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INLAND TRANSPORT EQUIPMENT
AND ITS ROLE
IN INDUSTRIAL AND AGRICULTURAL DEVELOPMENT
Importance of road transport, the perceived requirements for transport
especially for rural development*

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* The views expressed in this paper are those of the author and do not necessarily reflect the views of the UNIDO Secretariat. This document has not been edited.

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1. INTRODUCTION

Gloom has been so common in the Third World in the past five years that few people have noticed the first hint of improvement in economic prospects for nearly 4 billion inhabitants of developing countries. If the governments of those countries seize the chance, they will soon be striking back at man's ancient enemies of poverty, ignorance and disease.

The Third World's economic progress can be judged by whether its real gross domestic product (GDP) grows by more than 5 per cent a year or less. Between 1965 and 1980, the annual GDP growth averaged 6 per cent. Since 1980, it has slowed to 3 1/4 per cent. As the first half of the 1980s brought the toughest economic times for half a century, the chances of improvement are good. The optimistic tone of this statement is motivated by three main reasons:

First, developing countries are gaining greatly from cheaper oil: approximately 70 are net oil importers. Economic life is easier, due to the fall in price of a barrel of oil which is now at the same level in real terms as it was in 1973. This has raised their expected GDP growth in the last two years to between 3 and 3 1/4 per cent. Cheaper oil means more foreign exchange for roads, machines, fertilizer, schools, etc. It also means a chance to rebuild foreign reserves or pay off loans, both of which will improve their creditworthiness. In the longer run, the indirect benefits of cheaper oil will be even greater.

Second, rich countries, after realizing that the poorest countries cannot realistically be expected to pay their debts in full, start competing with each other.

Japan has just announced cancellation of debts owed by 17 poor countries, and America, which until recently has refused to grant concessions for debts, will soon follow suit. France has a plan which favours cancellation of one third of public and publicly-guaranteed debts of developing countries and England suggests that government aid in the form of loans should be converted into grants, that debts should be recalculated and interest rates cut.

It is generally agreed that debt relief can hinder reform and that it should therefore, only be given to countries which adopt sensible economic policies. The flow of new bank lending to the Third World has dried up, forcing developing countries to search for alternative sources of finance and to make better attempts to attract more direct foreign investment. The import of new technology and technical and managerial expertise which accompanies foreign investment can be as useful as the actual inflow of capital itself.

Third, and most important, there are signs of change in the economic philosophy of governments. Most African governments have done the opposite of their Asian - and successful - counterparts: they have aimed at import substitution rather than exports, allowed their exchange rates to become uncompetitive, shunned foreign investment, held down farm prices, and have given preference to hospitals and universities over local clinics and schools.

Governments have now started to realise that the root of the problem is bad economic policy, especially a 20-year African custom of discriminating agriculture. There lies the biggest moral for the Third World as it seeks again to push GDP growth above 5 per cent a year. Money is not what counts, but how it is used, and that depends on the economic policies of governments and how business and farmers respond to them. Today nobody argues that economic growth in the majority of developing countries, especially in Africa, depends on their agriculture. Rural sectors in these countries provide subsistence to the majority of the population.

The output from these sectors, however, remains insufficient to meet their needs. For the low-income countries, especially those of sub-saharan Africa and South Asia, where the majority of the 800 to 850 million poor of the world live, the highest priority must be given to the development of food stuffs, agriculture, livestock and forest products. This will help improve the food situation, as well as meet basic needs in these countries. The development of rural areas requires, among other services, better transport infrastructure and more transport equipment to establish links between production and market centres. Farmers who cannot sell or transport food do not bother to grow it.

Most developing countries have recognized that a comprehensive and far-sighted re-appraisal of the transport situation and of the means to strengthen this sector's contribution to the socio-economic development is urgently required. This recognition led, for example, to the launching by the United Nations of the Transport and Communication Decades for Asia and the Pacific (1985-1994) and for Africa (1978-1988). New strategies, policies and programmes are needed to develop an integrated medium- and long-term planning of the transport sector within the framework of national development objectives.

2. OBJECTIVES

The main objectives of this study are to:

1. Present at global level the situation of the inland transport sector and its impact on the other sectors of the economy of developing countries;
2. Define the situation prevailing in developing countries in the domain of motorised vehicle operation, maintenance, repair and spare parts supply;
3. Suggest possible new strategies, policies and programmes for developing an integrated medium- and long-term plan of the transport sector, with particular attention to the perceived requirements for transport equipment for rural development.

3. IMPORTANCE OF ROAD TRANSPORT

The continuing emphasis given to transport investments in all national plans is a clear indication of its importance in a country's development process.

Transport is not only the means of moving goods but also of communication. In rural areas of developing countries, the availability of other means of communication, such as telephones or mail, is very limited, and the importance of transport for this purpose is therefore increased.

Some countries have shown rapid economic growth following improvements in transport, but there were others in which no such change had occurred. Under some circumstances, transport investments in isolation may in fact be harmful to certain sections of the community, such as reduction in demand for labour.

Transport has already been referred to in several different contexts: the disadvantage of long routes and light traffic, and the role of rural roads in agricultural development. Aside from the general growth effects of increased access and reduced transport costs, improvement of transport and communication facilities has special importance. Transport costs weigh very heavily on the one third of African countries which are landlocked. Better transport and communication systems contribute significantly to the process of political integration and administrative consolidation - high priority objectives everywhere in the region. Development of rural transport infrastructure also offers special opportunities for community action and enhanced self-reliance.

The importance of road transport is also reflected by World Bank lending in the transport sector. In the 1950s, about 35 per cent of all lending by the World Bank was for transportation. In the 1960s and 1970s, this figure declined to 25 and 15 per cent respectively, and the same trend persisted in the early 1980s. During the same period, total worldwide lending by the World Bank increased from about US\$ 0.5 billion annually in the 1950s to the present 1980s level of about US\$ 12 billion annually. Therefore, the amount of money lent by the World Bank for transportation actually increased from US\$ 125 million in 1950 to more than US\$ 1 billion in 1980. Furthermore, in recent years a significant amount of lending for transport was accomplished through projects in other sectors such as industrial and mining schemes, rural and urban development and agricultural projects. These transport components (not shown under the transport sector), amounted to some 3 to 4 per cent of all World Bank lending.

The annual World Bank lending during fiscal years 1970 to 1980 for different modes of transport is shown in the following table.

Average annual lending by transport mode
(Fiscal years 1970-1980)
(in US\$ million)

Transport modes	Number of projects (annual average)	Modal-Total lent Per average year	Percent all modes	Approximate amount lent for project
(1)	(2)	(3)	(4)	(5)
Roads	20	500	52	25
Railways	5	250	26	50
Ports, shipping and inland water transport	6	180	19	30
Aviation	1	25	3	25
Total	32	955	100	130

Source: Neuner, Tillman A. International Financing of Transportation Programs.

The average amount lent for road projects is less than projects in railways and ports, mainly because many small countries with small projects are included in the average for roads. Furthermore, there has been an increase in World Bank loans for roads with low traffic volumes. Some of these roadworks can cost as little as US\$ 10,000 per km in contrast to much higher costs per km for roads with higher traffic volumes. Bank lending for transport has always been predominantly for infrastructure its construction, rehabilitation and maintenance.

At the same time, many problems prevent the transport sector from making its full contribution. The first is scarcity of resources. In most African development plans the construction of transport infrastructure over the past two decades absorbed 30 to 40 per cent of total investment. During the 1980s, a lower proportion of development expenditure will probably be available. Moreover, the large national transport networks, the scarcity of operating funds, and the special demands of road and other maintenance, especially in African countries, have combined to cause widespread deterioration of existing facilities.

3.1. Investment priorities and strategies

The possibilities in the transport sector are many. They clearly exceed the financial and manpower capacity of most governments in the next ten years, even with a great deal of capital and technical assistance from outside. It is essential therefore, to focus on the highest priority tasks, and to avoid activities that divert resources from them. Many valuable and useful projects will have to be postponed and improvements delayed.

In all modes of transport and communication, large-scale capital-intensive projects should be examined very critically by donors and governments. Tendencies in developing countries to prefer capital intensive solutions and in donor countries to seek projects offering markets for their manufacturers, have sometimes greatly reduced the real contribution of foreign assistance to development and even imposed serious long-term burdens.

Recipients and donors alike must be aware of these dangers and seek more economic alternatives such as measures to improve operations and maintenance to the existing facilities, rehabilitation of the existing infrastructure, improvement of traffic flow through better regulation and control, and reliance on less capital-intensive modes of communication, such as aviation and telecommunications. Transport development should be considered in the light of the country's total needs, capabilities and policies. Top priority should be given to maintenance, especially of trunk roads which are now the mainstay of the transport systems of most countries.

Aid suppliers, in addition to financing projects oriented towards maintenance should include components contributing to the development of maintenance capacity, even in projects mainly concerned with new construction. Ministries of works and their consultants should pay special attention to designing projects, especially surfaced roads projects, in order to minimize total system costs (construction, maintenance, vehicle operating costs) with realistic, rather than theoretically or legally perfect maintenance and axle-loading requirements.

The same applies to transport operators. It means enhanced attention to subdividing jobs so that they can be managed by local people, providing specialized training and appropriate on-the-job supervision, supplying credit to assist with bidbonds and the purchase of leasing of construction or transport equipment, technical assistance for small contractors, reduced economic regulations for transporters and above all, maintaining a stable and clear legal and financial framework in which local initiative can flourish.

3.2. Road Networks

In support of agricultural production strategies and wider geographical spread of development, high priority should be given to improving rural access, mainly by roads. Rural access roads include all non-urban roads which link with the trunk network.

Most national roads in developing countries were built between 1942 and 1981. Since they were constructed, traffic volume has markedly increased - in some instances from 50 to 500 per cent. As a result, many of the roads are now in a poor condition and are unsafe for driving. These roads are assuming a more important place in many countries' development plans and will continue to do so. It has been estimated, for example, that Nigeria's plan for self-sufficiency in food will require as much as 25,000 kms of new rural roads.

Such roads need constant maintenance and renewal arrangements are therefore crucial. Interesting experiments exist in this area: Kenya's system of local resident "contractors", for example, is highly promising for

populated areas. Each contractor is responsible for 0.5 to 2.5 kms of local road and is paid a comparatively low wage at the end of each month if the road is in satisfactory condition. The system is now applied to about 2,000 kms at a current annual direct cost of only US\$ 250 per kilometer. There is considerable scope and need in most countries for further experimentation with "appropriate technology" solutions to construction, maintenance and transport on rural roads, adjusting standards to the vehicles that will actually be employed, and using more locally available manpower, equipment and supplies.

4. TRANSPORT AND ROAD TRENDS

4.1. The trend of transport

A major investment in developing countries since the Second World War has been in the area of transport. Figures show that transport accounted for almost one quarter of IBRD loans and one-fifth of IDA credits ranking first and second in their lending operations.

Table 1: IBRD cumulative lending operation
by major purpose and region in 1987
(in US\$ millions)

IBRD loans to borrowers, by region				
	Sub-Sahara	Asia	Middle East	Latin America
<u>Agriculture and rural development</u>				
Area development	1276.4	1462.4	914.5	2919.6
<u>Transportation</u>				
Highways	1414.7	3670.1	2498.3	4578.8
Transportation sector loan	61.6	261.2	242.0	47.8
Urban development	509.8	2062.5	592.8	1915.1

Table 2: IDA cumulative lending operation
by major purpose and region in 1987
(in US\$ millions)

	Sub-Sahara	Asia	Middle East	Latin America
Agriculture and rural dev.				
Area development	1258.7	1108.9	63.0	15.0
Transportation				
Highways	2056.6	814.4	196.3	167.3
Transportation sector loan	15.0	105.8	-	120.8
Urban development	273.2	945.0	50.3	75.0

For most countries transport is the largest single sector for investment and for all countries it ranks in the first two most important sectors. Indeed, in nearly all developing countries the most noticeable transport development of the past three decades has been the growth of motor transport and construction of roads.

