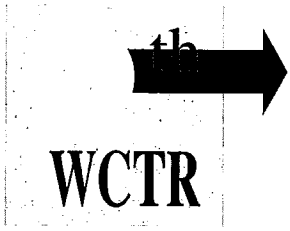

EVALUATING THE SOCIO-ECONOMIC IMPACTS OF RURAL ROADS: A CASE STUDY IN MOROCCO

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Abstract

This study assessed the impact of improving and paving rural roads, and determined how these investments improved transport, and filtered to the agricultural economy and the social sectors. Using a dual analysis (before-after, with-without), the study found major impacts in: elimination of road closures, lower vehicle operating costs, better passenger services, shorter access time to markets and services; higher land productivity and outputs, and changed technologies and output mix; higher primary school enrollment levels (especially girls), improved recruitment and retention of teachers, and similar improvements in health services, especially women. Surveys also showed a number of benefits in other areas.

BACKGROUND

This paper is based on a study by the Operations Evaluations Department, World Bank (1996),[1] that sought to understand the impacts that emanate from improving rural roads, and how they filter beyond the physical investments to the agricultural economy and the social sectors. The intention of the study was to derive lessons that can help Morocco and other countries to better assess the value of improving the rural roads network.

Morocco is situated on the extreme Northwestern corner of Africa, with a land mass exceeding 700,000 square kilometers, and combined Atlantic-Mediterranean coast lines which total almost 3,500 km in length. In 1995, the population is estimated to have reached 28 million inhabitants, of which close to 50 percent live in rural areas. Per capita income is estimated at approximately US$1,200.

Since its independence in 1956, Morocco has, as a response to climatic uncertainty, placed significant priority on the development of irrigated agriculture, and has invested substantial resources in dam construction and improving performance in the industrial crops sector, especially sugar, vegetable oil, cereals, dairy, and livestock. In addition to its commitment to food self-sufficiency, Morocco devotes substantial resources to the mineral industry and is the world leader in phosphate exports.

Concern for improving rural roads dates from the mid-1970's when Morocco's Ministry of Public Works commissioned a study to identify 8,000 km of rural roads in need of construction and/or upgrading. These efforts were reflected in the preparation of the 1981-1985 Development Plan. A key objective of this plan was to "...improve and expand the provincial road network to help alleviate rural poverty". This plan was the basis for the World Bank's Fourth Highway project, which included financing for investments in secondary and tertiary rural roads.

Rural inhabitants have received less benefits from the country's economic growth over the last decade than the urban dwellers. A result is that over 70 percent of the poor live in rural areas. The government, through investments in rural roads, combined with other infrastructure and social programs, is making efforts to improve the lot of the rural population. With this purpose, the government established a 5-year program (1996-2000) with a target to improve and pave 10,000 km of rural roads.

METHODOLOGY

The study assessed the impact of paving and other improvements (completed between 1987 and 1991) to four rural roads located in three different regions of Morocco: Northern (Chefchaouen), Central (Settat) and Southern (Marrakech). As a starting point, the study formulated four sets of hypotheses about the impacts of the road improvements:

- direct impact on transport infrastructure and services (such as, increased motorized traffic, decreased transport costs, improved access to services);
- impact on the agricultural economy (such as, reduced farm input prices, improved access to markets, increased outputs, changed output mix);

- impact on the social services especially health and education (such as increased use of existing facilities, improved capacity to recruit and retain qualified personnel); and
- impact on the environment (such as effects from increased traffic and economic activity, and transformation of output mix)

To test these hypotheses, the study utilized two types of analyses: first, for each of the roads considered, it compared current conditions with those before the investments (before and after comparison) and, second, it compared conditions in the project road relative to a control road which did not benefit from similar improvements over the period of study (with and without analysis). Control roads were located geographically near the project road so that they would reflect, to the extent possible, the 'without project' situation. Data was obtained from statistical records and from extensive surveys conducted at the farm, regional and village levels. Focus groups discussions at these levels helped interpret the data.

