substantially with the creation of DFRRI.

7. The reorganization of Colombian rural roads administration in 1972 has often been cited as a case of successful implementation of organizational changes. A national fund for rural roads (FNCV—*Fondo Nacional de Caminos Vecinales*) has existed since 1960, but until the early 1970s it functioned as a secondary entity in the Ministry of Public Works (MOPT) structure. In 1972 FNCV was reorganized as an autonomous organization under the MOPT and charged with planning, construction, and rehabilitation of rural roads. The institution enjoys a reputation for efficiency and sound management, which is confirmed by the good performance of the Bank's ongoing Rural Roads Project. Over 60 percent of rural roads in Colombia have been constructed either totally or partially by FNCV. The network of rural roads has increased notably at an annual rate of 10 percent (World Bank 1986; SAR *Colombia, Rural Sector Transport Project*, Latin America Office).

FNCV's activities are funded through a combination of transfers from the national budget on account of earmarked taxes on oil products (53.1 percent in 1985), special budgetary appropriations (14.8 percent), own resources from contracts to build roads on behalf of other institutions (2.7 percent), and multilateral and bilateral loans (28.2 percent).

Another example is the proposed organization and management reorganization of the rural road sector in Tanzania under present study by the Government of Tanzania and the Bank. It intends to improve the maintenance of the very deteriorated district road network in Tanzania.

8. For example increased specialization in rice production is reported by Mitchell (1977) as a result of a new road in an area with no other roads.

9. Better transport increased the use of market places in Thailand when an earth road from Chiang Rai to Chiang Kham reduced travel time from three days to three hours, and altered the regional rice trade. See Moerman 1968.

10. Airey (1980) documents that after improved school roads increased education opportunities, out migration increased indirectly. Areas have received migrants, as documented by Hegen (1966). Also intraregional movements in search of work or better economic opportunities are documented in Indonesia by Okada (1978).

11. Carnemark (1979) reports that the construction of a feeder road linking a village in Yucatan, Mexico with the main highway tended to strengthen the village as the service center of the surrounding villages. Blaikie (1977) reports the same for villages in West Central Nepal.

12. For a complete review of procedures see Carnemark 1984; Bovill 1978; and Hine 1982.

13. February 1989 Supervision Report, p. 2. Memo from L. Campbell to A. Seth on "Thematic Supervision—Feeder Roads and Water Supply Components of ADPs."

14. Pro-rata of total extension costs by proportion of extension agents in zone of influence to total number of agents.

15. Pro-rata of total commercial service cost by proportion of incremental fertilizer tonnage into zone of influence as a proportion of the total incremental fertilizer tonnage.

16. Page 2, February 1989 Supervision Report. Memo from L. Campbell to A. Seth on "Thematic Supervision—Feeder Roads and Water Supply Components of ADPs."

17. Letter from F.S. Idachaba, Head of Federal Agricultural Coordinating Unit, to Alan Denness, June 24, 1985.

18. See Devres 1980; Airey 1984; and Howe 1984.

19. Including the first and second MSADP approved quantities as detailed in Tables 7-9.

20. Statistics from tne Public Works Department and local bodies show that at least 90 percent of all rural roads were included for maintenance in 1961 (see Central Road Research Institute, *History of Road Development in India*, New Delhi, 1963). Estimates for Nigeria presented later indicate that no more than 15 percent of the LGA network is all-weather.

21. This unbalances the comparison with India in 1951, given that the length reported in Table 2 for that country includes only those roads on which maintenance operations were reported in 1951, and therefore the expected proportion of all-weather roads is probably far above the 10 percent reported for Nigeria.

22. Chapters 3 and 5 in Lele et al. (1989) examine interactions at the regional level between human and livestock populations, ecology, land availability, agricultural potential, ethnicity, social and economic organization, government policies and investments, education and health care supply, and income growth.

23. Chapter 5 in Lele et al. (1989) points out how the need for land expansion in the North in the next years will require larger amounts of land than that which is available.

24. For further discussion see chapter 5 of Lele et al. 1989.

25. Including millet, sorghum, cassava, rice, and cowpeas.

26. Delgado as quoted in Lele et al. 1989.

27. The fast rate of growth of traffic on main roads during the 1970s slowed down during the early 1980s, and finally declined during the late 1980s.

28. These were aggravated by a combination of thin pavements, construction practices which did not meet specifications, and delayed strengthening.

29. There are three levels of intervention: federal, state, and local government. New construction is carried out by the federal government through DFRRI, rehabilitation and mechanical maintenance mainly at the state level by the ADPs, and routine maintenance primarily by the LGAs with assistance from the ADPs and NDE (federal level) in a pilot program.

30. February 1989, Supervision Report. Memo from L. Campbell to A. Seth on "Thematic Supervision—Feeder Roads and Water Supply Components of ADPs."

31. Even though appraisal mentioned the road maintenance unit, it was not implemented in most statewide ADPs.

32. "Suitable roads engineers were never found for Funtua and Gombe," PPAR, p. 58.

33. See Lele 1989.

34. February 1989, Supervision Report. Memo from L. Campbell to A. Seth on "Thematic Supervision—Feeder Roads and Water Supply Components of ADPs," p. 2.

35. February 1989 Supervision Report. Memo from L. Campbell to A. Seth on "Thematic Supervision—Feeder Roads and Water Supply Components of ADPs."

36. Periodic maintenance (approximately every 5-7 years) includes among others the following activities: regravelling, compacting, grading, reshaping of the road's camber, and ditch repair. Recurrent maintenance (once or twice a year depending on traffic, soil, and rainfall patterns) includes mechanical grading.

37. Daily Times, May 30, 1989.

38. A simple regression model was estimated for length of federal roads in each region as a function of area in each region. The results give good fit (R2 = 0.89) and highly significant coefficients.

39. These targets are intended to be lower bound densities. The fact that targets should be higher for the North than for the Middle Belt, given its higher population densities and much greater agricultural production and rural population, will be taken into consideration in the calculation of upper bound densities in the following sections.

40. This is considering the length of rural roads as the sum of other district roads and village roads, both of which serve the function of rural roads as defined earlier in Nigeria.

41. DFRRI's targets for the first of three phases was obtained from DFRRI's office in Lagos. The targets for the three phases combined were calculated assuming the same regional targets for each phase. Therefore, the targets obtained for each region were as follows: Northern states 45 meters per square kilometer, Middle Belt states 54 meters per square kilometer, and Southern states 130 meters per kilometer.

42. For example the comparison of construction unit costs from appraisal and completion reports have the following problems. Construction costs reported at appraisal refer to proposed standards, while the costs reported at completion usually refer to an average of standards achieved in a vast area (a state in Nigeria is quite large), are usually not reported, and are different from the standards set at appraisal.