Movement of goods by truck and passengers by bus and taxi have become major new elements in the transport system. Most railways carry more than before, but they are losing short-haul business and much of the higher-valued manufactured goods that they used to carry.

This traffic is rapidly gravitating towards highways. The result is that railways are in a state of decline and there seems little immediate prospect of challenge in road transport's supremacy.

4.2. Road trends

Investments over the past three decades have produced considerable change in road systems of most developing countries. For example, in Africa, the length of the road network has increased at a rate of about 3 per cent, and paved roads almost 9 per cent annually. Figures confirm that road improvements favoured the construction or improvement of major rural highways rather than urban or minor roads. Emphasis is now being given to rural roads, i.e. low cost feeder or tertiary roads.

In many developing countries, the end of the 1960s saw the completion of basic trunk road networks and attention turned to the provision of more extensive secondary and feeder road networks. Despite the shift away from major highway construction, given present trends it is unlikely that the density of roads directly serving the rural areas will increase very rapidly in the future, due to the high cost of road construction and the limited resources at the disposal of the poorer countries.

Despite the emphasis placed on investment in roads, evidence shows that in the developing countries the density of the network is low and likely to remain so. As a result, there are large numbers of people living far away from motor vehicle road systems.

The last three decades have seen an unprecedented expansion in the road system and motor vehicle stock of most developing countries. The general expectation is that future growth will be somewhat slower. However, there are still large numbers of people living in developing countries who have limited access to motor vehicles. These people are dependent on traditional means of transport. Sporadic use is to be found of bicycles and primitive hand-carts and/or wheelbarrows; in some areas animals and animal carts are also used.

In most countries, the provision of roads has sensibly been considered independently of any questions pertaining to the supply or type of vehicles. Concentration of government resources on roads and lack of involvement with vehicles means that a major and indeed crucial part of the transport needs of the rural population is not being met. Most developing countries lack low-cost private vehicles widely disseminated among the majority of industrial workers, small businessmen and in particular farmers.

5. BASIC REQUIREMENTS FOR ROAD TRANSPORT

Although there has been some shift away from expenditure on major highways, they still dominate road investment and this emphasis is likely to remain. The high cost of modern highway construction is one of the main reasons why road networks in developing countries are and seem likely to remain sparse.

In one sense a concentration on major highway improvement in the early stages of a country's development is understandable. The elements of a road network are complementary, not competitive. Tertiary roads feed into secondary routes, which in turn connect with the primary network. Concentration on the lower orders of the system to the exclusion of the upper level network would be impractical. For most countries, the first

communication priority must be to provide reliable connections between the capital and the main ports, administrative centres, and agricultural productive areas for a variety of strategic, political, economic and social reasons.

The expected economic results of transport improvement had a number of consequences, the most important of which was savings in vehicle operating costs and road maintenance expenditures. Since both of these are related to the amount of traffic, existing and expected, the process worked in favour of main roads. These factors have unnecessarily increased the cost of road construction.

5.1. Road design standards

Geometric design of modern highways has never been translated for developing countries. The cost of construction of these roads is high because of the design standards imposed by the assumption of use by conventional motor vehicles. It is possible that in certain circumstances other, simpler and probably cheaper, vehicles might suffice just as well, or even be better. Slower and lighter vehicles would allow the alignment, strength and width of roads to be reduced relative to present standards with a considerable saving in costs.

In many developing countries, road design standards should more appropriately be drawn up to favour the operation of trucks and buses which comprise a large proportion of total traffic, rather than facilitate the speedy movements of the smaller proportion of private cars.

C. APPROPRIATE VEHICLES

Today, more than ever before, there is a need for effective collaboration between manufacturers and users of motor vehicles, in order to acquire more information concerning the needs and capabilities of developing countries.

As there is a clear relationship between the industrialization level of a country and the effectiveness of road transport as a whole, the term "appropriate" is used here to indicate the technical level incorporated in the vehicles best-suited to the socio-economic, cultural and political environment of a particular country. Bearing in mind the problems facing today's Third World countries (lack of maintenance and repair, low technical skills, etc.), the manufacturers in developed countries should consider developing countries not only as random markets where their products can be sold at relatively high prices (usually as part of an aid programme financed by their governments), but also as partners which will become prospective buyers as a result of the fruitful co-operation.

"Appropriate vehicles" should be characterized by the following features: low capital investment per unit, sturdy design, long service life, fuel effectiveness, high adaptability to particular environments, reduced maintenance periods, easy repairability. They may also be of an intermediate level of technical sophistication (i.e. somewhere between tradition and modern technology).

Given the difference in incomes and in topographical, road, farming and social systems, as well as in local resources and capabilities, there cannot be a "universal vehicle" appropriate to all the rural transport needs of the developing countries. In most countries different make/size body-type combinations of car and truck were imported. This led to severe shortage of spare parts and exposed the lack of suitable maintenance skills.

Very few developing countries (China and India are notable exceptions), have attempted to restrict the number of vehicles considered most appropriate to their stage of development. Restrictions because of foreign-exchange considerations or the desire for local manufacture are not uncommon: but restrictions because of alleged technological inappropriateness are.

In order to improve the transport capabilities of rural populations, the strategy must be based on providing a graduated choice of vehicles whose performance matches the need and whose cost is in sensible relation to income. The consequences of variation in operating environment, loads, cost, technical simplicity and use of local resources leads logically to a progression of human, animal, and at the extreme, simple motorized means of movement. These are named collectively "basic vehicles".

Such basic vehicles already exist and are used in different parts of the developing world, although their use is often localized. Some are primitive, being traditional devices which have remained unchanged for many years, others are used for purposes quite different from those for which they were originally designed. Almost all are capable of improvement, using contemporary technical knowledge so as to increase significantly their efficiency and usefulness.

Some of the basic vehicles are "two dimensional": this makes them suitable for use on the many footpaths and tracks which for the overwhelming majority of the rural population constitute the "road" system. All the vehicles could be operated on roads of a lower standard and at a cost lower than that prescribed by the requirements of conventional motor vehicles. Ironically it would seem that the more popular and simple the vehicle, the less information there is available.

6.1. Pedal-driven vehicles

The generation of human power applied by legs to rotating cranks has proved to be a highly efficient means of utilizing human energy. The most common application of this principle is the bicycle. It is four times as efficient as walking.

Excluding China, in the majority of countries the number of bicycles per 1000 persons exceeds the number of commercial vehicles. The bicycle is probably the most widely used wheeled vehicle in the world. The best estimate is that production of bicycles world-wide has increased by approximately 31 per cent since 1970 to an annual total of some 43 million. In comparison, production of all motor vehicles increased by 16 per cent in the same period to an annual total of 33 million. However, the world production of bicycles is concentrated in the developed countries.

Bicycles are used in many developing countries to meet the transport needs of both rural and urban areas. In the developed countries the bicycle has become steadily more complex, principally through the use of lighter alloy materials and advanced mass production techniques. The type of bicycle which at present predominates in the developing countries is relatively old-fashioned, bearing a resemblance to the type produced in developed countries 30 to 40 years ago. This type of bicycle is more appropriate to the needs of developing countries and is better able to operate on rough, unsurfaced tracks and paths for several years and to carry passengers and heavy loads.

Heavier and more voluminous loads can be moved by attaching a trailer. It offers the possibility of increasing significantly the cargo or passenger-carrying capability of the bicycle at low cost. Cycle trailers can be made of wood or steel and are suitable for production in small workshops. However, the use of these trailers is uncommon, except in French-speaking countries of Africa and Indo-China.

The utility of pedal power for transport can be extended by the use of a tricycle, purpose-designed for load-carrying. The tricycle needs a wider track than the bicycle and like all pedal-driven forms of transport is only suitable for use on relatively flat terrain. It is widely used in Asian cities as a passenger carrier where it is commonly known as a 'cycle rickshaw' or 'trishaw'. Where used, it is an important form of employment. A significant trend in recent years is the penetration of tricycles into rural areas.

6.2. Animal power

The use of animals is also a widely-used form of transport. A number of animals allow greater loads to be moved (horse, mule, donkey, ox, buffalo, camel).

Animals play an important role in the agricultural system of most developing countries, but more so in Asia than in Africa.

It is generally agreed that efforts should be directed towards introducing mechanized rather than animal-based agriculture. Thus, while there is a likelihood for a steady growth in mechanized agriculture methods, animal draught cultivation, especially in the poorest developing countries, will remain important for many years to come.

In many different parts of the world, pack animals are used, especially in steep, rocky or very sandy terrain where wheeled transport is impossible. The load varies according to route conditions and distance, and the only equipment required is a carrying container or saddle fitted to the animal's back.

Animal drawn carts are a major form of rural transport in the Asian region. These are predominantly bullock carts, though buffaloes, horses and camels are also used. Carts drawn by a single animal are occasionally observed, usually in urban areas. These carts can operate on very muddy tracks, but cause damage to surfaced roads because of the very high contact

pressure at the rim. Because of such damage to surfaced roads caused by steel-rimmed wheels, tyre manufacturers in India produce an alternative animal drawn vehicle (ADV) wheel. This is a pneumatic tyred wheel, run on ball bearings, the whole assembly being fitted to a specially fabricated steel axle. Such carts can carry loads of up to 2.5 tonnes on good surfaces.

The use of animal carts in Africa is not as widespread as in Asia, even in areas where animals are used for draught cultivation. Donkey carts, able to carry 400 kgs, are more important in Africa than in Asia, also the use of pneumatic tyres is more common. These wheels are usually used in conjunction with the discarded rear axle of a motor vehicle. They are excessively heavy since they normally include the useless brake drums and differential assembly. Maintenance problems are also encountered with the pneumatic tyres.

6.3. Motor vehicles

Motor vehicles can be divided into four groups:

Transportation of goods: lorries and trailers, refrigerator vans, road tankers:

Transportation of passengers: buses, passenger cars, small delivery vans, motorcycles and motor-rickshaws:

Public utility vehicles: garbage collectors, sweepers, road sprinklers:

Agricultural transport vehicles: harvest collectors (vehicles specially designed or modified for transport of grain, sacks, etc.); special purpose, for the transport of flour, milk, beverages, fertilizers, etc.; and animal transport (vehicles specially equipped for transport of cattle, sheep, pigs or poultry, etc.)

Tractors or other machinery (e.g. motorpumps, power generators), equipped with engines and main units derived from motor vehicles should also be mentioned.

6.4. Motorcycles

Motorcycles, including mopeds and motor scooters, meet the definition of a basic vehicle, being the cheapest form of motorized vehicle. For this reason their use in developing countries deserves broader review.

World production of motorcycles is estimated to have increased by approximately 23 per cent since 1970, dominated by the developed countries, mostly Japan. Of the poorer countries only India and Thailand have produced motorcycles in a significant number.

In the same period world private cars and commercial vehicle production increased by an estimated 14 and 22 per cent respectively. In absolute terms current world production of motorcycles is about the same as commercial vehicles and one-third that of private cars.

