Organization and Management of Road Maintenance in Developing Countries

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The deteriorating state of roads in many developing countries is causing concern and has been the subject of a major policy study by the World Bank. This paper, a part of that study, contains a discussion of some of the intrinsic problems that undermine the efficacy and efficiency of public road authorities, particularly those in developing countries. A number of reforms are recommended in order to create stronger incentives for efficiency, including separation of the planning and control (client) functions from the works execution (contractor) functions; greater reliance on competitive tendering of routine as well as periodic maintenance; reorganization of equipment ownership and management; and changes in the role, sources, and contractual modes for foreign technical assistance.

Road authorities traditionally perform three primary functions:

1. Roads development and maintenance;
2. Control of contracted works, including not only new construction but also larger works for rehabilitation and periodic maintenance, and in some cases routine maintenance; and
3. Direct (force account) execution of routine maintenance, often periodic maintenance, and in some instances new roads construction.

Of these three functions, contracted works for new construction and capital renewal have normally accounted for the greater part of expenditures. Direct execution of maintenance works has accounted for the preponderant share of road authority employment, and, for a number of reasons, a disproportionate share of the difficulties that have been experienced.

Despite strenuous and protracted efforts—including management consultancies, technical assistance, and training totaling more than $1.2 billion from 1971 to 1985 by the World Bank alone—the bank, its cofinanciers, and the recipient countries have had few successes in establishing institutions capable of sustaining cost-effective road maintenance with domestic resources. Three factors appear responsible for this lack of success.

1. The chosen institutional model—essentially a public-sector monopoly responsible for planning, controlling, and executing maintenance—is not conducive to accountability. This is because (a) there is an inherent conflict in vesting the planning and control function and the execution function in the same authority, with the former usually being overwhelmed by executional concerns; (b) there are no compelling incentives for efficiency; and (c) as a public service agency the road authority is subject to constraints that affect its ability to retain sufficient numbers of competent technical and managerial staff, limit its managerial flexibility, and impose on it employment-generation objectives irrelevant to the job of road maintenance.
2. There is no spontaneous constituency or organized coalition of political interests exerting influence to ensure that adequate funds are provided for road maintenance or that effective use is made of the funds appropriated. The separation of road ownership and use and the insidious nature of the road deterioration process contribute to this absence of public attention and pressure. The principal consequences of the road authority's neglect are broadly diffused among the road-using public and are unlikely to be perceived until the problem has reached an acute stage. In addition, road transport in most developing countries is seldom threatened by competition from other modes so that public carriers are not driven by economic necessity to press for better roads.
3. Inadequate and imbalanced budgets, combined with the inflexibilities of the civil service, undermine any systematic organization of maintenance activities. With a large share of appropriations immutably absorbed in wages of large unskilled labor forces, even small fluctuations in budget appropriations have major impacts on the availability of critical complementary resources such as fuel or spare parts.

The absence of an active constituency to promote the broader public interest for an efficacious and efficient road maintenance service and the limited range of services for which rail, water, or other transport provides genuine competition typically spawns a lack of concern at the political and managerial levels of government. The road maintenance organization often comes to be viewed primarily as a source of political patronage and unemployment relief. Vested interests view the maintenance mission as secondary at best, and their interests often conflict with efficiency goals. Following Hirschman's paradigm *(1)*, although public control of roads and limited access to other modes do not allow much scope for exit, no voice is raised to express the public interest in an effective and efficient road maintenance service.

A common feature of this lack of success in institutional development is the absence of accountability in the maintenance organization. The analysis and recommendations presented here result, therefore, from a search for ways of strengthening accountability, bearing in mind that a mere reorganization of government or of formal procedures is not likely to achieve this. No one can be held responsible unless he is given the means to perform the function for which he is being held accountable. Therefore to establish accountability in organizations typically requires eliminating some of the constraints that limit performance and frustrate even the most

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determined efforts. Alternatively, some activities can be transferred from the organization to be performed under the discipline of competitive markets where results are tested anonymously. Promising reforms that create conditions for more effective accountability are being tested in several countries. Such reforms include splitting works execution (contractor) functions from planning and control (client) functions, the common element being a system of incentives that promises to induce efficiency in the different institutions. Some reforms focus exclusively on the public sector agency, but most involve greater reliance on the private sector to reduce the burden on the public authority. In their ultimate form, these reforms would rely on competition in the marketplace to establish the balance between the private sector and a quasi-autonomous public enterprise *(2)*. All imply a substantial change in the role, sources, and contractual modes for foreign technical assistance.