Similar problems appear in the comparison of road construction and maintenance unit costs between different organizations and between countries. Under different institutional arrangements, different costs are reported including different proportions of total overhead. Donor projects usually report the total cost with an overhead representative only of projects which are added to an existing institutional framework. On the other hand, government figures include different levels of total overhead, usually higher than that of donor projects.

43. The per kilometer costs of road construction with equipment-intensive and labor-based methods were reduced after devaluation as the following table indicates:

	Construction Costs per Kilometer	
	1983 (U$1 = N 0.67)	1987 (U$1 = N 4.25)
	Equipment-Intensive Kaduna ADP	
Local Costs	U$ 24,160 = N 16,000	U$ 3,760 = N 16,000
Foreign Costs	U$ 12,440 = N 8,240	U$12,440 = N 52,900
Total	U$ 36,600 = N 24,240	U$16,200 = N 68,900
	Labor-Intensive PPWP	
Local Costs	U$ 32,220 = N 21,600	U$ 5,080 = N 21,600
Foreign Costs	U$ 1,270 = N 850	U$ 1,270 = N 5,400
Total	U$ 33,490 = N 22,450	U$ 6,350 = N 27,000

44. World Bank 1988c; and "DFRRI: Facts and Fiction," in *Newswatch*, March 28, 1988.

45. The costs per kilometer for DFRRI in Table 14 are set by the Directorate to allocate funds to each state, and include only "out of pocket" costs excluding equipment depreciation. However, the actual cost of road construction is not available, particularly since there have been some problems with the reports on the construction achievements in each state. A recent article interviewed the chairman of an LGA in Bendel state saying that only traces are found of the roads claimed to have been constructed in his LGA (*Newswatch*, March 28, 1988). Certain areas have been bulldozed and others graded but the roads are not usable.

46. Above upper bound targets but almost identical to the target road length to be maintained regularly.

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Annex 1. Rural Road Benefits

Bingswanger et al. (1989), for example, presented a comprehensive model in which the impact of roads and other rural infrastructure on agricultural productivity is studied. This impact is examined as it affects production, both in conjunction with other factors as well as separately. The framework presented in Figure 1 explores also the impact of rural infrastructure on private investments and on increased access to credit.[1] An extensive analysis was conducted in 85 districts in India with data for 1961 to 1981. Improved road investment was found to increase agricultural output (with roads contributing directly for seven percent each to the growth of agricultural output and fertilizer demand), with roads also contributing significantly to bank expansion. The conslusions suggest that the major effects are not via an impact on private investment but rather through improved marketing opportunities and reduced transaction costs of all sorts.

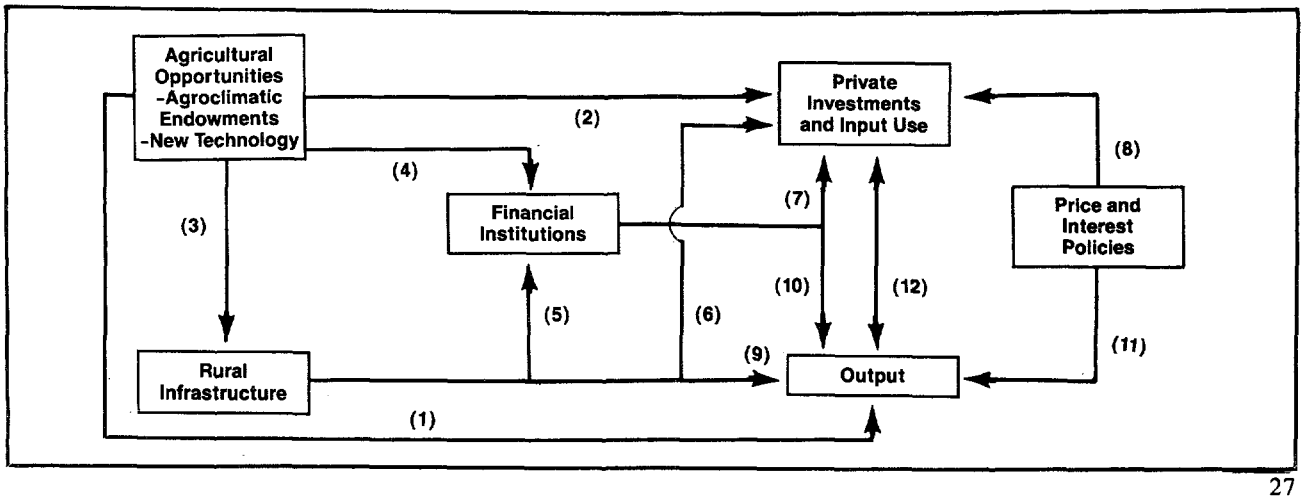
All these changes, however, vary according to local conditions. Exchange of agricultural products increase at existing levels of technology or at improved levels when not only land but also complementary resources are available through an improved quality of agricultural research (e.g., adaptative trials), increased access to extension, and increased supply of inputs. At low levels of technology price-based changes are likely to do less for increases in exchange than changes in technology. Indeed evidence suggests that in resource poor areas where scope for technical change is limited the majority of increase in demand for transport is for personal travel (Hine 1982).

One of the main effects of improved transport is its role as an accessory to agricultural modernization programs that encourage the introduction of mechanization, the use of chemical fertilizers, and high yield varieties. Adequate freight transport is necessary to ensure timely arrival of inputs at low transport costs. However, not only agricultural inputs find their way in. Rural areas are also opened to an inflow of consumer goods proportional to the purchasing power, increasing the demand for imported and urban produced goods, and expanding the market for national manufactures. This usually makes local artisans vulnerable to very strong competition, and therefore has the potential to increase the strength of rural-urban linkages. Transportation improvements can thus bring on a move away from village level subsistence toward greater specialization of urban and rural areas. Also within rural areas so far as different crops are concerned, a process occurs which can be seen as increasing modernization of agriculture (Richards 1984).

When improvements in road transport (e.g., a road rehabilitation) change the relative returns from labor and land, the potential for increases in production and consumption are greater if both land and labor availability are distributed equitably, and if institutions (e.g., markets) allow for such changes. Larger farmers are more capable of mobilizing factors of production in response to changes, and are therefore more able to appropriate a greater portion of the benefits. Where levels of poverty and available resources are such that effective demand for means of transport is low and few intermediate means of transport are available, the best road will have little more merit than a footpath (Richards 1984).