While the role of the motorcycle in developing countries is significant, its use is predominantly urban. The same would also appear to be true of the three-wheeled passenger and cargo carriers based on motorcycle technology, such as the Indian auto rickshaw and the Indonesian bermo.

A major reason why motorcycles are not used in rural areas would appear to be that production is dominated by the developed countries. Trends in the design of their products make them increasingly irrelevant to the requirements of rural areas of the developing countries.

Motorcycles have become steadily more complex and in all probability more expensive in real terms, with a shift away from kick-started single cylinder 2-stroke engines to electric-started multi-cylinder 4-stroke engines; from cable-operated drum brakes to hydraulic disc brakes; and from spoked to exotic alloy machined wheels.

For use in rural areas of developing countries the present requirements for the motorcycle are analogous to that of the bicycle: it must be strong, simple, easy to manufacture and maintain locally, suitable for continuous use on rough tracks and capable of being used as a cargo carrier rather than simply as a means of personal transport.

In the Philippines, some 90 per cent of motorcycles are fitted with sidecars. These combinations are based on Japanese motorcycles with power units in the range of 80-125 cc cm^3 , the complete vehicle being capable of carrying a payload of 250 to 400 kgs or two passengers plus the driver. The sidecars are generally manufactured in small, independent workshops which need nothing more than elementary metal cutting and welding equipment. The vehicles are used extensively in both town and country.

Perhaps the simplest and cheapest device that falls within the motorcycle category is the motorized conversion of the bicycle, which is made by fitting a small motor above the front wheel.

6.5. Simplified motor vehicles

Mention should be made of attempts to produce simplified versions of conventional motor vehicles. Several major international motor manufacturers, including Ford, General Motors, Toyota, Datsun and Volkswagen, are now producing what have been termed Asian Utility Vehicles (AUV). Basically a simple vehicle has been designed around a standard four-cylinder engine. All use major assemblies, including engines, gearbox and rear axle taken from the manufacturer's existing ranges, built into a simple, sturdy light-truck chassis with a beam front axle. A cab made up of flat panels, which can be produced without using expensive tooling, is added, and a number of rear bodywork styles are available, including flat-deck, closed-van and passenger-carrying variations. The intention is that these vehicles should be cheap to produce locally, as well as durable, economical to run and simple to maintain.

Since their introduction in the Philippines in 1972, the AUVs have grown rapidly in popularity and are now produced in smaller numbers in other Asian countries. They have not, however, yet penetrated into Africa to any significant extent.

Because of the complexity of the motor vehicle, and because it is designed for mass production, certain minimum levels of production and sale are necessary for manufacture to be economically viable. Complete domestic production is regarded as feasible in countries where the annual demand for cars exceeds 10,000 and that for commercial vehicles 50,000.

Assembly of semi-knocked-down (SKD) or completely knocked-down (CKD) vehicles can be envisaged in countries where the annual demand for cars ranges from 10,000 to 100,000 and that for commercial vehicles from 5,000 to 50,000. On the basis of these figures most of the poor developing countries ought, out of economic necessity, to rely on importing their conventional motor vehicle requirements. However, the undoubted prestige value of motor vehicles has tempted many developing countries into manufacture and assembly well before such thresholds have been reached - with a proportionate waste of resources.

Both the operating costs and the suitability of a particular mode of transport are critically dependent on loads and load factors, journey distance and terrain. One of the major reasons for arguing the appropriateness of basic vehicles is that they can be made to suit the consignment sizes, of travel and operational conditions. Until now, few vehicles have been designed specifically to meet the needs of developing countries. It is expected, therefore, that future development plans aimed at the transport sector should pay more attention to the procurement of appropriate transport equipment.

The term "appropriate transport equipment" for developing countries is often thought to mean simple and reliable vehicles. The concept is based on the observations that automobiles are generally designed in developed countries and that the operating conditions in these countries are quite different to those in the developing countries. Transport equipment more suited to the conditions in developing countries is needed, and can be provided through international co-operation between developed and developing countries.

6.6. Means of public transport

The degree of motorization in developing countries varies widely. In some it is similar to that in Western European towns, in others motorization is very restricted in scope. The network of roads suitable for motorized traffic is, on the whole, very limited and as a result traffic congestion is commonplace; the traffic density on these roads is extremely high - often exceeding that in towns of developed countries. The problems are further aggravated by inadequate traffic control and traffic discipline.

Passenger transport

With few exceptions, buses are the sole form of public transport in developing countries and usually run at a loss. The municipalities, constantly worried by expenditure as a result of the constant stream of immigrants, do their utmost to restrict subsidies to the urban transport undertakings. The result is disastrous for the passengers, as the number of vehicles in service is always inadequate. They are poorly maintained and continually overloaded, staff are badly paid, therefore difficult to recruit and insufficiently skilled. The chronic shortage of spare parts and the poor

maintenance of the vehicles reduces their service life to three years on average and the number of vehicles in service often to less than 50 per cent of the total. Major repairs are generally neglected.

At the same time the distances travelled by passengers are usually longer than in the industrialized countries where they rarely exceed 5 kms.

In some towns, there are collective taxis or private minibuses, in others trucks are modified for passenger transportation and even private buses, all of which belong to private operators.

Efforts to replace these semi-public transport systems by municipal systems are, in most cases, doomed to failure. A few municipalities decide to set up a municipal bus network only to find that instead of being profitable, this becomes an additional source of deficit, which leads to its gradual deterioration and sometimes even to its total liquidation.

Urban transport systems should be considered as an essential part of the urban infrastructure, and as such their profitability cannot be considered as a prerequisite for their existence.

7. FUEL SUPPLY AND DISTRIBUTION

As the operation of motor vehicles in developing countries is dependent exclusively on fuel, its supply, transport, storage and distribution is of vital importance; this causes specific problems for third world countries. It should be assumed that the growth and thus the proper supply and redistribution of fuel in developing countries was never in step with the increase in traffic and in the number of motor vehicles. The major problem lies not with the momentary satisfaction of demand which is generally met but with the difficulties and expenses, and the obstacles these pose to further transport development.

Developing countries, and especially the poorest among them, dispose of only a very modest railway network, and thus transport of fuel from oil ports to distribution centres and further to filling stations is done by road tankers or makeshift fuel transporters. The generally poor condition of both roads and transport equipment always tells on the continuity and efficiency of fuel supply.

7.1. Road Tankers

Although generally overlooked and not always properly considered, road tankers play a vital role in satisfying the exigencies of fuel supply in developing countries. Their operational condition and roadworthiness is essential. If not satisfactorily maintained they can adversely affect the functioning of the transport system in whole regions.

It is not hard to imagine what losses may be caused by a single broken-down tanker unable to reach its destination in a remote area. Its missing cargo of, say, 10.000 litres of gasoline, diesel fuel or petroleum could immobilise for days large numbers of motorvehicles, cause power plants to temporarily close down. Here becomes evident why basic models of road tankers should possibly be of the same make as the fleet of trucks or buses

served by them. Their regular service, maintenance, and eventually repair should be performed along with other vehicles of the fleet.

It can be concluded that without an efficient fuel supply system, based on reliable road tankers and an appropriate network of filling stations, no satisfactory road transport and traffic conditions can be envisaged.

7.2. Fuel Filling Stations

Fuel filling stations in developing countries evolved at random, following local necessities and not as a result of planning based on forecasts of traffic or population density. As a consequence, stations are scattered along routes indiscriminately and mainly in towns or bigger villages. Their equipment is obsolete and does not comply even with minimal fire safety regulations.

Any transport development programme or project should include a carefully-planned mode of fuel redistribution, taking into account that filling stations can have other roles than merely refuelling vehicles. In developing countries they could act as a "technical oasis" where road travellers are able to get technical assistance, have minor repairs undertaken and purchase spare parts and accessories. Cafeterias, toilet facilities and public telephones should be provided, especially in remote or scarcely populated areas.

The capacity of fuel filling stations is determined by the number of pumps. The capacity of individual pumps varies between 20 to 30 cars per hour. In populated areas, the required capacity is determined by the number of inhabitants and the density of traffic.

Filling stations along highways should be installed following forecasts for 10 years. Experience shows that around 10 per cent of the two-way traffic flow use the filling station. On highways the optimum distance between filling stations is 30 to 50 kms.

8. TRADE AND PRODUCTION OF ROAD TRANSPORT EQUIPMENT EVALUATION OF MOTORIZATION IN THE THIRD WORLD

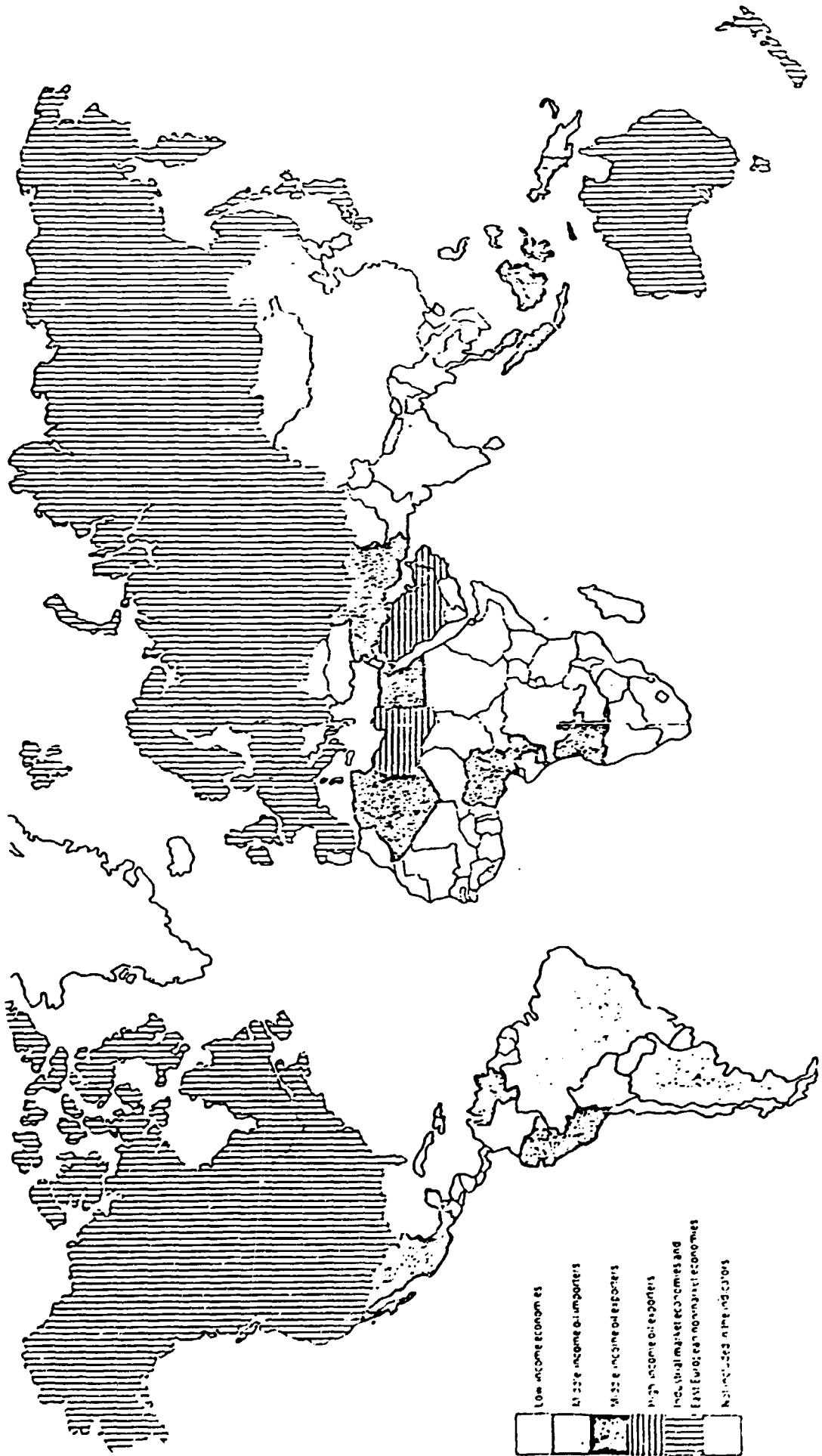
8.1. Defining the Third World

For analysis of trends in the vehicle industry in this chapter, the Third World is defined as comprising high income oil exporters and developing countries in the following geographic regions:

Latin America/Caribbean
North Africa/Middle East,
Sub-Saharan Africa,
South Asia,
East Asia/Pacific.