A study limitation is that since comparison roads were selected at the end of the project because they had no improvements over the project period, we cannot definitely attribute changes in the communities studied to road improvements. Despite the care in selecting control roads, it is possible that the communities near improved roads may have been systematically different from those in areas where the roads were not improved. For example, communities near improved roads may have been targeted for other improvements. In addition, the sample is too small. We believe, however, that viewed as case studies, the improved roads and the unimproved roads used for this study offer useful illustrations about the impacts of road improvements.

An additional caveat refers to the weather, and its influence on agricultural and socio-economic conditions. During the 10-year period under study, Morocco experienced periods of drought, when traditional agricultural production, notable cereals, fell sharply. The latest agricultural statistics, which were used in this study, were for the year 1993/1994, a year when rainfall was above normal. Thus, comparison of agricultural output with earlier years is somewhat distorted. However, for other aspects of the agricultural economy, as well as for most social impacts, rainfall conditions are immaterial to the analysis.

IMPACT ON TRANSPORT INFRASTRUCTURE AND SERVICES

All four roads studied were improved from an originally deteriorated gravel or unengineered track condition to an asphalt surface (mostly 4-meter paved width). The most direct impact was the elimination of frequent road closures during rainy periods, as the improved roads now are open to traffic year-round (Tables 1 and 2)

Table 1 - Road Conditions in 1982, Before Project

Region	Traffic (veh/day)	Surface	Periods of Road Closure
North	40	gravel, poor condition	about 90 days
Center	150	unengineered track	about 60 days
South	54	gravel, poor condition	during rainy season

Table 2 - Road Conditions in 1995, After Project

Region	Traffic (veh/day)	Traffic growth (%/year, since 1982)	Surface	Periods of Road Closure
North	640	23.8%	bitumen, 4-5.5m	nil
Center	275	4.8%	bitumen, 4 m	nil
South	192	10.3%	bitumen, 4 m	nil

The road users benefited in several other ways: the cost of operating vehicles dropped, leading to lower prices for freight and passenger services than in the roads not improved. Traffic on the project roads increased at higher rates than before the improvement, and comprised a larger proportion of larger, more efficient trucks. The supply of interurban passenger services increased substantially, especially share-ride taxis offering frequent service, where in the past the only service was a rural bus offering as little as one run a day. Ownership of motorized vehicles increased, both of cars and trucks.

The access time by the rural population to markets and social services fell drastically. In some cases, the time to access county and village administrative offices, agricultural extension personnel and rural markets, was cut by at least 50 percent (Figure 1). This improvement was a result of the better roads and, in some cases, of new facilities, whose construction was decided in part because of the improved roads.

Mode of Transport 1985	1995
Horse	Taxi
Horse	Taxi
Horse	Walk
Horse	Walk
Horse	Horse
Horse	Horse
Walk	Walk

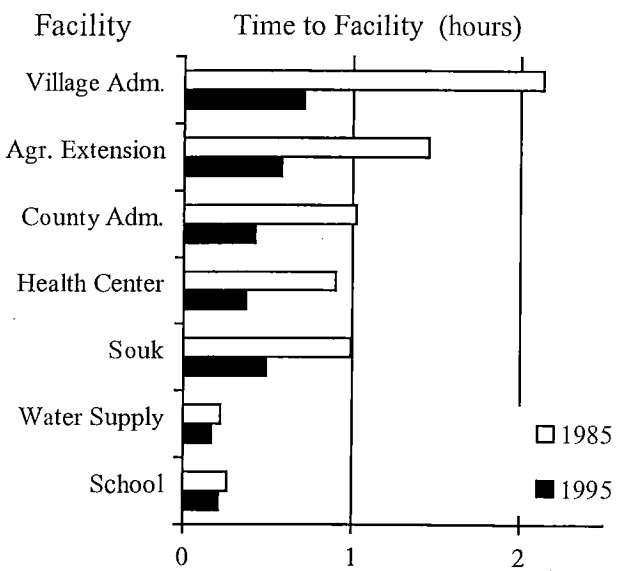

Figure 1 - Reaching Markets and Services: Modes of Transportation and Time Traveled (hours). (Aggregated for the three provinces in project zones only.)