Finally, local conditions (e.g., labor market) influence the choice of road construction and maintenance technology which in turn affects the extent of impacts of road improvement projects. There is a whole range of technologies varying from equipment-intensive to labor-intensive methods, all of which have different effects depending on their use of resources. The experience with labor intensive construction methods has, for example, demonstrated that low volume roads can be constructed and maintained wherever labor is abundant and available, even seasonally, increasing rural incomes even with the existence of institutional inefficiencies. Construction technology and the levels of agricultural production affect construction standards. With lower standards, for example, more regular maintenance is usually required, and better local institutional capacity is therefore desirable to maintain the road. Hence, the standards used are important determinants of the extent to which the rural population can actually use the related infrastructure.

Figure 1



Annex 2. Review of the Road Components in ADPs

2.1. Review of Views on Construction Targets at Appraisal

In the early enclave projects, rural road construction received a strong emphasis along with input distribution and extension in as much as it was seen to facilitate these activities and provide marketing opportunities for the expected increases in agricultural production. As the PCR for Gusau, Funtua, and Gombe noted, there were very few rural roads in the areas covered by these projects at the time of their initiation. Moreover, the roads that did exist were not only in poor condition but they could be used only during the dry season. Thus, a declared goal of these projects was ". . . to bring most rural farmers within two kilometers of a road" (PPAR for Gusau, Funtua, and Gombe, p. 28). As a result, the highest targets of rural road densities of all the ADP projects were set, as seen in Table 5. These targets were subsequently replaced by less ambitious targets in the larger statewide projects.

Since the conception of these ADPs in the early 1970s, the existing local capacity for rural road building was identified as a persistent constraint. However, as Asif Faiz noted on an earlier draft "in these three projects there never was a serious attempt to mobilize small contractors and local residents as was done in the Rural Roads Access Programme in Kenya." The construction task was entrusted to field construction units managed and operated by the projects themselves.

Lafia and Ayangba ADPs set lower construction targets, and with the same reasoning of shortage of local building capacity, the actual construction was performed by project construction units. In this context the PPAR for Lafia and Ayangba (p.20) cites a revealing criticism, namely that "unless the road components were used to build up local road expertise through local contracting, these would hardly leave road building institutional development any heritage at all."

In the first statewide ADPs (Bauchi, Kano, and Sokoto), the proposed road-building intensity was much less than that actually achieved in the earlier enclave projects. For instance, the density of new rural roads targeted for the Bauchi ADP (BSADP) was 18 meters per sqare kilometer of the project area compared to 77 meters per square kilometer actually achieved at Gombe, the enclave project that preceded Bauchi (see Table 5). In part this is because only surfaced, all-weather roads which could withstand wear and tear better were to be built in all three statewide ADPs.

As in the case of the enclave projects, road construction was to be performed by the projects themselves. Given the large size of the projects that was incumbent upon their statewide nature, each project was divided into zones. Each of these zones was to have its own road construction unit supervised by a zonal roads engineer and a mechanical engineer. The recruitment of engineers, as well as the purchase of road construction and maintenance equipment (through ICB), was to be done internationally.

Although it is not clear from a reading of the appraisal report for Kano whether this applies to it also, at least in the case of Bauchi and Sokoto, the road programs were to be phased so as to allow for preconstruction training given the shortage of experienced, local road construction operators and mechanics. In addition, the appraisal report for Sokoto (p. 38) indicated that because of the watershed alignments which would be needed for the fadama roads, secondary roads would have to be built to provide access to villages cut off from the main roads as a result of these alignments.[1] Thus, it was proposed that "the project would assist LGCs in undertaking these road networks with their own resources. In this way, LGCs would benefit from project expertise and gain valuable experience and a sense of involvement in carrying out their own road construction program." Finally, the appraisal reports for all three statewide ADPs indicated that the annual rural road program "including justification, length and location" would be prepared by each project in consultation with the state ministries and LGAs,"and would be subject to an annual action plan to be agreed with the Bank prior to the beginning of each calendar year."

In the SAR for the Southern Borno ADP, the Bank has been forthright about the undesirability of undertaking new rural road construction in LGA jurisdictions because of the inability of the LGAs to maintain them. Both SARs for the Southern Borno ADP (June 23, 1986) and the first MSADP (June 3, 1986) were released at about the same time, and yet in the case of the MSADP the Bank has seen a role for the LGAs as discussed below. In fact, in the SAR for the Southern Borno ADP, the Bank alluded to the futility of constructing new roads in LGA jurisdictions. As that SAR (p. 9) observed,

> Experience with existing ADPs has shown that local government agencies assigned the responsibility for maintaining new roads constructed under the projects have neither the financial nor physical resources to fulfill this function. A similar situation exists in Borno State; the existing Local Government Authority (LGA) road network is not being maintained and there appears no likelihood that this situation will improve. Consequently, further additions to this system are not justified.

Thus, the road program envisaged by the Bank under the Southern Borno project focuses on tracks ". . . which are maintained by local communities and has not assumed that LGAs would fulfill this role" (SAR for Southern Borno ADP, p. 5). In brief, the main objectives of this program are to undertake improvements on about 1,000 kilometers of tracks built and maintained by local communities so as to make them more accessible during the wet season. In this, the project would cooperate with the local communities to identify the required improvements as well as provide materials and assistance for the actual work. The project would also perform spot improvements on about 150 kilometers of LGA feeder roads, and construct 135 kilometers of new access tracks to the fadamas. These new tracks would be maintained by the project during the project implementation period and for four years after the completion of the project; thereafter, the responsibility for their maintenance would be transferred to local communities.

In line with the shift of emphasis in the statewide ADPs from road construction to road rehabilitation and maintenance, the first Multistate ADP (covering 7 states) focused on rehabilitation and maintenance from the outset. However, at about the same time that the MSADP commenced, the Directorate of Food, Roads, and Rural Infrastructure (DFRRI) was also established in the president's office with counterpart institutions in the state governments. Judging

from early supervision mission reports for the MSADP, there is a clear division of functions between the project and the DFRRI inasmuch as the former will undertake only rehabilitation and maintenance work and the latter only the construction of new roads. For instance, a supervision mission report for the Anambra state component of the MSADP (February 18, 1987) noted that "it was agreed that there is no conflict between the road program envisaged by the ADP and the DFRRI. The DFRRI would concentrate on construction of new roads and the ADP would focus on rehabilitation and maintenance of existing roads."

In much the same way as for the earlier ADPs, an objective of the first MSADP road program, as stated in the project SAR, is to provide farmers with all-weather access to service centers for the purchase of inputs and the sale of output. But in addition, the SAR (p. 21) assigns to this program two other objectives which are of an institutional nature, i.e., to ". . . begin to build a permanent capacity in the LGCs to maintain their roads, and . . . strengthen the Nigerian institutional capability to prepare, implement, and monitor execution of a feeder road program."