Remark: Countries are often classified in two groupings: developing and developed countries. This classification is however misleading.

Groups of economies



Countries, classified as developing, are in many respects more developed than so-called developed countries. Considering such facets of human life as morale, culture, social relations, democratic rights, equal opportunities etc., a so-called developing country might be much more developed than a so-called developed country.

It would be clearer if countries were grouped into the industrialized and less industrialized. This is in fact what is usually meant by the classification into developed and developing countries.

8.2. Recent economic developments

For the industrial countries, economic recession occurred mainly during the 1980-1982 period. For developing countries, whose economies are dependent on the industrialized countries, there was roughly a one year time-lag, with recession in many regions being most severe between 1981 and 1983.

The general effect exacerbated the problems and instabilities which had emerged in the 1970s. However, the response in the early 1980s in terms of government economic policy was much firmer and more uniform within the main economic blocs. The period was characterized by instability due to the difficulties of servicing dollar-denominated loans at high interest rates in the context of a rapidly appreciating dollar; falling commodity prices, including oil; and growing protectionism in the markets of the industrial countries.

Between 1970 and 1986, the total outstanding long-term debt of LDCs expanded almost tenfold, from US\$ 70 bn to US\$ 686 bn. Lending to LDCs did in fact decline, but the loans made in the early 1970s were scheduled in such a way that substantial repayments became due in the early 1980s. Events since 1980 have caused problems to most borrowers to repay these debts. Consequently, the number of developing countries having to reschedule their debts rose dramatically from an average of 3 % per year in the 1970s to around 30 % per year in 1985.

An examination of data for individual countries reveals that there are few - except South Asia - which do not face a serious debt problem and that there are a number with horrific repayment liabilities.

By the mid-1980s, therefore, serious debt problems affected most of the Third World. Most developing countries have had to make further policy adjustments to cope with the debt situation; the industrial countries have also had to respond, particularly their financial institutions. In this respect, commercial banks have played a large part in financing LDC deficits, with their share of the lending increasing from 15 % to 36 % over the past decade.

8.3. The Role of the Third World as an Export Market for the Major Producing Countries

Nine major producing countries (MPC) - Japan, the USA, West Germany, France, Canada, Italy, Spain, the UK and Sweden - account for well over 90 % of the world's vehicle exports.

Data on MPC exports to the Third World and its constituent regions are presented in the next tables.

Table 3

Imports of Passenger Cars into Third World, by Region

	1976 (000s)	1981 (000s)	1984 (000s)	1986 (000s)	% change '86 on '84
Latin America/Car.	254.0	350.9	238.6	280.3	+ 17.5
North Africa/ME	466.1	567.3	390.5	412.2	+ 5.6
Sub-Sahara Africa	146.6	207.7	106.0	114.9	+ 8.4
South Asia	11.4	9.7	45.5	60.4	+ 32.7
East Asia/Pacific	190.5	282.5	280.1	302.8	+ 8.1
Third World Total	1068.6	1418.1	1060.7	1170.6	+ 10.4

Table 4

Imports of Commercial Vehicles into the Third World, by Region

	1976 (000s)	1981 (000s)	1984 (000s)	1986 (000s)	% change '86 on '84
Latin America/Car.	154.7	187.8	95.6	103.7	+ 8.5
North Africa/ME	429.4	527.7	471.5	450.9	- 4.4
Sub-Sahara Africa	135.6	215.9	73.5	90.9	+ 23.7
South Asia	22.4	26.0	41.8	63.2	+ 51.2
East Asia/Pacific	222.7	346.1	324.4	353.6	+ 9.0

Third World Total	964.8	1303.5	1006.8	1062.3	+ 5.5

Both tables confirm the strong relationship between economic performance and vehicle demand, the latter's response to economic performance usually being subject to a time lag.

Import volumes for the leading markets in the Third World are presented in Table 5. The data illustrate the global and regional trends already described, and the sensitivity of Third World markets to economic and political pressures.

It should be noted here that the high income oil exporters - Saudi Arabia, Libya and Kuwait - experienced substantial declines in vehicle imports between 1981 and 1984, due to increased local assembling activities. This slightly increased between 1984 and 1986 after realization that total demand could not be satisfied by local production.

Table 5

Leading Passenger Car and Commercial Vehicle Markets
in the Third World

Volumes Imported (000s)

	Passenger Cars			Commercial Vehicles		
	1981	1984	1986	1981	1984	1986
Latin America/Caribbean						
Argentina	33.9	0.8	0.5	12.5	0.7	0.8
Chile	85.6	9.6	12.3	49.1	8.8	10.3
Mexico	27.8	10.5	9.8	x	x	x
Colombia	18.5	18.6	19.3	19.9	6.3	12.9
Ecuador	x	x	x	14.5	3.8	8.3
Peru	23.2	6.1	3.2	13.0	7.1	4.3
Venezuela	18.6	9.7	8.3	20.3	13.1	10.2
North Africa						
Algeria	30.2	40.3	35.2	23.8	61.9	58.3
Egypt	15.8	7.1	9.6	33.2	39.4	40.8
Libya	59.7	45.8	20.3	67.0	11.6	10.9
Middle East						
Iran	82.2	9.2	12.4	28.2	86.3	50.9
Iraq	55.1	22.9	20.5	52.2	2.3	5.8
Kuwait	38.2	36.9	40.4	25.7	13.9	20.4
Saudi Arabia	145.7	112.2	120.9	193.1	167.3	184.3
Sub-Sahara Africa						
Nigeria	134.8	49.3	52.4	144.3	19.3	29.8
South Asia						
India	-	20.7	25.3	x	x	x
Pakistan	-	24.7	26.9	20.4	36.4	44.0
East Asia						
Taiwan	23.7	22.7	24.0	12.0	11.8	13.2
Indonesia	28.9	33.4	38.2	170.0	129.1	144.0
Malaysia	94.6	101.4	101.3	30.0	39.7	42.9
Thailand	25.8	38.4	29.6	66.8	82.1	92.0

x - Not leading markets in indicated vehicle sectors
- Negligible volumes recorded

Iraq's vehicle markets clearly suffered badly from the war with Iran where car imports also decreased. But the greatest collapse in vehicle demand took place in Nigeria, where political and economic trends were highly unfavourable. In 1981, this market ranked second only to Saudi Arabia within the Third World. Oil market developments affected Nigeria particularly badly. Its oil revenues were not adequate in relation to the very large population which had to be supported, and political instability and poor economic management exacerbated its problems.

In contrast, the leading markets of Asia were successful. The populous countries of South Asia - India and Pakistan - emerged in 1983 as major vehicle importers. Markets in East Asia were largely stable, with some countries (Malaysia and Thailand) showing growth. The main exception was the Philippines which also suffered from severe political and economic problems.

The 1984 and 1986 data on leading markets emphasizes the sharp decline in vehicle demand throughout the Third World. Also, there have been a few changes in the relative positions of individual markets. Saudi Arabia remains the Third World's leading vehicle market and, with Algeria achieving growth, the North Africa/Middle East region is still a more attractive market than Latin America. Here, Chile and other major markets showed very poor results in 1984 and 1986.

Most of the Asian markets have ascended in the Third World hierarchy. The economies of these countries generally have an underlying strength and resilience provided by a certain degree of industrialization, well-developed trade and financial sectors, and diversified commodity exports.

8.4. The Role of the Third World as Producer and Assembler of Vehicles

Over the past decade, the process of evaluation from assembly to manufacture in Third World vehicle industries has continued. However, there is still wide variation between regions and countries in degree of local content being supplied to vehicle industries.

This variation can be explained by a number of complex factors at the economic, political and industry levels, and the impact of these factors on individual levels and countries. Some of these factors relate to levels of economic development, in particular industrial development and the growth of manufacturing capability in non-automotive sectors, the government trade and industrial policies, and the strategies adopted by manufacturers in the major producing countries.

Full vehicle production was established in Latin America and India well before the 1970s. In East Asia, there were important developments in those industries which resulted in greater value added in production from local sources. Here, the Republic of Korea - under Japanese, American and European influence - was forerunner and graduated from being an assembler to a producer.

The data in Tables 6 and 7, however, shows that ground gained by Third World producers during the 1970s has to some extent been lost in the mid-1980s. Between 1981 and 1986, output by the main producers indicated in the tables increased by 10 % for cars and 16 % for commercial vehicles.

Table 6

Third World Production of Passenger Cars (000s)

	1976	1981	1986
Brazil	526.9	406.0	538.3
Mexico	212.5	355.5	200.0
Republic of Korea	25.6	68.8	158.5
Argentina	142.1	139.4	141.9
India	38.3	59.1	86.0
Venezuela	97.1	82.8	72.0
Total Third World	1042.5	1111.6	1196.7
Total worldwide	29139.8	27895.9	30778.1
Third World share	3.6%	4.0%	3.9%

Table 7

Third World Production of Commercial Vehicles (000s)

	1976	1981	1986
Brazil	458.5	373.8	326.3
Republic of Korea	22.6	64.3	106.9
India	46.7	89.8	94.9
Mexico	112.5	241.6	75.0
Venezuela	65.6	71.7	38.0
Argentina	51.4	32.9	25.6
Total Third World	757.3	874.1	666.6
Total worldwide	9805.4	10024.8	11290.8
Third World share	7.7%	8.7%	5.9%

While the established producing nations - Brazil and Argentina - achieved higher car outputs (although their commercial vehicles output declined), the new producers suffered major declines in both car and commercial vehicles output. Mexico, for instance, mortgaged its oil revenues against an overvalued peso during the mid-seventies. The small size of Venezuela's domestic market and industrial base was insufficient to support what proved to be an oversized vehicle industry.

In contrast, the Asian producers were successful in expanding their output. India achieved substantially increased vehicle production, whilst South Korea - the new producer - forged ahead with much higher levels of output, thanks to its status as a closed economy with a relatively large domestic market and GDP per capita growing at 6 % p.a.

East Asia has been the focus of much of the growth in Third World assembly operations. Taiwan, following South Korea as a high growth industrializing developing country, rapidly expanded its output during the early 1980s. The ASEAN countries, particularly Malaysia and Indonesia, have large assembly operations. In line with other developments, however, output by the Latin American assemblers has fallen sharply.

Output in two other major assembling countries - Iran and Nigeria - has suffered from political and economic events. Overall though, the profile of Third World vehicle assembly, as shown by the list of major assemblers, has changed little in recent years.

Growth in the number of plants was particularly noticeable in East Asia, parts of Africa, and the Middle East (see graph), and this increased total productive capacity in the Third World. However, in many territories there has been poor capacity utilization, and in some the installation of an excessive number of plants has resulted in inefficient structures which require rationalization.