PUBLIC COMMITMENT AND ACCOUNTABILITY

It is significant that in all cases in which there has been substantial success in establishing effective road maintenance institutions, there have been individuals in positions of responsibility who grasp both the importance of the maintenance function and the necessity for the efficient use of resources (e.g., in Malawi and Paraguay the heads of state have taken a personal interest themselves). Without political commitment at some level, the maintenance function invariably suffers from neglect—it may be starved of finance, have its ostensible resources diverted to serve other purposes, and be shunned by the ablest civil servants.

In countless instances political and private interests have brought pressure to bear on road authorities to divert resources intended for road maintenance to other purposes. These are often though not always legitimate public interests, but regardless of motivation, the effect in disrupting the maintenance mission of the road authority is the same. Controlling such interference is often one of the most critical challenges faced by the management of road authorities. Sometimes it can be successfully resolved at the managerial level, but in other cases it is a political issue that can be resolved only at the political level. Therefore ways of creating counterweights in public opinion, necessary to strengthen the hand of rational government, should be considered. The consequences of road neglect are a matter of public interest, and, as such, they need to be made known to the general public and potential interest groups, associations of trucking and bus companies, and business more generally, including potential vendors of road maintenance supplies or services, in hopes of stimulating the coalition of interests necessary to influence public policy. An interesting precedent in the United States is the effort by the Urban Institute to instruct journalists and city dwellers more generally in ways to evaluate the efficacy and efficiency of their local governments in performing a wide array of municipal services, including road maintenance *(3)*. Similarly, in the United Kingdom county road authorities are now required to publish an annual report comparing the costs of operation with private contractors' rates *(4)*.

There are various examples of audit functions assigned to authorities within the governmental sphere independent of the agencies responsible for particular activities. The U.S. General Accounting Office is one such example; the independent inspectorate of education in the United Kingdom (Her Majesty's Inspectors of Education, independent of the Ministry of Science and Education) is another. These are control mechanisms in a system that provide for accountability—their ultimate effectiveness depends on accountability being seriously enforced. Whatever the auditing mechanism, the principle requires that an authority in government demand accounting for the state of the roads, maintenance activity in physical and financial terms, and the strategy employed and the reasons for it. Clearly, further experimentation is needed in developing countries (encouraged by aid agencies) in alternative ways of enhancing the public accountability of the road authorities.

MONITORING PERFORMANCE

Monitoring the performance of public road authorities is as essential for those who are to be held accountable for maintenance as it is for the audit of their performance. However, in many road authorities, it has proven to be extremely difficult. One of the most compelling conclusions to emerge from surveys of road maintenance conducted by the World Bank in Latin America and Africa is that critical management data are not available, are inconsistent, or are clearly incorrect in many cases (see box "Efficiency of Resource Utilization: West Africa and Latin America and Caribbean"). Such problematic areas include estimates of the condition of the network, maintenance requirements, equipment availability and utilization, maintenance outputs, and unit costs. Much can be done to improve the management of road maintenance operations without such information; for example, improved day-to-day field supervision without elaborate record keeping *(5)*. Clearly first priority must be placed on competent field supervision, for without it, any record-keeping function is meaningless.

But substantially strengthened program planning, as well as monitoring and control at the central level, is still essential for answering key questions concerning maintenance strategies. The key to effective maintenance is to anticipate needs, which is not feasible without a system of periodic inspection of pavement conditions. Any planning tool that is to be used has to be calibrated to specific country conditions, and that requires information not only on the condition of roads at a given time but also on their evolution. The second most important parameter to monitor on a continuous basis is traffic, not only in terms of total traffic volumes but also in terms of distribution by type of vehicles and axle loads.

ADMINISTRATIVE DECENTRALIZATION

Some have argued for regional decentralization of the integrated governmental road maintenance function primarily on the grounds that a road authority more accessible to local constituencies will be more responsive to the needs for better roads and will not have management difficulties as a result of scale and dispersal. World Bank experience is not conclusive on this point, but among the cases reviewed, there appears to be little correlation between success in road maintenance and the degree of regional centralization or decentralization. Among

Efficiency of Resource Utilization: West Africa and Latin America and Caribbean

Data from road maintenance surveys in Latin America and West Africa demonstrate that higher levels of output could have been achieved with the limited funds allocated to road maintenance but are inadequate to provide a meaningful quantification.