The aim of the rehabilitation and spot improvement program is to improve road success by undertaking work especially along those stretches of roads most prone to disrepair (e.g., water crossings and areas with poor drainage). But unlike the earlier ADPs which have preferred to perform road construction and maintenance tasks themselves through project units, "the preferred method of execution is by contract." The SAR for the first MSADP noted that studies were underway in the various states included in the project to assess the availability of local contractors, and to consider the relative efficiency of using them as opposed to the project undertaking the work itself. It was suggested that only in cases where local contractors were not available would the project carry out the work itself.

The project SAR states that ". . . the participating states, with the exception of Plateau and part of Benue, have adequate . . . LGA roads constructed to varying standards." In spite of this, the road rehabilitation targets were set at 600 kilometers spread over four years in each of the seven MSADP states, and no further provisions were made to improve, if needed, the densities in Plateau and Benue. As Table 6 shows, the resulting densities of road rehabilitation vary widely from state to state but are in line with densities for road construction in previous ADPs (see Table 5). The road selection task was assigned to the Infrastructural Services Division to be created in each state ADP, with assistance from FACU. One of these programs prepared for Benue state criticizes the road rehabilitation target, set equal for all states, because in order to achieve the annual rehabilitation target included in the SAR, some of the selected investments will have economic rates of return below the 15 percent required.[2]

The second MSADP includes the states of Niger, Kwara, and Gongola which have some of the lowest densities of rural roads in the country. The SAR sets the lowest targets of roads to rehabilitate per square kilometer of project area (see Table 6). Road rehabilitation as in the previous MSADP was to be carried out "in general" by contractors. While no apparent reason for these lower densities is included in the SAR, the rehabilitation targets of the third MSADP return to the level of the first MSADP (as shown in Table 6). The views on rehabilitation arrangements at appraisal are the same as in the second MSADP with one minor exception. The SAR clearly limits the amount of work done under force account to 20 percent, as a means to ensure maximum efforts to develop the work through contractors. In addition to the cost benefit analysis estimating as benefits the road user savings and increases in production, the SAR states that the roads to be rehabilitated should have traffic of more than 25 vehicles per day.

Most of the above discussion has been about densities at the state level. Much less is known about the distribution of target densities within subareas of each state, at the LGA level. Unfortunately, with available data this exercise is not possible. As an example, an examination of the plans for the first two years of the Benue ADP (part of the First MSADP) indicates that there is a more or less balanced distribution of roads among the 23 LGAs in the state.[3] Each year's program includes approximately 10 of the 23 LGAs in the state. The only concentration of roads to be rehabilitated (as a proportion of total kilometers) is observed in those LGAs which are in a radius of 65 kilometers from Makurdi, the state's capital.

2.2. Review of Views on Maintenance at Appraisal

The maintenance of the rural roads constructed under the early enclave projects, as the SARs indicated, was to be the responsibility of the local government authorities (LGAs). In this context, the SAR for Funtua (Annex 4, p. 4) observed that while "some maintenance would be undertaken by the project during the development period, the allocation of construction plant for maintenance would not be allowed to interfere with output of new road; thus once a new road has been built maintenance responsibility would be handed over to the Katsina Local Authority." Funds were to be allocated under the projects for the purchase and operation of maintenance equipment. Also, in the case of the first three projects, it was proposed that staff of the local government authorities would be seconded to the projects for "training and operational control."

Once again, in the Lafia and Ayangba ADPs also, road maintenance was to be entrusted to the LGAs. However, unlike in Gusau, Funtua, and Gombe where the intent at appraisal was to hand over the roads to the LGAs almost as soon as they were built—i.e., even while the projects were still functioning—this time it was to be done on completion of the projects. In relation to this, the SARs for Lafia and Ayangba (pp. 11-12 and p. 11, respectively) noted in an identical fashion that "the project would work closely with LGC to develop an adequate road maintenance capacity that could be operated by the LGC at the end of the project period." Indeed, during the period of their existence, these two projects were expected to not only maintain the roads constructed by them but also the nonproject roads in their jurisdictions, and for the first time the SAR for Ayangba contained targets for routine and periodic maintenance.

The staff appraisal reports for Bauchi, Kano, and Sokoto were completed in early 1981. On the other hand, the Ayangba and Lafia projects did not close until 1984. Thus few lessons pertaining to road maintenance would have been available, and available lessons would have been limited largely to those from the completed trio of initial ADPs (Gusau, Funtua, and Gombe). All the same, it is interesting to note that some of the maintenance arrangements proposed by the SARs for Bauchi, Kano, and Sokoto conformed to the recommendations contained in the

project completion reports for Lafia and Ayangba.

For instance, according to the SARs for Kano and Sokoto, a road maintenance unit, quite distinct from the road construction unit in terms of being assigned its own equipment and staff, was to be set up in each project zone (this was recommended by the project completion report for Lafia also). Although distinct road maintenance units were proposed in the case of Kano and Sokoto, this was not so in the case of Bauchi.[4]

The SAR for Bauchi indicated that zonal construction units would maintain the new roads for a period of one year after construction before relinquishing them to the LGCs for future maintenance. Nevertheless, the SAR also made it clear that if the need arose, the Bauchi road construction units would be prepared to maintain these roads for the entire period of the project. Because of their ultimate responsibility for road maintenance, it was agreed upon between the Bauchi state government and the Bank during negotiations that the LGCs would provide funds and staff for all road maintenance work carried out by the project (no such financial arrangement was mentioned by the SARs for Kano and Sokoto). As opposed to Bauchi, in Sokoto's case, all roads built under the project were expected from the outset to be maintained by the proposed zonal maintenance units through the entire period of the project. On the other hand, in the case of Kano, it was indicated that traffic monitoring studies were to be performed on the project roads, and the responsibility for the maintenance of those roads used by more than 100 vehicles a day was to be transferred to the State Ministry of Works and Highways; although it is not clear from the SAR, it seems that those project roads carrying less than 100 vehicles a day were to be maintained by the project maintenance units for the entire project period.

All three statewide ADPs were to provide training to LGC staff in order to prepare them for their future responsibilities with respect to road maintenance. In this context, the SAR for Sokoto specifically referred to the inclusion of a road maintenance training engineer in that project to identify the training needs of the LGC staff. Finally, in the case of all three projects, the SARs suggested that on completion of the projects the zonal road maintenance units (the road construction unit in Bauchi's case) could serve as the basis for the creation of joint zonal LGC boards for road maintenance and construction. The view was that this would not only be more efficient than each LGC having a separate maintenance unit but it would also vitiate the need to divide among LGC's the zonal equipment accumulated under the project (again, this was recommended by the PCR for Lafia also).