The improvement in the roads resulted in a significant reduction in the cost of operating vehicles, often leading to lower transport rates offered by commercial trucking services. For example, data from a focus group for the two Southern routes shows that the rate for a truckload of merchandise between two population centers some 10 km apart went down from 300 Dh[ii] before the project to less than 150 Dh once the road was improved. In some cases, the reduction in the price of transport services paid by the local population was purely due to the better surface condition, which resulted on lower operating costs of the vehicles circulating on them. In other cases, transport prices decreased for many road users because the improved road completed a long haul link that was substantially shorter in distance than the existing road.

Another benefit was an increase in the quality and frequency of commercial transport services. For example, focus groups conducted in the Southern region noted that prior to the road improvement the only passenger service was a daily run of a rural bus. Today, a fleet of some 40 share-ride taxis serve these roads, with a frequency of several taxis per hour.

Survey data also revealed that annual transport costs of farming inputs (fertilizers, herbicides, seeds) per unit of cultivated area decreased drastically in the project area in the Northern road compared to the control areas. The annual transport cost of agricultural products to markets decreased in both the project and the control areas between 1985 and 1995, but the gains are substantially greater in the project than in the control areas (Figure 2).

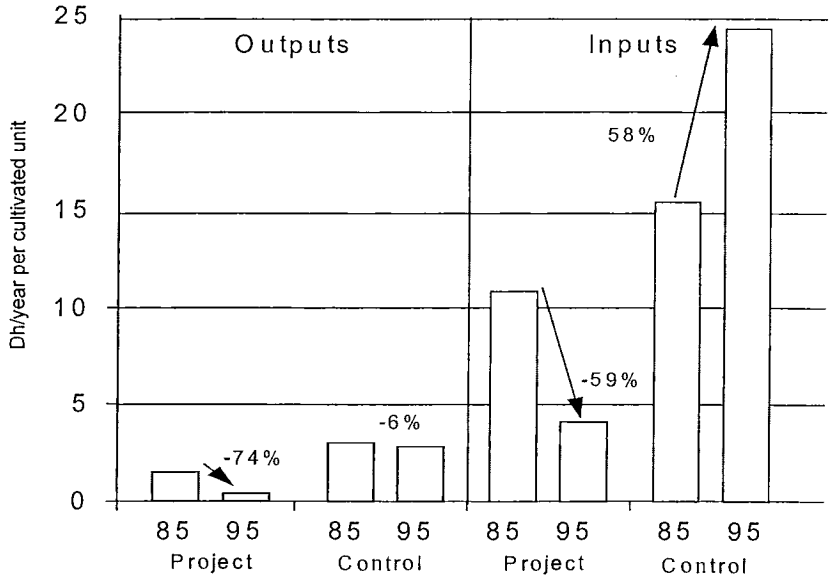

Figure 2 - Transport Costs of Agriculture Inputs and Outputs per Unit of Cultivated Land in Northern Region Road

Household transport expenditures over the 10-year period to 1995 increased (in current Dh) both in the project and in the control zones, but substantially more in control (188%) than in the project zones, despite the fact that annual household expenditures overall increased more in project (148 percent) than in the control (87 percent) zones. At the same time, improvements in the agricultural

economy and in social indicators were also better in the project zones. Generally, higher household expenditures and better overall social welfare lead to higher transport expenditures, but this did not happen. A likely reason is that improvement of the roads did cause transport prices, in current terms, to increase less in the project zones than in the control zones, even as the quality and frequency of road transport services improved more in the project zones.

Overall, motorization in the project zones increased. Ownership of cars increased about 3 times, reaching in 1995 one car per every 10 farms, compared to one car per every 30 farms in the control zone. Ownership of trucks followed a similar pattern, increasing in the project areas by about three fold, to reach in 1995 one truck for every 11 farms, compared to no change in the control zones, where truck ownership remained close to zero.