Nearly one-half of the countries in the Latin American survey carried out very low levels of periodic and routine maintenance considering their level of maintenance expenditure and the kilometers of roads actually maintained (i.e., excluding those roads that were not maintained at all in 1983 and 1984). Three countries resealed or strengthened less than 1 percent of the paved road network despite receiving the funds required to carry out at least one-half of required preventive maintenance. Even worse were two countries that resealed or strengthened 1 percent or less of their paved roads even though there were sufficient funds to carry out adequate preventive maintenance. Where these funds were absorbed is not clear. In two other countries, far more emphasis was placed on gravel roads with the result that hardly any work was done on the paved road network.

Given that a substantial portion of the road network in the region was in fair to poor condition because of the deferment of periodic maintenance, it might be expected that considerable expenditure had been put into routine maintenance, but this proved not to be the case. On average, light patching was only 25 percent of that required and heavy patching was 20 percent. Less than one-half of paved shoulders were maintained and less than 40 percent of culverts were cleaned annually. Gravel and earth roads were graded twice a year on average, although five countries were unable to grade roads even once a year. However, productivity was quite low—one grader accomplished only 3 km/day of mostly light grading compared with a more satisfactory norm of 5 to 6 km/day.

A similar situation prevailed in West Africa where only 1 percent of the paved roads and 3 percent of the gravel road network received any kind of periodic maintenance though funds were sufficient to carry out far more work. About one-half of the countries should have been achieving at least twice the level of periodic maintenance actually performed. Although there were few data on the level of routine maintenance, information from other sources indicated that the level was quite low in many countries. Productivity of graders was also quite low, particularly for four countries, which had an output of less than 0.25 km/day per grader.

the more successful cases, Paraguay is highly centralized, whereas Malawi is relatively decentralized. Both Korea and Algeria are very decentralized, but have achieved different levels of performance. Several countries (e.g., Kenya, Senegal, and Zaire) have alternated between centralized and decentralized organizations without clear evidence of significant differences in performance between the two approaches.

There also are obvious potential pitfalls in decentralizing authority and in increasing political sensitivities, as illustrated in the cases reviewed. Although there may be shortages of technical and managerial staff at the central levels, such shortages may be far more severe at the local level. Whether at the central or local level, greater political sensitivities may be accompanied by greater susceptibilities to divert maintenance funds to more popular construction activities to undertake cosmetic but ultimately ineffective maintenance measures, and, most critically, to employ large numbers of redundant staff—as demonstrated by experience in Kenya and Honduras, two of the more politically sensitive ministries.

FUNCTIONAL DECENTRALIZATION—HARNESSING COMPETITIVE FORCES

A stronger case can be made for administrative decentralization than for functional decentralization, which involves separating the planning and control functions from works execution, especially if competition can be relied on to operate in the latter. By limiting demands to planning and control functions, the road authority is less likely to be overwhelmed by executional priorities, and accountabilities can be strengthened. Second, contractors (private or parastatal) operating under strong incentives with greater managerial freedom to procure and manage resources and a better prospect for retaining the most productive staff, may stand a better chance of developing an efficient, lasting institutional capacity (in the form of a dynamic industry) for the execution of road maintenance services. Third, when contractors become involved in maintenance activities, their lobbying efforts can increase budgets for road maintenance.

The principal contrary argument, which varies depending on local circumstances, is that contracting maintenance may actually increase costs because of increased administration (e.g., measuring and certifying quantities for payment); increased redundancies (when the government establishment cannot be reduced or relocated to the private sector); or lack of genuine competition in the procurement process (in extreme form, tender collusion), which prevents cost savings from being passed on to the public. Other arguments are that contractors may not have the requisite capacity, or that those that have the capacity are disinterested in small routine maintenance contracts (especially in remote areas), and that contractors' resources might not be available to government to help meet emergencies, such as earthquakes, famines, and so forth.

The experience in the nine countries reviewed here *(6)* sheds light, both positive and negative, on these *a priori* arguments. Some mistakes have been made, but, in general, contracting of routine as well as periodic maintenance has proven to be remarkably efficacious. In seven of the nine countries reviewed, roads under contract are now generally well maintained; in the other two countries, Colombia and Nigeria, initial problems encountered in the first small experiments are now being overcome. The evidence also suggests that contractors can operate at lower costs. In the one case (Ponta Grossa, Brazil) where fully comparable costs under similar conditions were available, the force account operation, commonly viewed as very efficient, was found to be 59 percent more costly. Contractors have been attracted to maintenance opportunities even in remote areas, and often small local contractors can be found whose local base solves the problems of remoteness more cheaply than can the centralized road administration (or larger contractors). Contractors have also been willing to commit their resources to the government in the event of emergencies.