Unlike the previous projects, the SAR for the first MSADP divides responsibility for maintenance operations. Recurrent maintenance,[5] was assigned to the project, and periodic maintenance[6] to the LGCs. As the SAR states, "in each state one mobile unit is established to carry out biannual recurrent maintenance on 400 kilometers of roads. The LGCs would be closely involved in their planning and implementation. There will also be close liaison with LGCs to establish routine maintenance capability on about 1,000 km of roads in each state." The training of LGC personnel as well as supervision and equipment was to be procured by the project.

Some uncertainty was expressed by the SAR about the ability of the LGCs to maintain roads after the project period given their financial problems. It was, however, indicated that (p. 22) "the project is seen as only the first phase of a longer term program and additional support could be provided under a second phase." In this context, funding needs and the progress in the development of a local road maintenance capacity were to be reviewed every year on a joint basis by the state governments concerned, the LGCs, the project management, and FACU engineers.

The SAR for the second MSADP (May 1988), as in the case of the first MSADP, also divides the responsibility for maintenance operations. In this case the project funds recurrent maintenance and portions of routine maintenance. Recurrent maintenance will be performed by a force account mechanical maintenance unit in each state, which will be for rental to the LGCs, but will not be subject to contract. The costs of these units inclusive of overhead costs will be monitored by FACU and compared to private contractor costs. The LGCs and ADP would jointly agree on an annual programme, defining the extent of force account and contract works. The project will finance initial training of LGC engineering staff and provide each LGC with necessary hand tools for routine maintenance. Routine operations would be manual and carried out with the lengthman system. One lengthman would be assigned for each three to four kilometers of road, and a headman for every eight lengthmen. The LGCs would pay the lengthmen and headmen and be reimbursed for the work done after a supervision from each ADP. The maintenance targets in the second MSADP cover a larger proportion of existing roads (see Table 6).

Finally, the SAR for the third MSADP (draft October 1988) assigns, as in previous projects, recurrent maintenance to be done by contractors on an annual basis awarded under competitive bidding, and routine maintenance under the LGCs. The maintenance targets for this project are higher in absolute numbers per state, than all targets in preceding projects (see Table 6). As a proportion of all rural roads in the state, the targets are similar to that of the previous MSADP. The SAR has no specific mention of the actions recommended from each LGC with reference to the rest of the network.

2.3. Review of Rural Road Standards

The early enclave projects intended to build roads according to one uniform standard of minimum specifications. These roads were supposed to be unsurfaced, with a right of way of 12 meters, and a carriage-width of 5 meters. Soon after initiation, the PPAR states, the three projects decided to build only surfaced roads since "the roads will generate much traffic and the vehicles using them were heavier than expected."[7] Other than this change, the specifications followed closely the SAR.

The Lafia ADP changed deliberately the standards after initiation, increasing the carriage-width to 6 meters, and constructing two types of roads to meet different levels of traffic: (1) a type I road with laterite surface and culverts for roads with high traffic, and (2) a type II road with no surfacing or culverts. In this project as in Ayangba no control of surfacing thickness or quality of surfacing was conducted.

Specifications in these enclave projects complied with the project design, but the completion report states that there was a wide range for their acceptance. For example, the carriage-width increased one meter in the five early enclave projects, while it was reduced in the Ekiti-Akoko ADP. The same is true of the camber, i.e., the slope of the section between the road center line and the edge, which varied between 2 and 5 percent in these ADPs.

Finally, the multistate ADP projects have adopted standards that are equal to those of the Ministry of Works, and that adapt to the variability of traffic among different rural roads. These standards have three versions, according to the level of traffic, including: (1) farm access roads (up to 50 vehicles per day), (2) feeder roads (up to 100), and (3) LGA roads. There is no specific mention as to how much these standards have been achieved, and how quality control is supervised in the more recent projects.

The *actual* standards achieved in the first MSADP vary unnecessarily between projects and exceed the standards set.[8] As an illustration, the actual pavement width of some of the roads constructed varied between 7 and 10 meters against a suggested width of 4.5 meters, a difference that leads to a substantial increase in rehabilitation and maintenance costs. In the future the Bank expects to correct this, reimbursing against standards previously set and therefore ignoring excesses.

2.4. Traffic Counts

First, road impact evaluation should vary given the wide variation of traffic levels discussed below (see section 2.3.). Second, a review of the completion and appraisal documents shows that traffic counts in the earlier projects were only done sporadically, and never in a way that allowed a systematic evaluation of changes in road use. The PPAR for Gusau, Funtua, and Gombe (p.32) mentions only one road count where 400 movements were observed in a road in one week. In the same way, the PPAR for Lafia and Ayangba mentions that "all the formal economic analyses . . . overlooked the principal contribution of their feeder roads: namely road user cost savings." The PCR for Ekiti-Akoko states that "benefits from roads were not recognized" in the evaluation. Post project traffic was collected for the Bida ADP roads. Since these roads are now part of the Niger state ADP project, these traffic levels will be used for the future project evaluation. The Bank criticizes the methodology of the counts stating that the "data is suspect."[9]

For the more recent ADPs, FACU has collected traffic data on some roads before and after improvements. However, comparisons for the same road have not been possible in most cases, because the surveys are conducted on roads which are later not included in the road programs, or have not been included in the road programs to date. For example, the road selection for Benue State (First MSADP) states that "traffic levels on roads rehabilitated are not known for most roads, despite the fact that a traffic count study was commissioned by FACU. However, the roads covered in the survey do not coincide with the areas of influence of the candidate roads in the first year plan in these states."[10] Probably in view of the difficulties encountered in conducting road counts, the Bank hired a consultant to conduct appropriate counts on the roads to be included in the second MSADP in Kwara and Niger state.

Available traffic counts indicate that traffic levels vary widely. For the BIDA ADP roads included in the Niger State ADP (first MSADP), observed traffic varied from 15 to 124 vehicles per day, which clearly denotes the need to include road user savings in the busier roads.

From the consultants counts for the second MSADP, the results yield even larger variations of traffic in the supposedly rural roads. In Niger state, five out of ten roads surveyed had daily traffic ranging from 174 to 658 vehicles per day, while in Kwara state two roads had traffic of 350 and 970 vehicles per day. These large volumes of traffic are quite distinct from those expected in the PPAR for the first MSADP in which "site inquiries by the appraisal mission in agricultural areas generally indicated average daily traffics (ADT) of 30 to 35 vehicles on market days and normal of 15 to 20." The differences in traffic volumes are encountered simply because often roads that carry larger volumes of traffic and should be classified as secondary roads for administrative reasons end up being classified as a rural road to be included in the rehabilitation program. This is common given that the definition of rural road is too broad, particularly if no traffic data is collected.