IMPACT ON AGRICULTURE

The study found that in the road project areas overall levels of agricultural activity increased in volume of production, productivity of the land, and monetary values of the output. The agricultural production mix was transformed as farmers were able to shift land from low value cereals to high value fruit and orchards, which yield higher profits, thanks to the reduction in perishability risks brought about by the better quality and year round operability of the roads. In two of the three study regions, land used for vegetables and fruits increased by over 40 percent over the study period.

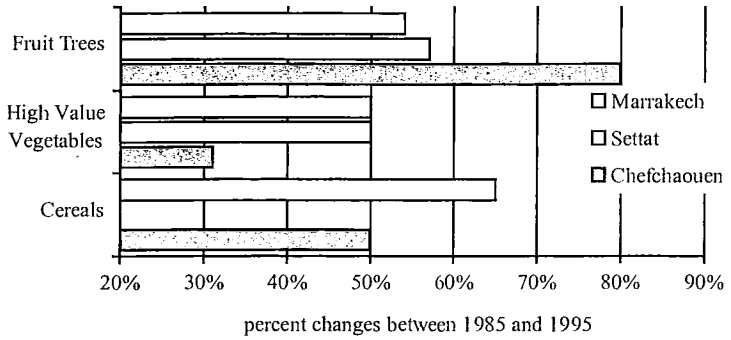

Figure 3 - Changes in Agricultural Productivity (Output per Unit of Cultivated Land) in Project Areas Between 1985 and 1995 (percentage change)

The transformation of the agricultural economy followed the well known Von Thunen model (Figure 4). In this model, the "economic" distance to market decreases as roads are improved, encouraging farmers to substitute grains by vegetables, which yield higher profits but due to their perishability require reliable and speedy transport.

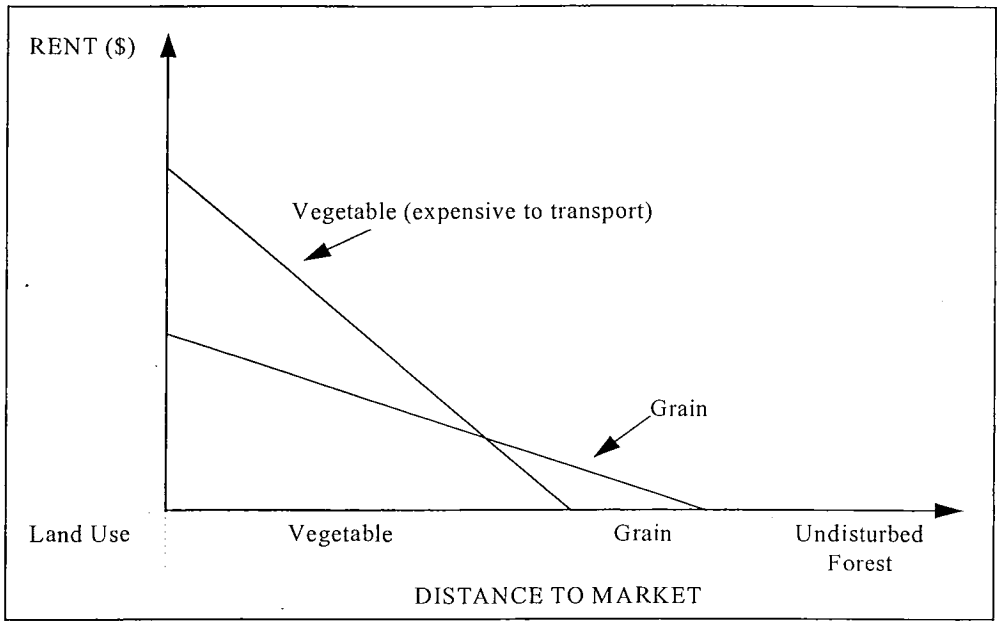

Figure 4 - The Von Thunen Model [iii]

Other agricultural effects included livestock production shifting towards pure breed cows; increased use of modern agricultural inputs, especially fertilizers, as improved transport made distribution channels better; increased use of agricultural extension services by the small farms (by a startling more than four times over the project period). The shift to higher value products, combined with improved yields for traditional crops, raised the value added per unit of cultivated land.