In 1986, location of plants in the regions of the Third World was as follows:

Major Vehicle Assemblers in the Third World

Latin America

Chile
Columbia
Peru

North Africa

Algeria
Egypt
Morocco
Tunisia

Middle East

Iran

Sub-Sahara Africa

Nigeria

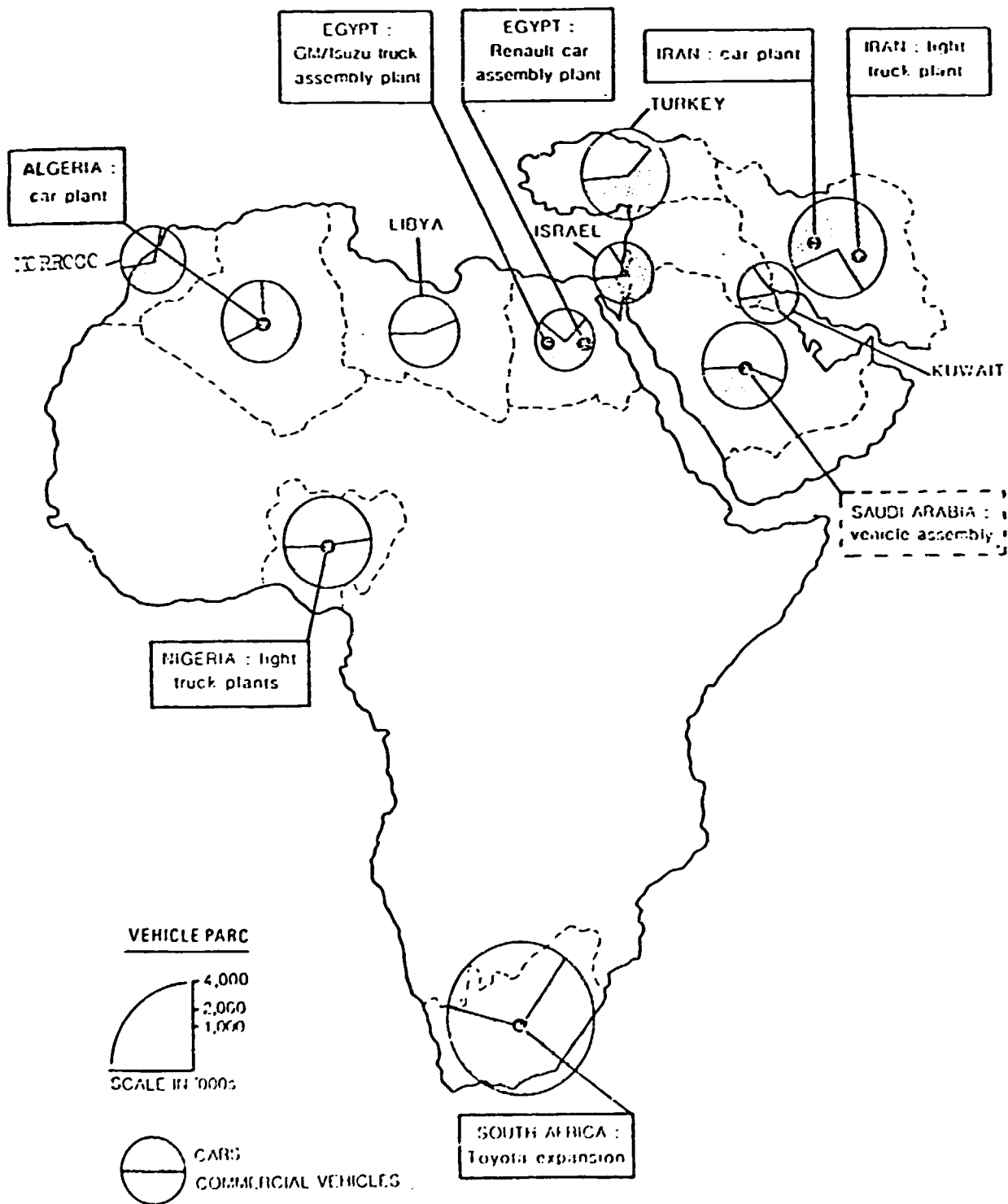
South Asia

Pakistan
India

East Asia

Indonesia
Malaysia
Philippines
Taiwan
Thailand

MAJOR VEHICLE ASSEMBLY PLANT DEVELOPMENTS PLANNED IN AFRICA AND THE MIDDLE EAST, AND VEHICLE PARCS



Of the 444 plants in the Third World in 1985, 62 % were producing or assembling commercial vehicles. Latin America/Caribbean and East Asia have the largest number of plants overall, each accounting for approximately 30 % of the total. Sub Sahara Africa houses over 20 % of Third World plants and has a greater number of commercial vehicle plants than any of the other four regions.

Much of the expansion in Third World productive capacity has been instigated by Japanese manufacturers who have been the driving force in East Asia. However, the Japanese have also been active in establishing facilities in Sub-Sahara Africa.

Some European manufacturers, particularly those in France and West Germany, have expanded their assembly operations most significantly in Africa and the Middle East. US manufacturers have been less active and much of their presence is still concentrated in the traditional Latin American markets and in Korea.

The major producing countries rank according to number of plants in each region as follows:

Presence of MPC Manufacturers in the Third World ranked
1 and 2 by number of plants

	1.	2.
Latin America/Caribbean	USA	Japan
North Africa/Middle East	France	USA
Sub-Sahara Africa	UK	Japan
South Asia	Japan	UK
East Asia	Japan	FRG

By 1986 Japanese manufacturers were responsible for 29 % of all plants located in the Third World, nearly half of those being in East Asia. West German and USA manufacturers each accounted for 16 %, the former with a notable presence in East Asia. French and British manufacturers had similar shares, a significant proportion of their plants being long established in African and other former colonial territories.

8.5. New Factors of International Trade in Vehicle Industry in the Third World

The developing countries' share of world trade remains minimal as can be seen from the preceding paragraphs. Those developing countries holding the most important share in world trade are Brazil, Mexico and Republic of Korea: their exports are oriented towards North America. Brazil's automotive exports are also aimed at Europe and Africa (see graph). A good proportion of this trade is components, and this share too will rise in the next few years. The trade is chiefly intra-firm in nature and once more the investment plans and requirements of the companies themselves suggest that this element will grow.

The foreign exchange stranglehold, which has been a permanent fact of life for many developing countries and is now the case for almost all of them, save a few Arab petroleum producers, has inevitably begun to affect trade relations. This can be seen in the appearance of various cases of barter trade. For example, in 1982 Jamaica concluded two arrangements, one with Chrysler and the other with General Motors, involving the exchange of aluminum for vehicles. Given that there is increasing use of aluminum (as substitute for steel) in car production, the deals would seem to make sense, though of course the critical issue is the terms under which such barter take place. Algeria has, similarly, conducted deals with Honda involving the exchange of oil for vehicles: once again the terms of this exchange have not been divulged.

The extent to which barter trade may expand depends on those developing countries who have the kinds of raw and semi-processed materials which car producers are looking for - the two examples of aluminum and oil are obvious ones and certainly both of these commodities could be traded by other developing countries. Unfortunately the list is not that long and with the rapid reorganization of production systems and in particular the increasing use of inputs which depend on substantial technological efforts, the chances are that developing countries will not find it easy to conclude the barter deals.

Barter deals imply restrictions and vice versa. Table 8 presents a summary of automotive trade restrictions. Looking at the developing countries the striking feature is that import restrictions are in force practically everywhere and that, as may be expected, the LC and export requirements appear strongest in those countries where operations of foreign producers are substantial.

BRAZILIAN AUTOMOTIVE EXPORTS

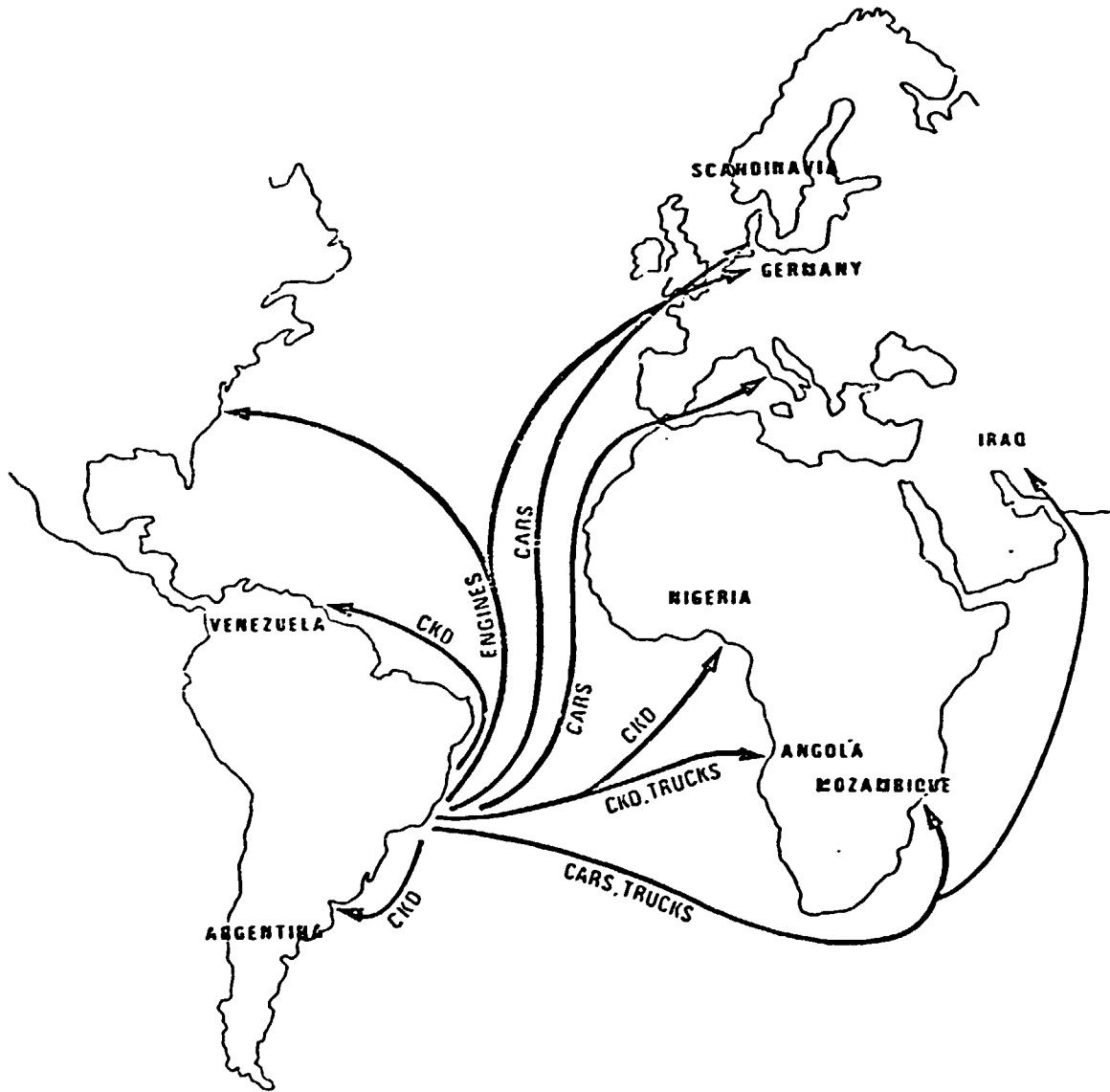


Table 8

Survey of Automotive Trade Restrictions in the Third World

Country	Local Content Requirements	Import Restrictions	Export Requirements
Algeria	no	yes	no
Argentina	yes	yes	yes
Brazil	yes	yes	yes
Chile	yes	yes	yes
Colombia	yes	yes	yes
Ecuador	no	yes	no
Egypt	yes	yes	no
India	yes	yes	no
Indonesia	yes	yes	no
Kenya	no	yes	yes
Kuwait	no	no	no
Malaysia	yes	yes	-
Mexico	yes	yes	yes
Morocco	yes	yes	no
Nigeria	yes	yes	no
Pakistan	yes	yes	yes
Philippines	yes	yes	yes
Saudi Arabia	no	no	no
Republic of Korea	yes	yes	yes
Tanzania	no	yes	no
Thailand	yes	yes	no
Uruguay	yes	yes	yes
Venezuela	yes	yes	yes

8.6. Outlook

The links between developing countries and the industrial countries are now financial as much as trading. Economic prospects for all country groupings will depend upon policies implemented by governments in both the industrial countries and the Third World. The critical policy areas for the Third World are likely to be interest rates and protectionism.