2.5. Review of Indirect Benefits

The ex-post evaluation in the PPAR for Gusau, Funtua, and Gombe considered the road construction program to have been successful as it both ". . . provided each project with the infrastructure required to implement project activities and . . . very important transportation access to the village farmers" (p.31). Indeed, in the context of its calculations of the ex-post economic rates of return the PCR (p.48) observed that the computed rates could be significantly raised by the inclusion of indirect benefits in addition to the direct ones associated with production increases."[11] The most notable among these benefits were felt to be "the benefits derived from road construction which are manifested in the extended life of motor vehicles, lower prices of consumer goods, lower operating costs for [passenger] transport, [and] value of time saved [to passengers]."

The PPAR for Lafia and Ayangba reflected also on the deficiency of the economic analyses performed for these projects to take account of the benefits of the constructed rural roads. In addition to overlooking road user cost benefits, as mentioned in the previous section, "all the formal economic analyses . . . overlooked the stimulus to production and trade of all kinds" (p.8). The PPAR consequently decided to retain the reestimated project ERRs of 6 percent for both Lafia and Ayangba because ". . . uncounted road benefits could well offset the discount in crop production benefits introduced by the Bank in the PCR overview." If the ex-post rate of return is 6 percent and the technology and extension components are considered to have yielded no return, then the share of roads in the estimated 6 percent rate of return is obviously much higher than 6 percent.

Finally, a recent supervision mission reports that as a result of road rehabilitation in the Kaduna ADP a survey "showed [a] reduction in the cost actually charged for transportation of farm produce by pickup or minibus [33 and 48 percent, respectively] . . . with corresponding reduction in passenger fares."[12]

2.6. Review of Maintenance Achievements

The view at the time of the appraisal of the early enclave projects, as noted above, was that all types of maintenance were the responsibility of the LGAs. However, in terms of the actual experience of the projects in relation to this question, the PPAR (p. 40) noted that the LGAs ". . . have been deficient in funding and staff resources, and have had priorities which do not include maintenance of project-built facilities" (PPAR, p. 40). More specifically (p. 40),

> At Gusau, LGCs have begun contributing to the costs of the maintenance being carried out by the project unit, while at Gombe the LGCs have been doing some maintenance work themselves, though this has not been adequate. LGCs in the Funtua area have not yet accepted responsibility for maintenance.

In the case of Gusau, the intention seems to have been that the LGAs would contribute financially to the project for the maintenance work until such a time that a zonal maintenance unit could be created to serve the needs of a number of LGAs. What in fact happened was that the project road construction unit continued to exist and perform the maintenance functions even after the project itself closed, i.e., until the start of the Sokoto statewide ADP which then took over the responsibility for maintenance of the roads constructed at Gusau.

The road component was considered to constitute the only successful aspect of Ayangba and Lafia and substantial benefits were associated with it during the project period. The PPAR (p. 8) for these projects expressed uncertainty about the future flow of such benefits "because of the unresolved problems of maintenance." As noted above, it had been proposed at appraisal that the projects would collaborate with the LGAs on maintenance in order to prepare them to assume full responsibility for it on completion of the projects. But as the PCR for Lafia (p. 71) observed, ". . . joint maintenance program with LCG's have not proved possible. The LCG's . . . simply lack the staff and resources to participate effectively." The PCR for Ayangba (p. 143) further noted that "The SAR proposal that the roads should be handed over to the LGCs is clearly impractical and the only sensible solution would seem to be the project unit remaining operational and funded for maintenance." This indeed happened at Gusau as mentioned earlier.

Concern about post-project maintenance of roads came to the fore early in the case of Lafia and Ayangba because signs of deterioration emerged almost as soon as the projects were completed. Certain features of the road construction programs pursued by these projects contributed to this early deterioration. The features in question can be summarized on the basis of the PPAR for these projects:

First, the projects were deficient in meeting their road maintenance targets although they exceeded their targets for road construction. For instance, at Lafia, little maintenance was attempted in the first three years, while in the last two years, the financial difficulties faced by the project restricted the amount of maintenance that could be undertaken.

Second, it appears that in exceeding their road construction targets, the projects might have sacrificed quality. As the PCR for Ayangba (p. 142) noted ". . . the rapid progress" made by the road construction program "was not without a cost. Technical standards were changed and the resulting quality is not as good as should have been attained." On the other hand, in the case of Lafia, as mentioned in the last section, a significant portion of the total road length constructed consisted of unsurfaced roads. Interestingly enough, the PCR for Lafia (p. 71) pointed out that given the excess capacity of the project road-building plant, all roads could have been surfaced at little extra cost.

Finally, despite the intention at appraisal to establish a separate road maintenance unit in each project, as distinct from a road construction unit, this was not done in practice. The road construction unit was expected to meet the maintenance requirements also. This might explain why, for instance, at Lafia, very little maintenance work was undertaken in the first three years of the project; it was during these years that the majority of the roads were built and the road construction unit probably had little time to devote to maintenance.

Thus, the PPAR for Lafia and Ayangba (p. 3) concluded that the limited efforts of these projects with respect to maintenance, "together with the absence of specific post-project arrangements for maintenance and the poor resources of the Local Government Authorities (LGAs), have left roads in a deteriorating condition soon after project completion." In relation to this, the PCR for Lafia (p. 71) provided the following advice for future projects:

> The feeder road maintenance problem is completely predictable and should be taken into account in designing future projects. First, feeder roads should be built to higher standards initially to minimize subsequent maintenance requirements. . . Second, projects should set up separate maintenance sections within the roads unit which could continue with state or local government funding after the initial project investment period; keeping a functioning unit together makes more sense than dividing equipment among a number of LGC's.

The road maintenance arrangements that had been envisaged in the SARs for the statewide projects were proving to be unrealistic in all cases as indicated by the midterm reviews. For instance, in the case of Bauchi, the decision at appraisal to hand over roads to the LGCs, after they had been maintained by the project itself for an initial period of one year, did not materialize. The project found that the LGCs did not have the funds to do this and consequently initiated arrangements whereby it acted as a "maintenance contractor" to LGCs.

In the same way, the intention at appraisal in the case of Kano to entrust the maintenance responsibility for all roads carrying over 100 vehicles a day to the State Ministry of Works and Highways was also proving difficult to implement. As the midterm review for Kano (p. 19) noted "The transferring of responsibility for maintenance of roads is usually a slow and often difficult task particularly when the agencies accepting the responsibility do not have adequate equipment and funding." Thus, as was already being initiated at Bauchi, the midterm review for Kano recommended that the project enter into contractual agreements for performing the required maintenance work itself and be paid for it. Lastly, against the appraisal view that the roads constructed at Sokoto would be relinquished to the LGAs for maintenance on completion of the project, the midterm review for Sokoto (p. 15) noted that ". . . project officials are aware that LGAs will not be able to take over the maintenance because of lack of resources." It was indicated that the project was making arrangements to do that maintenance work itself.