Thus, the possibility of contracting a major part of routine, as well as periodic maintenance should be considered by every

road authority. Care must be exercised to ensure that the public monopoly is not replaced by a new cartel of private interests, as shown by experience in Nigeria and Brazil. Retention of at least a small governmental capacity, reorganized as a publicly owned contracting company or companies in competition with private contractors, will be desirable to ease transition problems and in the long run provide a source of comparative costs, help reduce the danger of monopolistic exploitation, and enhance government management flexibility. Putting the government in competition with contractors should stimulate pressures for efficiency on both sides. A major experiment along these lines has been under way in the United Kingdom since 1981 with very promising initial results *(4)*.

Although the overall burden of responsibilities on the road authority is normally reduced by the introduction of contractors, the nature of the government's responsibilities changes sharply, and there is increased need for contract management skills. Many governments may want to consider using a consultant or a management services contractor to develop management systems and contract instruments, as well as to provide training for nascent contractors and government staff. Where there is no well-established domestic contracting industry, routine maintenance—technically simple with minimal investment requirements—provides a suitable vehicle for development. Careful planning and introduction of contracts on a small trial basis initially can reduce risks, permitting the government and contractors to develop capabilities before putting too heavy a burden on a new system. All of the successful contracting schemes have involved close coordination between the government and the contractor in defining the work to be done and in planning the work program.

MEASURES TO IMPROVE THE EFFICIENCY OF GOVERNMENT OPERATIONS

In cases in which direct government operations remain a significant portion of the total maintenance efforts, it is essential to improve their efficacy and efficiency. Needed improvements in management of equipment must be considered before human resources.

Equipment Management

Equipment is one of the most costly resources in road maintenance, yet all available evidence suggests that equipment use is extremely low, often no more than one-half reasonable norms (see box "Equipment Utilization: West Africa and Latin America"). Although availability (i.e., the amount of time a machine is in operating condition) may be good during the first 1 or 2 years of the life of new equipment, thereafter it typically declines sharply, as machines begin to wear and maintenance is inadequate due to lack of spare parts and properly trained mechanics. Equipment utilization may be poor even during the first years (sometimes because of the lack of fuel) and, because it is dependent on availability, is necessarily poor during subsequent years.

Many of the most serious inefficiencies stem from the imbalance in different resources. Available resources first go to paying permanent staff salaries and little may be left for spare parts, fuel, or other complementary resources (see box "Overstaffing and Resource Imbalances: Kenya"). In many cases the problem is compounded by the restricted availability of foreign exchange. Higher productivity can be achieved by allocating funds among the different activities in a more balanced manner—and the more restricted the budget, the more critical is this balance. In practice, this often implies reallocating a significantly higher fraction of available budgets for the recurrent foreign exchange costs of spare parts, fuel, bitumen, and so forth, in order to ensure effective use of equipment and associated work forces.

Equipment Utilization: West Africa and Latin America

According to data from West African and Latin American surveys, vehicle and equipment utilization was well below what is generally regarded as efficient—1,250 hr/year. In West Africa, vehicles and equipment were operated an average of 630 hr/year, ranging from 420 hr for steelwheel and tire rollers to 840 for dump trucks. In Latin America, utilization of vehicles averaged 800 hr and equipment 750 hr; in one-half of the cases, equipment was used less than 700 hr/year. Plants such as asphalt finishers and asphalt and aggregate crushing had even lower rates of utilization; asphalt finishers had the lowest rate of 420 hr/year.

Low utilization rates are partly explained by lack of spare parts and fuel for equipment fleets. In the case of West Africa, low expenditures on spare parts and fuel appears to have been a major reason for low utilization. According to the limited data available, about 40 percent of authorities received only one-half of the necessary funds for spare parts to keep the fleet fully operational. In 1982 expenditure on fuel in nine countries was only about one-third of that required to keep the equipment fleet operational 1,000 hr/year. Altogether, the data available for 1982 indicate that at least one-half of the countries had equipment fleets that could not be maintained because of a lack of spare parts or could not be operated because of a lack of fuel.