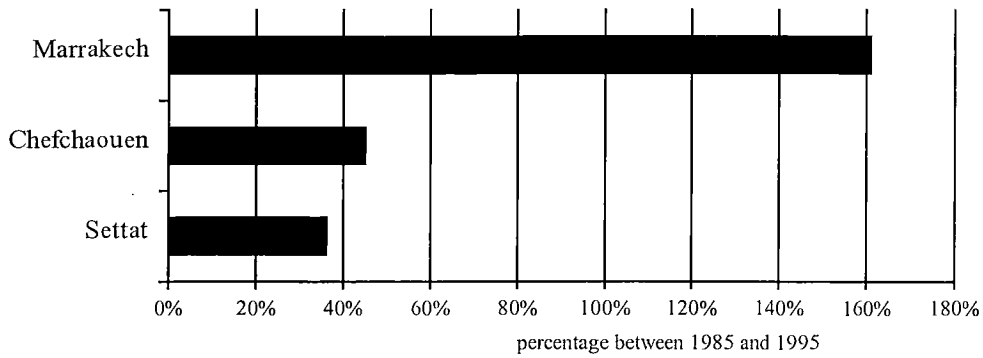

Figure 5 - Changes in Agricultural Value-Added (Dh per Unit of Cultivated Land) in Project Areas Between 1985 and 1995 (percentage change).

Improvements in the agricultural economy led to related changes in workloads, employment on farm and establishment of new shops; these changes followed different pattern depending on the regions. Off-farm employment grew overall by more than six times in the project zones (compared to about three times in the control zones) and happened across all three regions. The study found that

agricultural practices in the control zones, which did not benefit from improvements, remain essentially the same today as a decade ago.

IMPACT ON SOCIAL SERVICES

Overall Social Impacts

The surveys showed that while enrollment in primary education increased throughout all areas covered by the study, the gains in the areas served by the project roads, where enrollment more than doubled between 1985 and 1995, was substantially higher than in the control roads.

Table 3 - School Attendance (ages 7 to 15), in Project Zone, Before and After Project (*Percentages*)

	1985	1995	Percentage Change
All three regions aggregated			
Boys	39	81	108%
Girls	17	54	220%
Northern			
Boys	49	81	65%
Girls	10	38	287%
Central			
Boys	44	85	93%
Girls	26	67	162%
Southern			
Boys	34	80	134%
Girls	15	52	250%

In parallel, the quality of education improved, as it became possible to recruit teachers to staff the schools, and absenteeism of both teachers and students dropped.

The findings on the impact of improved, paved roads on education corroborate the findings of a study by Khandker *et al* (1994) based on a comprehensive survey carried out in 1990-1991 of standard of living throughout Morocco, notably that: "The presence of a paved road increases school participation for both boys and girls. When there is no paved road in a community, the school attendance is 21 percent for rural girls and 58 percent for rural boys. In contrast, the rate increases to 48 percent for rural girls and 76 for rural boys if there is a paved road in the community."

The rural population also nearly doubled their use of health care facilities (hospital and primary care) and, similarly to education, the quality of health services was enhanced as the supply of medicines improved, health officials launched a campaign to staff rural health care centers with a doctor, and immunization and other health prevention programs became easier to implement.

Table 4 - Changes in Frequency and Distances to Health Services in Project and Control Zones, Before and After Project, for all Three Regions Aggregated[iv]

	Infirmary		Health Centers		Hospitals	
	Distance (km)	Frequency of visits (days/year)	Distance (km)	Frequency of visits (days/year)	Distance (km)	Frequency of visits (days/year)
Project Zone						
Before	2.3	4.3	20.7	2.8	60	1
After	2.5	6	8.7	5.6	60	2.4
Control Zone						
Before	5	3.5	9.6	3.7	40	0.8
After	1.7	4.6	9.8	5	40	1.6

Rural-urban interaction increased several-fold in the two directions: urban dwellers visiting their rural relatives, and farm household members visiting cities.