The reports of recent Bank supervision missions provide some idea of the experience of these statewide ADPs with respect to road maintenance since the aforementioned midterm reviews were completed (i.e., May/December1985). Following the general conclusion of the midterm reviews that the LGCs did not have the capability to carry out the required maintenance, these supervision reports underscore a growing concern within the Bank about the future maintenance of the project-constructed roads. In this vein, a supervision mission report for Bauchi (December 3, 1986, p. 4), while acknowledging the project management's view that the project could exceed its road construction target by a considerable margin (i.e., by even more than what was anticipated at the time of its midterm review), ". . . reiterated the Bank's concern that the capital asset

developed under Gombe ADP and BSADP should not be sacrificed to an over-ambitious new construction programme."

Supervision mission reports for Kano and Sokoto suggest that in these projects, which appeared unlikely at the time of the midterm reviews to achieve their road construction targets before closure, the emphasis had shifted from construction to maintenance. To quote a supervision mission report for Kano (December 3, 1986, p. 6), "It was agreed by the State Government and KNARDA that the authority would in future concentrate its efforts on the rehabilitation and maintenance of roads and not on new construction." Similarly, in a supervision mission report for Sokoto (December 3, 1986, p. 9), it was observed that ". . . the mission fully supported management's emphasis on road maintenance as the main focus of the project's road program." This same supervision mission report for Sokoto, however, also suggests that the intention at appraisal (1981) to establish distinct zonal units for construction and maintenance had not been implemented as of December 1986. For the report stated that "SARDA is proposing to form four road maintenance units from the existing road construction units, and four new units from equipment to be procured . . ." (p. 9).

Given that in addition to a lack of expertise, funding constraints were also considered to constitute an important reason for the inability of local authorities to maintain roads, the aforementioned supervision mission reports for Kano and Sokoto as well as Bauchi indicated a willingness on the Bank's part to finance some of the recurrent costs associated with the maintenance work undertaken by the projects. Indeed, in Sokoto's case, the supervision mission (p. 10) affirmed that "recently Bank's management has agreed that the Bank would be willing to finance on a declining basis part of the non-salary recurrent costs of SARDA's road maintenance and rehabilitation program." Nevertheless, all of these supervision mission reports stressed that

> . . . in general the Bank expected the State or Federal Government to cover the recurrent costs of operations like road rehabilitation and maintenance. This was to ensure that when the Bank loan funds were exhausted the local authorities had already been providing for recurrent expenditures and thus the chance of disruption in maintenance and rehabilitation was minimized.

The achievements of the first MSADP are included in Table 9. This project was the first to divide maintenance operations, and even though the actual kilometers maintained are well below targets in all states, the number of kilometers with recurrent maintenance in one year are higher compared to that of most previous ADPs.

"Routine maintenance [in 1987] is practically non-existent in most states at this stage of the project." The ADPs and LGAs could not agree on the percentage of expenses to be reimbursed by the ADP to the LGA and local communities. Meanwhile, the LGAs did not carry out maintenance activities citing lack of funding availability for salaries. This points out the recurrent lack of financial ability of the LGAs which is still an unresolved critical point under the present proposed arrangements.

Annex 3. Cameroon Rural Road Target Densities

For comparison purposes the regions in Cameroon are broadly as follows: the Northern Plains (North and Far North provinces) have predominantly Sudan Savanna vegetation, rainfall between 400-1,000 millimeters, and population densities of 25 persons per square kilometer. In the Central Savanna (Adamaoua province), where Sudano-Sahelian Savanna predominates, rainfall averages 1,400-1,700 millimeters per year, and the population densities are low (about 7 persons per square kilometer). The Western Highlands, with Sudano-Guinean vegetation, fertile soils, heavy rainfall between 1,700-3,000 millimeters, and population densities of 82 persons per square kilometer. Finally, the Tropical Rainforest (i.e., East, Center, South, Littoral, and Southwest provinces) has a dense vegetation cover, which gives way to sparser Guinea forest and wooded savanna as one moves away from the coast. This region has heavy rainfall of over 3,000 millimeters a year in the Coastal region, and population densities that vary between 80 persons per square kilometer in Littoral, to 20 for the region as a whole.

Several projects were reviewed, covering all the provinces in the country. The target densities were calculated as in the previous section (see Table below). According to these calculations, the targets in both countries fall in the same range, between 30 and 120 meters per square kilometer. As in the previous analysis of road target densities in Nigeria one finds a close correspondence with population densities, and accordingly one can see that the highest targets are the ones for the Western Highlands, followed by the Northern Plains and the Tropical Rainforest. The lowest targets are assigned in the sparsely populated Central Savanna.

Cameroon Regional Average Target Densities
Meters per square-kilometer

Project	Area	Road Kilometers	Target Densities
Northern Plains			
Projet Centre-Nord SODECOTON	24,200	645	26
North and Far North Provinces SFRP[a]	102,600	3,590	35
Central Savanna			
Livestock Project	8,000	150	20
Adamaoua Province SFRP	61,990	480	8
Western Highlands			
Western Highlands Project	13,890	900	65
West and Northwest Provinces SFRP	31,190	3,820	122
Southern Tropical Rainforest			
ZAPI East Rural Dev. Project	13,500	540	40
Cocoa Project	25,000	950	40
Center, South, Littoral, Southwest Provinces SFRP	161,260	6,400	40
East Province SFRP	108,900	310	3

Annex 4. Rural Road Densities in India

Roads in India in 1961

State	Area sq.km. (1)	Population (2)	Total Roads km (3)	Meters per square kilometer (4)	Meters per person (5)	Other District Roads (6)	Village Roads (7)	Rural Roads (6)+(7) (8)	Meters per square kilometer (9)	Meters per person (10)
			Total Roads							
Andra Pradesh	274,674	35,977,999	53,818	196	1.5	2,862	16,985	19,847	72	0.6
Assam	121,984	11,860,059	29,139	239	2.5	529	16,078	16,607	136	1.4
Bihar	174,083	46,457,042	80,555	463	1.7	13,777	28,308	42,085	242	0.9
Gujarat	186,879	20,621,283	24,344	130	1.2	5,281	4,276	9,557	51	0.5
Maharashtra	307,909	39,504,294	50,760	165	1.3	4,310	13,671	17,981	58	0.5
Jammu & Kashmir	222,802	3,583,585	10,461	47	2.9	633	4,561	5,194	23	1.4
Kerala	38,858	16,875,199	19,422	500	1.2	533	6,828	7,361	189	0.4
Madhya Pradesh	443,434	32,394,375	47,229	107	1.5	2,572	11,988	14,560	33	0.4
Madras	129,842	33,650,917	46,448	358	1.4	4,889	13,471	18,360	141	0.5
Mysore	191,976	23,547,081	62,275	324	2.6	3,697	22,912	26,609	139	1.1
Orissa	155,819	17,565,645	31,114	200	1.8	3,038	10,617	13,655	88	0.8
Punjab	121,947	20,298,151	30,190	248	1.5	4,923	9,846	14,769	121	0.7
Rajasthan	342,268	20,146,173	40,982	120	2.0	7,875	11,823	19,698	58	1.0
Uttar Pradesh	293,846	73,752,914	98,304	335	1.3	7,995	43,233	51,228	174	0.7
West Bengal	87,873	34,967,634	64,491	734	1.8	6,200	26,165	32,365	368	0.9
Delhi	1,484	2,644,058								
Himachal Pradesh	28,177	1,348,982								
Manipur						355	177	532		
Tripura	10,453	1,141,492					675	675		
Andaman & Nicobar Islands	8,327	63,348	160	19	2.5	100		100		
All India	2,919,821	436,424,429	705,002	241	1.6	69,569	241,614	311,183	107	0.7