During the next five years, two thirds of developing countries' debt has to be rolled over or amortized. Thus, the period 1986-1990 is likely to be a period of transition during which further financial and policy adjustments are made.

Provided that current policies are pursued and improved upon, Third World countries in the 1990s will be able to resume steady growth at rates near to those achieved in the 1960s and 1970s.

9. PLANNING IN THE DEVELOPING COUNTRIES

In the last three decades, planning of road transport has changed dramatically. Until the mid-1950s, it consisted of estimating future traffic demand by means of simple economic growth rates. In the late 1950s, however, scientific planning, through which traffic demands were related to land-use and modal choice was introduced.

Good planning methods and practice are critical in the transport sector because of the large volume of resources it absorbs and the complex problems of intermodal complementarity and competitiveness which have to be assessed, i.e. relations between:

- roads and railways,
- air and rural roads,
- coastal and ocean shipping
- telecommunications and road construction.

Decisions must be made whether to favour operations that have high fuel costs per traffic unit (such as low-density aviation) or road transport, which is more fuel efficient.

Prior to 1960, except in a few more advanced countries, the urban transport problem in its modern form was hardly recognized in the developing world. Traffic moved slowly, but not for lack of road space, rather because most of the traffic consisted of slow-moving non-motorized vehicles, e.g. carts, bicycles and rickshaws, together with large numbers of animals and pedestrians. Transport planning amounted to little more than widening the main radial arteries, laying out new side streets and gradually converting surfaces from earth to paved roads.

In the 1960s, with the rapid growth of vehicles, the transport problem began to hit the developing countries with sudden and dramatic force. There was little expertise in those countries and although the transport problem had a much longer history in Britain and the USA, the methods of transport planning designed for Europe and North America were applied in the developing countries before they had been adequately proved in their places of origin.

Adaptation to the different conditions of the developing countries had to be made by consultants as best they could within the time and budget limits of their contracts. The result was not always satisfactory. The methodology of some elaborated transportation studies was severely criticized and the conclusions were also rejected in developed countries. It is not surprising, therefore, that similar planning studies in developing countries also came under fire.

Owing to the present widespread economic crisis and the debt burden in the majority of developing countries, a large number of these countries are paying increased attention to industrial and transport planning. UNIDO played a significant role in assisting an increasing number of developing countries in their planning and programming efforts. The aim of the assistance was to establish priority development targets and to review, through innovative approaches, the situation of the transport sector, while, at the same time paying specific attention to the rehabilitation and modernization requirements of existing transport equipment.

This led to a big, all-embracing plan, preceded by a correspondingly large and comprehensive planning study of land-use and all parts of the transport system for the next 25-30 years.

3.1. "Big Plan" Method

Methods for planning became rapidly more complex and need not be described in detail. Basically the approach was to divide the area into a large number of small zones and determine how many trips, both for passengers and goods, were made between each pair of zones. The trips were classified according to motivation, mode of transport, land-use and household characteristics of the places of origin and destination. The spatial and modal distributions of the trips were then analysed as functions of the land-use patterns and transport cost and the choice of route was simulated as a function of travel distance and/or time. The purpose of the analysis was to produce a model which, given knowledge of land use, household characteristics and the available transport facilities, estimated accurately the intricate movements of traffic on the system by mode.

The model could then be used to show what would happen if the transport facilities were changed and if, over time, the land-use and household characteristics were altered. In theory, the model was an excellent tool for investigating the complex changes to be expected as a result of future changes in population, employment, income and car ownership, and for comparing the impact of alternative transport systems and land-use arrangements. It did not actually design the alternatives however, nor did it automatically solve the problem of choosing between them. It provided a lot of information about them but the final choice of "what to do" still posed some difficult questions. The application of the model had to be preceded by a design stage to determine what could be done, and followed by an evaluation stage to decide what should be done.

The big plan approach in developing countries produced some useful results. For example, it yielded a lot of data and led to a better understanding of the problem, but it also produced incorrect or inadequate

results, some of which were inherent in the method itself. Particularly those involved the interaction between transport and land-use, public transport, congestion, trip generation, traffic composition, budget, size of model and other problems.

9.2. The "Incremental Improvement" Phase

In 1974, faith in forecasting was shattered and attitudes towards transport planning changed. The oil crisis and the subsequent world recession, together with high inflation, colossal disruption in the international balance of payments, and fluctuations in exchange rates, made nonsense of most previous forecasts, especially in transport. At the same time it was apparent that most demographic forecasts in the industrial countries were also inaccurate.

The incremental improvement approach was based on the following:

- problems in the existing situation;
- lack of financial resources.
- much could be done without large investment by using existing facilities more efficiently;
- governments were invariably anxious, in their own self interest, to produce tangible improvements quickly.

All these facts spoke in favour of "immediate action" or "short term improvements" programmes, with emphasis on low-cost measures, which necessarily meant management improvements or minor structural changes. The theory behind that approach was that it was unnecessary to make forecasts for the following year, since it could already be seen. If the focus were towards making small, but positive improvements, progress could be made.

The planning of incremental improvements is a process of looking for existing problems and finding quick solutions. It does not necessarily eliminate the use of computerized models (which have become unpopular in some quarters), because a network model can certainly be of assistance in planning traffic management schemes, bus routes or the location of markets and other big traffic generators. But the sort of model needed for this purpose is different from the big plan model.

The advantages of this approach are obvious. It leads to rapid results, at least for a time, but the shortcomings are also fairly clear. The basic principle that the sum of the series of incremental improvements must add up to progress is not necessarily true, and is certainly not sufficient. History has repeatedly shown that transport improvements which appeared obviously desirable at the time may be ultimately counter-productive. In fact, it is precisely because the results of earlier piecemeal planning were so chaotic and unsatisfactory, that comprehensive, long-term planning was introduced.

Moreover short-term plans are, by their nature, short-sighted and fail to give due weight to long-term investments, which, by virtue of their long life or high capacity, will give benefits over a long period. They also penalise projects such as railways, fly-over and multi-level car parks, in

that they are not accorded sufficient weight. As a result, an approach that ignores the future beyond five or ten years in a field like transport, where capital structures are typically long-lived and offer large economies of scale, is bound to bias investment choices in favour of inefficient stop-gap measures.

The longer incremental planning continues, the more obvious will become the need for something more comprehensive and far-sighted (although not the big plan).

In developing countries many plans have been ignored because governments lacked money or interest.

Implementation requires three essential conditions: acceptance, finance and capability. In developing countries, acceptance often means approval by the cabinet, president or monarch, as well as ministry and/or city council or mayor. Many plans have failed acceptance, not for sound, technical reasons, but for political or personal reasons, sometimes resulting from a change of government. Moreover, there is usually little or no communication between the planners and the people whose agreement is ultimately needed. Even when accepted, plans are often either not implemented or only after a long delay, because of lack of funds. Thus, it may be argued that plans should be financially realistic, but this is not easy. In some instances, planners and the departments involved may wish to press for more money by putting forward ambitious plans.

Given the political will and the money, there remains the problem of actually carrying out the plan. Usually there is no difficulty in obtaining the necessary engineering capability, but there are obstacles in developing countries, to enforcing land-use proposals. Few developing countries have any reliable means of controlling the way in which the land is developed or redeveloped. Restrictions on land-use lower its value, in the short run at least, and therefore, open up the possibility of corruption. Hence, even if legal powers are available, they are often ineffective.

Acquiring land for construction poses another set of problems, apart from its monetary value. For example, the acquisition of land for road construction may involve the disruption of traditional land tenure arrangements, even if legal powers exist, or can be obtained, to permit compulsory purchase, these arrangements may deter or delay governments from acquiring the land. Also, there are difficulties in implementing management measures, which may be essential parts of the plan, for example, a financial policy for public transport is obviously necessary, but whatever means are proposed to pay the cost of the service, if they involve higher fares or higher taxes of any kind, they are difficult to enforce. Further, the police in many developing countries are unwilling to enforce vehicle and traffic regulations.

9.3. Causes of planning failure

Planning is a difficult and controversial task. Even with the best intentions and greatest skill, planners will never satisfy everyone and will almost inevitably antagonize some. Also, in many cases they have failed to

influence development in the way they intended, and where the plans have been accepted and implemented, these have often failed to achieve the results expected.

The main reasons for such failures may be summarized as follows:

- poor planning techniques: these however have steadily improved and are better today than 20 years ago when scientific planning began to be applied in developing countries:
- inadequate terms of reference: some planning studies were doomed from the start by terms of reference that excessively limited the area and aspects to be covered:
- poor data:
- lack of political realism: some plans have contained proposals that stood no chance of acceptance. The planning authorities either had no familiarity with political realities, or wished to ignore them:
- lack of budgetary realism: again the planning authorities may have had no feeling for what was financially feasible, or else they wished to push their case regardless. Either way, many plans have been shelved for lack of money:
- lack of qualified staff:
- lack of planning controls:
- inadequate means of enforcement: police, inspectors, traffic wardens may be unable or unwilling to enforce regulations:
- lack of feasibility: it is not enough to blame failure on the lack of planning controls and enforcement. One should not sow seed in unsuitable soil. Plans should be designed for the practical conditions which are going to be encountered. Too many plans err on the side of an ideal and lose sight of what is achievable.

10. CHANGES IN STRUCTURE OF TRANSPORT BETWEEN NOW AND THE YEAR 2000

10.1. General trends

The future structural development of large cities in the various countries/regions will be determined significantly by:

- the magnitude and speed of the growth of the population of large cities;
- the economic and social structure of the country in question and the future progress of this structure, and
- the attitude of the country's population to urban and rural life.

Combined, the above factors will lead to an overflow of existing cities throughout the world, or where the pressure is very great, to the establishment of new settlements. An important point is whether this proceeds in a largely unplanned manner or within an ordered and well-planned framework. Overflowing growth may be caused by uncontrolled migration into the cities from the countryside, but it may also be the result of the large-scale realization of the desires of the individuals to live in "green" areas.

The rapid urbanization of today's world is well known. In 1800 approximately 3 % of the world's population lived in towns with a population of more than 5000 inhabitants. In 1920 the figure was 14 % and in 1970 30 %. During this period the world's population had increased twentyfive fold. This process is continuing, and by the end of the century more than half of the world's population will be concentrated in urban areas.