Impact on Women

Education.

There was a dramatic improvement in the project zones in the enrollment of girls in primary school: it went up from 17 percent in 1985 to 54 percent in 1995. This happened consistently across the three zones under study, and all three zones registered enrollment levels higher than the national average for rural areas, especially in the Central region, where girls' enrollment reached 67 percent. One reason cited for the substantial improvement in girls' enrollment is that several new primary schools and satellite classrooms opened during the period.

By comparison, enrollment of girls in primary education in rural areas throughout Morocco remained practically constant during the study period.

Despite the large gains in the enrollment of girls in primary education in 1995, in the three zones combined, girls' enrollment levels were still substantially below boys', 54 percent versus 81 percent. It appears that the traditional reluctance of parents to send girls to school—because they contribute more than boys to household chores such as getting water and caring for siblings, and because of perceived dangers of rape when there are long distances and difficult trails to school—is still the primary cause for their lagging behind boys.

Health.

In the project zones, there was a clear gain in the frequency of visits by women to health services: their visits to a hospital more than doubled (2.4 per year in 1995, compared to 1.10 in 1985) and their visits to the primary care centers also increased (3.1 in 1995 compared to 2.3 in 1985). Men made relatively similar gains percentage-wise, but the frequency of their visits to hospitals was much lower than women (0.8 per year in 1995); however, it was about the same for visits to primary care centers.

Focus groups reported that women gained substantially from health programs in maternal and infant care and family planning, but no statistics specific to the project zones were available.

Another health impact is the diversification of the diet. Focus groups in the Northern region reported that while in the past they rarely ate fish, they do so now at least once a month; they credit this change to the paving of the project road, which has enabled refrigerated trucks to have access to the *souks* (rural markets) serving their areas. Similarly, it was reported that consumption of fresh vegetables and fruits increased.

Cooking and Heating

A major gain in women' welfare stemming from the better quality roads was the introduction of butane for cooking and heating. For example, focus groups in the Northern region reported that before the improvement of the road, women had to spend an average of 2 hours daily in order to get and carry fuelwood. Butane gas, used extensively in urban areas, did not reach the rural areas due to the high transport and distribution costs. The price of butane dropped almost 50 percent following the improvement of the road, and became affordable to the local population. A similar phenomenon was reported in the other regions.

IMPACT ON THE ENVIRONMENT

Changes in transport conditions and in the agricultural economy had both negative and positive effects on the environment although, overall, no environmentally sensitive areas were at risk by the road projects (which did not involve new construction). Negative impacts were those resulting from the increased traffic and economic activity, especially air and noise pollution and road accidents, and the increased use of fertilizers and other chemicals which, in all likelihood contaminated the water table. Positive impacts resulted in part from the transformation of the agricultural economy, notably curtailment of extensive goat and sheep herding -- that damages the soil cover -- and increased tree plantations, and from the broader use of butane substituting for fuelwood, whose demand exceed the size of Morocco's sustainable forests.

ECONOMIC ANALYSIS

The improvements in the agricultural economy and in access to social services translated into increases in the roads' traffic levels at rates substantially higher than on the unpaved roads. The study quantified the economic benefits accruing to road users in the form of savings in vehicle operating costs compared to the original, unpaved roads, and the economic gains resulting from avoiding carrying freight at the substantial higher costs of animal transport when the roads are closed to motorized vehicles. Social impacts, although real, could not be isolated for attribution to the road investments and particularly could not be reduced to monetary terms, especially since analysis techniques used for social investments generally rely on cost-effectiveness measures rather than on cost-benefit indicators. Therefore, social impacts induced by the improved rural roads were not quantified in the economic analysis.