Note: Total roads in column (3) include national highways, state highways, major district roads, other district roads, and village roads. District roads serve areas of production and markets in the district connnecting them with one another or with main highways. Village roads connect villages and groups of villages with one another and with the nearest district road or highway.

Source: (1) and (2) India, Central Statistical Organization 1961. Statistical Abstract.
(3) and (6) Central Road Research Institute 1963. "History of Road Development in India," New Delhi.

Annex Notes

Annex 1

1. "Better agroclimatic opportunities such as better rainfall, a higher moisture holding capacity of the soil and better irrigation potential directly affect agricultural output (relation 1). Better opportunities also increase the economic return to private farm investments such as tractors, draft animals or pump sets (relation 2). The greater private profitability of agriculture in well endowed regions induces farmers to press governments for increased investment in the supportive infrastructure (relation 3). Financial institutions find it more profitable to locate in environments where a good agroclimate and rapid technical change lead to a substantial demand for agricultural investment and working capital and a high repayment capacity (relation 4) and where good infrastructure reduces their cost of intermediation (relation 5). Private agricultural investment and input use is more profitable the better the agricultural opportunities (relation 2), the better the government infrastructure (relation 6), the cheaper the cost of financial services (relation 7), and the more favorable price and interest policies are which are pursued by the government (relation 8). Exactly the same factors affect the output supply (relations 9,10,11). This means that agricultural opportunities must be translated into public and private investment efforts to affect agricultural output. The traditional production function approach has attempted to estimate the direct impacts of capital stocks (investment) and input use on output (relation 12), ignoring much of the factors discussed here and all the simultaneity problems" (Binswanger 1989).

Annex 2

1. Given the emphasis placed on small-scale irrigation in the statewide ADPs, an objective assigned to the road construction programs at Kano (KNARDA) and Sokoto consisted of improving and building fadama access roads stressing the importance of roads in facilitating irrigation.

2. FACU, *Project Year Two, Feeder Road Improvement Programme* (Benue ADP), Ibadan, Nigeria, 1988.

3. FACU, *Project Year One. Feeder Road Improvement Programme*, Federal Department of Rural Development, Federal Agricultural Coordinating Unit, Ibadan, 1982; and FACU, *Project Year Two. Feeder Road Improvement Programme*, Federal Department of Rural Development, Federal Agricultural Coordinating Unit, Ibadan, 1988.

4. It is not clear why arrangements differed among the three projects especially given that they were all appraised at about the same time.

5. Mechanical grading performed once or twice per year depending on traffic levels.

6. Includes manual pothole repair, drain and ditch clearing.

7. Surfaced roads refer to a road with 10 to 15 millimeters of laterite surface which ensures an all-weather condition.

8. February 1989 Supervision Report. Memo from L. Campbell to A. Seth on "Thematic Supervision—Feeder Roads and Water Supply Components of ADPs."

9. PPAR Second MSADP.

10. FACU, *Project Year Two, Feeder Road Improvement Programme* (Benue ADP), Ibadan, Nigeria, 1988.

11. Ex-post calculated rates of return were 16, 18, and 24 percent for Gusau, Funtua, and Gombe, respectively, including all project components.

12. World Bank, *Kaduna State ADP, Aide-Memoire*, December 1988.

Annex 3

1. Proposed Second Feeder Roads Project. The road kilometers in this case are the total kilometers to be maintained every year.

List of MADIA Discussion Paper Series

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THE MADIA STUDY

Although many generalizations have been made about the agricultural crisis in Africa, relatively few detailed country and cross-country studies of African agriculture based on systematic data analysis have been conducted. Similarly, although foreign aid has constituted a large part of total government expenditures in Africa for close to fifteen years, there has been little analysis of the role of external assistance in African countries that goes beyond political criticism of official assistance or the alleged self-serving objectives of donors. The impetus for the study "Managing Agricultural Development in Africa" (MADIA) was to begin the process of filling this gap and to explain the nature and sources of the agricultural crisis, particularly the extent to which it originated in resource endowments, historical and contemporary events, external and internal policies, and the economic and political environment.

The MADIA study involved detailed analysis of six African countries—Kenya, Malawi, Tanzania, Cameroon, Nigeria, and Senegal. In addition to the World Bank, seven donors, USAID, UKODA, DANIDA, SIDA, the French and German governments, and the EEC participated in the study. The analysis of country policies and performance during the last 20-25 years was carried out with the benefit of substantial input from the governments and nationals of each of the countries represented. The study had three main areas of focus: (1) the relationship between domestic macroeconomic and agricultural policy and agricultural performance, (2) donors' role in the development of agriculture, and (3) the politics of agricultural policy.

The MADIA study was the result of encouragement and support from many people. Anne Krueger, former Vice President for Economic Research Staff in the World Bank, encouraged the establishment of these studies on aid and development in 1984. Gregory Ingram, former Director of the Development Research Department, provided unstinting support for the study. During the reorganization of the World Bank in 1986, the strong support from Benjamin King, then acting Vice President for Economic Research Staff, proved invaluable. Barber Conable, President of the World Bank, and Mr. Edward V. K. Jaycox, Vice President for the Africa Region, have played a key role by ensuring support for the study's completion, as did Stanley Fischer, the Vice President for Development Economics. Yves Rovani, Director General of the Operations Evaluation Department, was particularly helpful as the MADIA study drew heavily on the works of OED.

A special debt of gratitude is owed to the World Bank's Research Committee, which provided the initial funding for the study, and to the MADIA Steering Committee. In particular the strong support of the chair of the Steering Committee, Stephen O'Brien, has been of critical importance.

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