In developing countries an increasing number of people migrate to the towns in the hope of finding a life which is easier, more comfortable and less monotonous than in the villages. Unfortunately these lures of urban life are usually denied as most African towns have a surplus of unskilled labor. The growth of towns in the developing countries is even faster than in the developed countries. This growth will be even more pronounced in future and will reach an annual average of 4.8 % around 1990. The growth of conurbations with over 500,000 inhabitants will be even faster: it is estimated that it will be 5.2 - 5.8 % per annum.

The population of such conurbations will thus double in 10 - 12 years. Such rapid growth entails the need to increase the urban infrastructure at least at the same rate in order to maintain urban services.

10.2. Special effects in the developing countries

In developing countries, owing to the belief of the rural population that the towns offer better income prospects than the rural areas, the demographic pressure on the towns will continue to be such as to prevent any possibility of properly planned urban development. In order to provide the same services per head in the year 2000 as they do today the developing countries would have to expand their infrastructure and public financial resources by about two thirds. Even this, however, would not be enough to effect an improvement on present conditions.

It must be borne in mind that in almost every large city in the developing countries there are densely built-up areas with narrow streets and that only in the rarest cases are the existing main services sufficient to cope with the present situation, let alone with additional dwellings or workplaces. In the older settlements the historic inner areas, with their high population densities, are problem areas with correspondingly poor living conditions.

On the other hand, in many cities between a quarter and more than half of the population is already living in "shanty-towns", on the fringes of the city, without adequate sanitation or other infrastructure facilities.

This trend in structure, heightened by inadequate transport infrastructure and equipment, will intensify the problems of viability of large cities in developing countries between now and the turn of the millennium.

Building efforts will have to concentrate on massive, high density housing projects. On the other hand, the increase in the size of the better-off section of the population, with its continuing desire for separation of the spheres of living, work, shopping and leisure, combined with the rapidly growing use of private - and often excessively old - cars, will pose very serious traffic and environmental problems for the Third World cities.

10.3. Development of City Traffic

There are close reciprocal relationships between a country's economy, its urban development and its transport.

The more diversified a country's economy and the greater the degree of division of labour practiced within it, the greater will be the volume of traffic generated. Mobility and standard of living are mutually dependent. High living standards result in high mobility and vice versa. In the developing countries in particular the growth of mobility is faster than the growth of income.

In cities in developing countries with more than a million inhabitants, expansion of local public transport is absolutely essential in order to avert the following major negative influences:

- pressure of population on the cities,
- congested central areas and unplanned urban development,
- concentration of motor traffic in the large cities,
- inadequate infrastructure for local public transport.

The large cities and conurbations in the developing countries will have to cope with the following transport related problems between now and the year 2000: Ever increasing transport needs as a result of the increase in population; the increasing separation of the functions of the residence, work and recreation accompanying the increasing division of labour and the further increase in mobility of the urban population as incomes improve; an increase in motor vehicles in the conurbations despite a relatively low gross national product and corresponding standard of living, and oil prices; lack of financial resources to expand transport infrastructure which is already inadequate both in the field of private transport and local public transport.

The following additional points should be mentioned in connection with the developing countries, especially in Africa:

- the very heavy demands placed on the available vehicles which have limited usability;
- the universally high rate of capacity utilization of the vehicles, given the large and steadily increased demand;
- the often poor state of the roads;
- the need for repairs and spare parts resulting from use.

The low level of efficiency of the transport workshops, which in many instances is aggravated by a shortage of spare parts (as a result of lack of indigenous spare part industries or a lack of foreign currency for purchasing spares from industrial countries) frequently leads to internal "cannibalising": for instance, vehicles, which are often in quite good condition, are broken up to provide spares for other vehicles. This inevitably leads to a further decrease in the number of vehicles available for use and a simultaneous increase in the demands placed on those vehicles that are in use.

This chain of cause and effect, far reaching in its consequences, which has also been described as a "complex of problems of road transport" in the developing countries, is illustrated in Table 8.

There are a few further negative factors which restrict and reduce the scope and effectiveness of public transport in the developing countries. They include low employee/operational vehicle ratios, in some cases a low level of education, training and reliability among personnel, very low fares in relation to operating costs (owing to the low purchasing power of the population) and so on.

The consequences of all these problems will result in a general deterioration in transport conditions as well as cause substantial impairment of the environment and have adverse repercussions for the inhabitants. An attempt to reach comparable standards to those achieved in local public transport in Europe would certainly be desirable in these countries but will only be partially feasible.

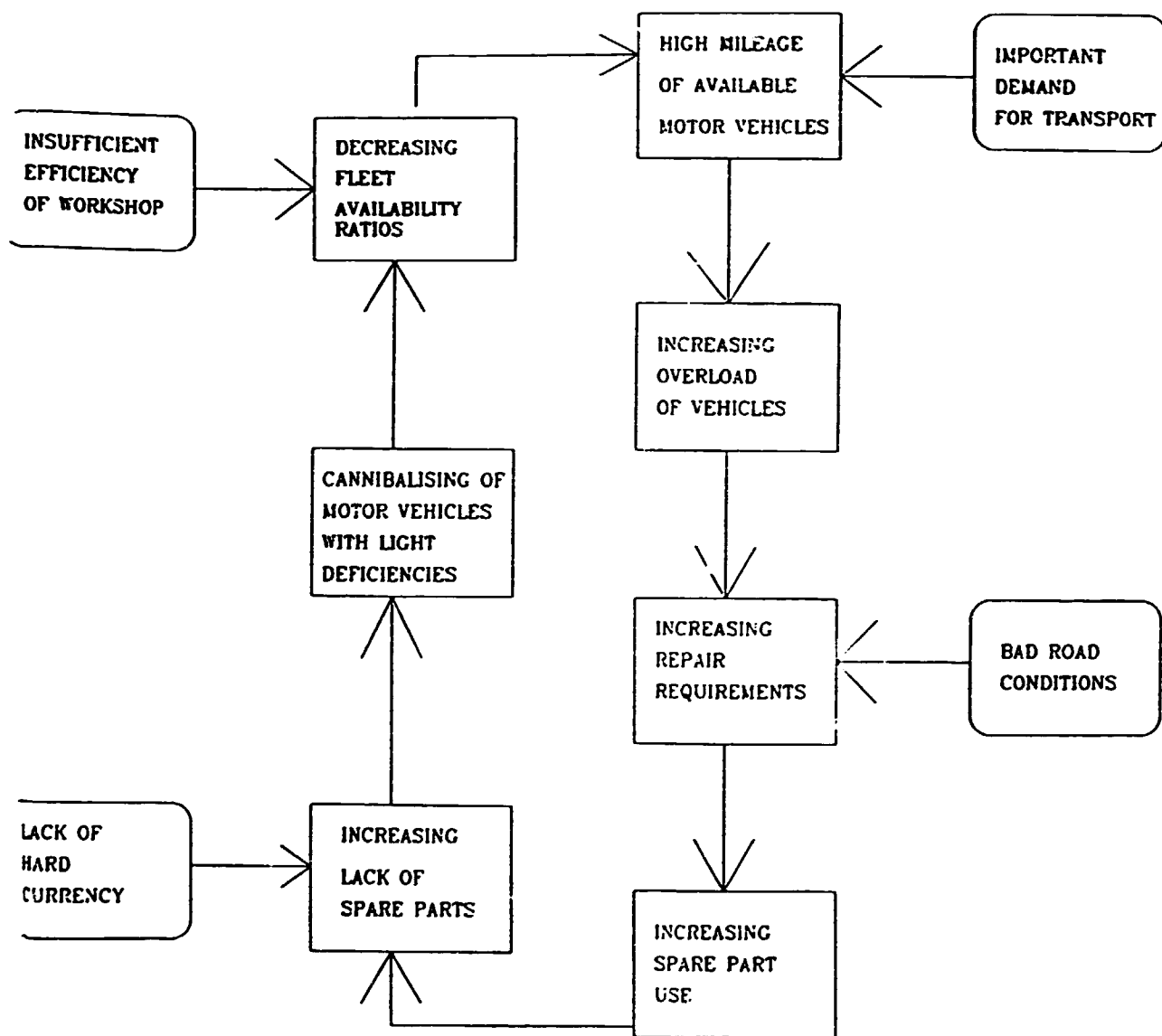
In many cities there will still be high capacity rail transport (metropolitan railway, rapid transit, light rail) even by the year 2000. In some cities, especially in the newly industrialized countries, the construction of rapid transit rail systems, which has already been started, is being continued, but owing to the lack of financial resources such construction will lag behind the general population increase and urban development.


The main burden of meeting public transport needs will therefore continue to fall on buses (both standard size and minibus). In addition, alternative types of transport (e.g. rickshaws, samlors, bemos) powered by very small motors or by human strength, together with taxis in different forms, will not only retain their present status, but will actually gain in importance.

In view of the generally low standard of public transport, the higher earning section of the urban population will continue to make little use of it. At the other end of the scale there are broad strata of the population who, owing to their social position and income, will not be able to use public transport even in the year 2000 because they cannot afford the fares. This trend will grow more pronounced owing to the fact that the distances between the home and the workplace will become greater as the city overflows its original boundaries causing the cost of travel to become ever higher.

This indicates that even by the turn of the millennium a substantial proportion of daily urban journeys in the developing countries will be

CIRCULUS VITIOSUS OF MOTOR VEHICLE TRANSPORT
IN DEVELOPING COUNTRIES



Legend:  = external factors

accomplished on foot or by bicycle. Journeys, whether on foot or by transport, will be made chiefly because they are economically necessary (work, education, shopping, personal business).

10.1. Proposals

The following short-term measures are recommended as possible ways of improving the transport situation in cities in the developing countries:

- Dispersing traffic concentrations, e.g. by staggering working hours in different locations and/or by road-tolls for certain areas, bans on private car use at certain times.

Improvement of the traffic situation by improving the organization of road traffic, moving and stationary traffic, two wheeled and pedestrian traffic, accompanied by, inter alia, priorities for local public transport and extension of "paratransit" practices.

Improvement of traffic discipline by appropriate education, training of specialists, traffic controls, technical inspection of vehicles.

Over the longer term there must be efforts to eliminate in-built defects produced by poor town planning and to create new residential units in the areas surrounding the cities. This will have to be done by:

- Co-ordinating the spatial function of supply areas at subsidiary supply points located concentrically at various distances from the city centre.

Taking due account of transport routes when drawing up land-use plans.

Establishing and concentrating jobs in commerce and industry at the end of transport chains in order to produce counterflows to the main traffic flows to and from city centres.

To this end:

Urban expansion must take place not in concentric rings but radially along individual traffic development axes:

The infrastructure of the individual new settlements must be expanded on the principle of division into subsidiary centres (establishment of centres of varying size and function); and

- By specially fostering public transport: traffic management must be made easier and environmental damage by private transport must be limited.

In this connection it should be pointed out that it will not be possible to simply transfer the transport strategies and planning methods of industrial countries to the Third World without adjustment. The developing countries require simple, practical and cheap solutions which do not have to rely exclusively on foreign aid for their implementation but which can be put into effect using indigenous resources.

II. INTERNATIONAL CO-OPERATION

A continuing dialogue between developed and developing countries with the object of raising the developing countries' share in world industrial output through increased international co-operation began in the seventies and has produced many good results. The type of technical co-operation required for the development, adaptation and transfer of suitable technology continued to become more and more complex, specialized and specific in nature.