The economic returns as well as the timing of the improvements for all project roads were found to be satisfactory (economic rates of return ranging between 16 and 30 percent). Even under a worse case scenario assuming lower traffic growth and reduced benefits from vehicle operating cost savings, the returns would have remained satisfactory. The benefits of the investments are expected to accrue to farmers in the form of expanded use of commercial freight services substituting for non-motorized carriage of loads, including the operation of heavier, more efficient trucks. The rural population in the roads' areas is expected to benefit mainly by the availability at affordable prices of frequent services by share-ride taxis.

CONCLUSIONS

Main Conclusions

The design of the study with its dual type of analysis (before and after, and with and without) allowed to carry out a unique investigation into the improvement of rural roads and their broader socioeconomic effects.

Most of the starting hypotheses were corroborated by the study's findings, confirming that rural roads improvements normally generate substantial social impacts in addition to the quantifiable economic benefits accruing to road users.

Many of the impacts were felt equally in all three regions considered in the study. In the transport sector, this was the case with the elimination of road closures, increase in the amount of large trucks offering lower rates, and increase in the availability of share-ride taxis, all of which showed a high degree of impact. The extent of other transport impacts as well as agricultural and social sector impacts differed considerably from region to region.

The lack of an adequate rural monitoring system made the data collection difficult, and suggests that Morocco as well as other countries could derive significant benefits from the setting up of a simple and practical monitoring system.
Impact on the social sectors are difficult to integrate with the traditional economic analysis, but the findings suggest that, as a first step, a multicriteria approach could be developed for assessing rural road improvements that would combine economic with social benefits

Summary of Impacts

Transport Infrastructure and Services

- year-round use of the roads, eliminating frequent road closures during rainy periods;
- reduced operating costs of vehicles, and lower rates for freight and passengers, resulting in substantial household transport savings relative to regions that did not benefit from road improvements;
- traffic increasing at rates higher than the past trend and comprising a higher proportion of bigger trucks that offer lower transport rates;
- a major increase in the supply of rural passenger services, especially share-ride taxis;
- a higher degree of ownership of motorized vehicles, cars as well as trucks; and
- a substantial reduction in access time by the rural population to markets and social services.

Agriculture.

- the overall level of agricultural activity increased in volume of production, productivity of the land, and monetary values of the output;
- the agricultural production mix was transformed, land use shifted from low-value cereals to high-value fruit orchards, and livestock production shifted to pure breed cows;
- the use of modern inputs, especially fertilizers, improved as distribution channels became easier and enjoyed lower costs;
- as a result of the shift to higher-value products, and the overall increase in yields, the value added per unit of cultivated land increased;
- related economic changes in workload, employment on and off-farm, establishment of new shops followed different patterns depending on the region.

Social Sectors

- *education*: enrollment of children in primary school more than doubled between 1985 and 1995, and quality of education improved; as new facilities were built it became possible to recruit teachers in the rural areas served by the project, and absenteeism of both from students and teachers dropped;
- *health*: visits per person to health facilities (hospitals and primary care facilities) nearly doubled over the period and, similarly to education, the quality of health services improved, as new health centers were built (except in the Marrakech area), supply of medicines was facilitated, health authorities launched a program to staff rural health centers with a full-time doctor, and immunization and other health prevention programs became easier to implement;
- *gender*: while the road projects did not originally aim to have specific gender impacts, they did: girls' enrollment in primary education more than trebled; women benefited from maternal and child health care programs; and, equally significant, the introduction of butane at affordable prices (thanks to the existence of paved roads) dramatically reduced women's chores of daily collection of fuelwood for cooking and heating; and
- *rural-urban interaction*: the improved rural transport services resulted in several-fold increases in social exchanges, both by relatives from the urban areas visiting the farms, and by farm household members visiting nearby cities.

ENDNOTES

i) A summary note, in the form of a Precis, was also published by the World Bank' Operations Evaluation Department (1996).

ii) Dh=Dirham, local currency. In 1997, US$1 equals about 9.5 Dh.

iii) As presented in Chomnits et al (1994).

iv) In the 1980s, health centers were conceived as primary care facilities serviced by a full-time doctor, while infirmaries were supposed to be staffed by nurses only. In practice, the intended level of staffing was often not reached.

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