In the case of Latin America, the explanation for low utilization of equipment is not so readily apparent. In general, authorities had sufficient funds for spare parts to operate the fleet 1,000 hr/year although there were three cases in which the funds allocated were much lower. On average, agencies received 82 percent of the funds required for fuel but about 40 percent of the agencies received less than two-thirds of the funds required to keep the fleet operational 1,000 hr/year. Part of the explanation for low utilization may lie in poor management of equipment fleets and possibly insufficient numbers and quality of mechanics.

Several questionnaires returned from both regions did not include data on equipment utilization or on required expenditure for spare parts and fuel; in other surveys such data were inconsistent. Also, estimates of equipment depreciation were given in few returns. The weakness of such data indicates in some cases the complete absence of cost-accounting systems for equipment and in other cases the lack of monitoring and analysis of data collected. The failure to cost the use of equipment and the lack of proper financing mechanisms for equipment replacement has been one important reason for the increasing age of fleets in many Latin American and West African countries where, according to the survey, about one-half of the maintenance equipment was more than 7 years old.

Overstaffing and Resource Imbalances: Kenya

In Kenya operating funds (for fuel, spare parts, bitumen, etc.) for maintenance activities have become more scarce during the past few years. The effects of the general budgetary squeeze were exacerbated by two parallel developments affecting the roads department: the growth in permanent establishment personnel and the government's district focus policy. Until fiscal year 1982 the roads department had employed on average some 9,500 personnel under the casual labor (works paid) regime while some 1,000 staff were in the permanent establishment. The corresponding emoluments constituted some 39 percent of the total recurrent budget (KL 6.7 million out of KL 17.3 million). From all sources an amount of KL 9.7 million was available for operations, which at the time was already inadequate.

Three years later, however, the situation had dramatically deteriorated. The number of establishment positions in the roads department had increased from 1,000 to 14,600. The integration of works paid personnel in the establishment explains only part of the growth. As part of the district focus policy, other ministry personnel at the local level were brought under the umbrella of the roads department. As a result in 1986, of the total personnel, more than 94 percent came under the district, and of the funds that are handed over to the district (KL 10.5 million, representing more than 55 percent of the total budget of the roads department), more than 90 percent were spent on personnel-related expenditures, leaving little for operations. Meanwhile, funds for operations controlled by headquarters were down to KL 6.3 million.

Accountability for equipment management and incentives for efficient utilization need to be strengthened in most road authorities. In some authorities, efficient management has been achieved through operation of departmental plant-hire schemes on a basis similar to a commercial plant-hire organization. By compelling explicit accounting of costs, such schemes inculcate greater cost consciousness and, hence, generate pressures within the government for efficient utilization of plant and vehicles, helping to control diversion and curtail excess investment. By making finances of the plant-hire organization dependent on revenues generated from plant hirings, strong incentives may be generated to keep the plant in operation because a broken-down plant generates no revenues. Spare parts can also be regularly replenished and equipment replaced out of revenues generated from plant hire. Unfortunately, such schemes have not worked well in many developing countries during recent years partly because of the public administration's failure to resist pressures from equipment users to understate equipment costs, or even to see to it that the bills are paid, and partly because of the reluctance of treasury officials to cede financial autonomy. Consequently, funds generated are neither adequate nor available on a timely basis, and the true costs of equipment remain hidden.

Plant-hire schemes, however, are not inherently complex or difficult to undertake. Successful schemes exist in Cameroon and Malawi as well as several industrial countries. Some mechanism to ensure proper pricing, budgeting, and financing will be an important ingredient of any program to ensure more effective use of government-owned equipment.

Human Resources

There is room for improved utilization of human resources in several different facets of road maintenance. At one end of the spectrum is the substitution of unskilled labor for machinery. If properly managed, labor-based methods can be more cost-effective than equipment for many maintenance activities in which wage rates are less than about $5 to $6 per day. They are less dependent on foreign resources and for that reason are normally less susceptible to disruption. They create needed employment opportunities and increase self-reliance. To be cost effective, however, labor-based methods must be properly organized with strong incentives for efficiency structured into the conditions of service. The simple lengthman system whereby individuals living alongside the road are retained to maintain 2 to 5 km (thus minimizing demands for costly transportation), with payment and continued employment dependent on satisfactory performance, has served many countries well.

It is critically important to preserve the employer's flexibility in hiring and firing and to avoid the buildup of large unskilled labor forces on permanent civil service status. In many countries the road authority has been viewed as a source of employment. The Kenya example illustrates typical consequences. In many countries, this is a critical problem that must be addressed, either through long-term attrition (as in Brazil since 1972) or through transfer of maintenance responsibilities and employment opportunities (under more flexible, incentive-based terms) to alternative organizations such as contractors (Argentina during 1979–1984). It is significant that in Malawi and Paraguay the permanent labor force has been kept small, complemented by casual labor as required and as funding permits.

At the opposite end of the spectrum is the government's difficulties in retaining competent managers, engineers, technicians, foremen, mechanics, and so forth. It is unlikely that constraints on civil service salary scales will be removed, but often some measures can be taken to raise incentives for the most productive staff to remain in service with the road authority. In Ethiopia, as in the United Kingdom *(4)*, the road authority has, after some trial and error, managed to incorporate bonus incentives based on work unit productivity. In several countries, field allowances not only encourage more active field supervision by middle level managers but also serve to raise levels of compensation.

High levels of staff turnover are likely to continue in most government agencies, however, and the road authority will need to train and develop substantially larger quantities of staff than its own needs would otherwise dictate. In effect the ministry of works serves as a training and proving ground for personnel for the private sector as well, and this is a useful role for it to play. However, it does give rise to the demand for more effective manpower planning, training, and development programs to anticipate and meet needs. These plans should deal not only with the quantitative requirements of the training program but also with the qualitative aspects as well and should be based on in-depth analysis of the type of skills that need to be developed. They should incorporate the role of technical assistance, particularly when expatriates are retained in line-management positions, an alternative that in the short run may yield substantial results in dealing with emergency situations. In the case of Malawi, after more than two decades, well-

experienced local staff have been groomed for executive positions and the number of expatriates is declining sharply. (See box "Successful Manpower Management and Development in Malawi".)

Ultimately, the most critical factor is personnel management. Staff must be motivated and inculcated with a sense of duty and accountability. High performance must be recognized and rewarded. Recruitments and appointments to managerial positions must be based on competence and not patronage. Weak performances are all too often blamed on inadequate training when they have their roots in inadequate, nonexistent, or unenforced personnel management policies. Under these circumstances even the most expensive training schemes are powerless to correct the problem.

Successful Manpower Management and Development in Malawi

The ministry of works and supplies has about 100 professional staff, 450 subprofessional and supervisory staff, and about 1,350 other permanent staff for a total permanent staff of only 0.3 employees per km of main road. In addition, an average of about 2,300 workers are employed on a casual basis (predominantly for maintenance of lower-class rural roads), but this number fluctuates between 1,500 and 3,300, depending on the season and the workload.

In the past the ministry was administered by senior expatriate staff in line management, but expatriates have been gradually replaced—declining from 135 in 1977 to only 35 today—as qualified Malawians gained the necessary training and experience. The majority of graduate civil engineers comes from the Blantyre Polytechnic, but some have received their first or second degree overseas. The ministry has a total of 44 posts at the graduate entry level, and operates an in-house training program of 2 to 3 years' duration, leading to registration examination by the Malawi Board of Engineers. Only after registration are the engineers eligible for promotion to the lowest professional grades. Subsequent promotion is dependent on ability and experience. The expatriate professional staff compete on an equal basis with Malawians for promotion to higher level positions. The result of this system has been the building up over time of a well-qualified and experienced professional staff.

TECHNICAL ASSISTANCE

Technical assistance for road maintenance has traditionally focused on advisory services, management systems, and training for the public sector roads authority. Rarely in World Bank practice has technical assistance provided management services in an executive as distinct from an advisory capacity; the Malawi case discussed earlier is among a few exceptions, which would also include Zaire or the Côte d'Ivoire. Typically the scheme is such that the purveyor of technical services has only an advisory role with at most indirect responsibilities for any measurable output, very limited risks, and at best limited incentives for improving performance.

Attempts have been made to come to grips with this problem through performance incentives for the providers of technical assistance. To do so involves changing roles, a different apportionment of risks between the provider of technical assistance and the government client, and possibly different sources of technical assistance. Traditional suppliers of technical assistance are generally not well structured financially to accept significant risks. For this and other reasons, it may also be desirable to look to new sources for technical assistance.

One obvious source in the road maintenance field is international civil engineering contracting companies. Construction companies are, of course, fully accustomed to risk-taking and performance-related incentives. They also have staff with requisite qualifications who are accustomed to working together as management teams in developing countries. With the prolonged worldwide downturn in major construction, companies that previously would not have been interested in merely management services type of contracting appear now to welcome such opportunities.

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