Developing countries are in various phases of industrial development. Some countries have just started with manufacture, some are almost industrialized, some appear to have specialized in mining, petroleum refineries and basic consumer industries such as food, beverages and tobacco. Here there is international co-operation. However, the majority are relatively under-represented in such branches as machinery, iron and steel, paper and paper products, transport equipment, and plastic products.

The direction of international co-operation should therefore be changed from a methods oriented approach to more of a problem oriented approach. More emphasis should be laid on selective co-operation based on studies of facts.

Any demands or requirements for co-operation on the part of developing countries should be preceded by an internal in-depth self-evaluation. True, there is an ever increasing demand in transport equipment, but for some countries it would be a tragic error should they wish to satisfy this demand by local production.

Self reliance is creditable, but many instances have shown that building up an industry cannot start with establishing automobile manufacturing or assembling plants.

Today's automobile production is concentrated in a few highly developed, industrialized countries and is characterized by automation e.g. robotization and sophisticated technology. There is also a distinct overproduction, resulting in competition and many unsold automobiles. For this reason, save a few exceptions, international co-operation should not be aimed at setting up new plants for manufacturing automobiles or automobile parts in developing countries, but instead at supplying more technical assistance and seeking new possibilities for capital investment (joint ventures) in the transport sector. It must be remembered that international co-operation does not necessarily mean only contacts between developed and developing countries. Regional co-operation in geographical areas (parts of Latin America, Asia, Africa) contains many possibilities yet unexplored.

II.1. Technical Assistance

External assistance plays a significant role in the industrial and economic growth of developing countries. Through this assistance it is possible to shortcut the process of development.

The most important assistance comes from UNIDO, whose role it is to promote and accelerate the industrial growth of developing countries and to co-ordinate the efforts of all the United Nations agencies in this field. As means of assistance UNIDO contributes expert advice, equipment and training

facilities. The recipient countries themselves shoulder the major cost of projects, by contributing land, buildings, services, staff and cash. The work in this field continues and the efforts made by all sides have yielded promising results.

The major problem facing most of developing countries today (and Africa in particular) is the continued and recurrent imbalance between agricultural food production and the ever-growing population in both rural and urban areas. The economy of many developing (and mainly African) countries is broadly based on agriculture, with limited levels of industrialization and development in the production and transport sector.

Technical assistance aimed at solving the problem of producing machinery that will optimize the use of inputs to agricultural production as well as advice on the operation and repair and maintenance of a rather complex transport system is the kind of help developing countries expect.

It should be noted that technical assistance offered to developing countries should not be the exclusive privilege of international organizations or donor governments. Large manufacturers of transport equipment and other companies dealing with transport have much to offer in this field. As part of their marketing activity they can also provide advisors, experts and other personnel who, while introducing certain products or systems and training local manpower, can impart precious market information which will be helpful in designing appropriate equipment for the specific needs of developing countries.

Experts and advisers in co-operation with local or other specialists, will specifically be expected to:

- Review and evaluate the prevailing situation in the transport sector (number of operating vehicles, their age, place and condition of operation, state of maintenance and repair facilities etc.).
- Review and evaluate existing data concerning eventual production (vehicles and spare parts, production capacity).
- Categorize the vehicle fleet (both private and government-owned) in the country by type, make and model, by location.
- Based on manufacturers' recommendations and taking into account local conditions, establish for each type, make and model the frequency and nature of the required preventive maintenance to be performed.
- Review and appraise the suitability of the existing maintenance and repair workshops, equipment and other facilities available.
- Review and appraise the existing manpower resources available, its deployment and utilization.
- Advise the responsible government authorities of these requirements in order that they can be considered and promulgated to all government departments.

- Recommend new facilities required, including a time-phasing of their construction.

Recommend required improvements. Study procedures and flow of maintenance work for public transport vehicles.

Advise on organization of public transport, operation of public buses, with a view to improving the public transport operation and avoiding duplication of maintenance facilities.

- Determine the demand trend for each kind of vehicle and the necessary specification of spare parts.

Prepare and recommend standard exigencies towards newly acquired transport equipment, based on climatic and environmental conditions as well as local experience gained so far on working and operating conditions.

Liaise with government agencies and local specialists and assist them in establishing the most economical plans aimed at the development of the transport sector enabling it to meet the increased demand.

- Assist in formulating and conducting "in plant" training programmes and in defining the outside fellowship training.

- Recommend nominees for outside training, focusing on the principle that only such personnel be trained who can be expected to employ the gained knowledge profitably.

Review and evaluate existing data concerning local production of vehicles, production capacity, volume of import demand for various parts, accessories and material needed for the production.

- Consider the optimum size of production in relation to the projected supply/demand gap and assess the production facilities and conditions required.

- Consider the advantages and disadvantages of expansion/diversification as opposed to the creation of a new capacity to fill the supply/demand gap for each product.

- Explore and recommend possible ways of regional co-operation among neighbouring countries, and in this context initiate enterprise-to-enterprise co-operation.

Prepare industrial project profiles which would give a preliminary indication of the feasibility of the project: the profile should be in accordance with UNIDO's recommendations.

The proposed guidelines for technical assistance will help the developing countries in enhancing the transport sector and in solving technological problems, thereby contributing to the change of the economic structure by increasing the transport sector's share of the economy. These

goals are to be attained by upgrading the process of industrial planning, by allowing optimum utilization of investment capital and by ensuring that development is responsive to national needs.

11.2. Technology transfer

In formulating their technology policy, developing countries continue to show increasing interest in technology transfer.

Technology available today being the consequence of the historical process in which technology evolves, and developed countries having an almost uninterrupted history of technological evolution, the process of technology transfer is naturally directed from advanced countries to developing ones.

The term "technology transfer" has been defined as: the process of information transfer between science, technology and actual utilization of scientific data and ideas, to wit: production of goods and services; the process by which science and technology are diffused throughout human activity; the transfer of research results into operations; the process by which technical information originating in one setting is adapted for use in another setting. Collectively, these and other definitions share a common theme which characterizes the process as one of bringing technology into widespread use in solving mankind's problems in the shortest practical time.

Technology transfer, however, cannot be successfully realized without (a) assisting developing countries in the selection, acquisition and development of technology consistent with their conditions and capabilities, and (b) preparing them at the same time for the changes in the world technological scene and in that context helping them to strengthen their technological capabilities.

The process of technology transfer is a complex one which is aimed basically at getting the knowledge from the generator into the hand of the user. Technology is transferred into the developing countries via such customary mechanism as direct investments, export of machinery, equipment and products, industrial and trade fairs, licensing contracts, training arrangements; supervision or quality control at production sites or at home-plants; and technological workshops. Although the method of transfer depends greatly on the technology to be transferred, and the characteristics of the receiver, in all cases the transfer takes time as it is a matter of building up extensive capabilities at the receiving end.

Standardization

One obstacle in technology transfer is the tendency of one party to take advantage of the other. Recognizing this problem, UNIDO has published guidelines as to how this transfer could be effected to the mutual benefit of the parties involved. Unfortunately, no mention of standardization is made in such documents. However, standards organizations do play a significant role in the transfer of technology. As has been the case in more industrialized countries, there are many advantages that society in a developing country can derive from standardization.

Standards can give guidance to transfer even without buying technology. International understanding is such that any country can adopt the standards of other countries, or international standards issued by ISO, IEC, etc. Consequently, a very useful transfer of technology is facilitated. Standardization therefore offers innumerable advantages, short as well as long term, to producers, consumers and the national economy as a whole.

The movement of technologies in new contexts of technology transfer may be regarded as one of the most significant mechanisms which has helped to reduce the technical and managerial gap amongst the industrialized countries. On the contrary, it has contributed to widening the gap of comparative wealth of the richest and poorest nations. That is one of the reasons which has led to negotiations on international codes of conduct for technology transfer and multinational corporations. In this sense, UNCTAD and other United Nations agencies have become the focus of developing countries' efforts to obtain a new economic order in which they can acquire better terms of trade, increased access to technology, an increased flow of resources from industrialized countries, and a code of conduct regulating international technology transfer.

It should be added that technology does not operate in a vacuum: technology, unlike science which is universal, is a commercial commodity which as such involves development cost and cannot be expected without some form of payment. Its development requires an economic, cultural and technical environment which cannot be easily duplicated beyond the confines of the society in which it developed originally. Developing countries should develop their own capability for generation and adoption of technology to suit their requirements.

Thus, significant technology transfer can and will occur only when the right people, markets and ideas coincide with usable technology at the right point of time. Technology, per se, may be the least important element in the overall transfer process. This holds true for the transport sector as well as for other branches of economy.

12. GOVERNMENT AND INSTITUTIONAL INVOLVEMENT IN THE DEVELOPMENT OF ROAD TRANSPORT

In the development of road transport in developing countries the assumption appears to have been that the private sector would supply whatever vehicles were necessary to make efficient use of the roads provided by the government. Transport assistance is more effective if designed to address the sector as a whole, rather than focus on individual parts thereof.

It is true that the emphasis is often on the solution of obvious transport problems, such as completion of missing links in the primary transport network, on meeting demands in urban public transport, provision of reasonable access to basic industries, urban settlements and rural food-producing areas. In the course of development, the choice among alternative investment options becomes more difficult and more sophisticated planning becomes necessary.

Governments should support development of road transport on a broad basis which includes infrastructure, purchase of trucks and buses and the

institution and financing of transport enterprises. The main thrust should be directed to the development of capability in both the public and private sectors for operation maintenance, and renewal of transport equipment, investment of financial resources is a necessary but not sufficient condition for achieving development. It is essential on the part of the government to supplement financial assistance with institutional development and policy changes. This may involve improving management information systems, project preparation, manpower staff training, providing sound data bases for transport planning and introducing price incentives in tariff policies for all modes of transport to make the transport market function better. They should avoid distortions in pricing policies and move in the direction of reducing protection, regulation and subsidization with the objective of facilitating competition and innovation.

Developing local capabilities for maintenance and repair has been difficult in a number of countries and particularly in the road transport (and transport equipment) sector. Some reasons for this are that such operations are highly decentralized, geographically scattered, and utilize a relatively low technology, but the main barrier has been motivational. Although it is well known that maintenance and repair are among the activities bearing the highest economic return, there is a general lack of awareness of its significance at administrative and political (government) levels. Unless traffic is disrupted it is an obtrusive activity and has more of the visibility of new construction works or procurement of shiny equipment. Deterioration of both roads and transport equipment is normally gradual over a period of years, and is thus not likely to spur immediate action by governments or institutions. Conversely, the benefits of road construction or purchase of a batch of new buses seem more immediate and tangible. This difference in impact generally results in higher political support for construction and purchase of newest equipment and sometimes in an actual premium for diverting resources from maintenance and repair to financing glamorous projects. Governments really devoted to the economic growth of their respective country should resolutely avoid such pitfalls and make every effort to build up efficient domestic capacity for adequate maintenance and repair. They should rely more on a staged approach attuned to their country's absorptive capacity and real needs.

In this context reconditioning of motorvehicle parts - as an immediate action - should be promoted owing to the nature of this activity which is characterised by low unit investment and its indisputable role in keeping traffic on the move.

National institutions should be oriented towards more efficient training with the scope of easier absorption of new technologies, promotion of national standards and regulations aimed at the achievement of more homogenous vehicle contingent, and thus more efficient traffic.

The environmental problems arising from pollution caused by motor vehicles should also be dealt with by the respective institutions.

A P P E N D I X

S t a t i s t i c s

Total Motorvehicle Production 1986-1987

(thousands)

	C a r s		Commercial vehicles		T o t a l		% Change 87/86
	1986	1987	1986	1987	1986	1987	
Germany (Federal Rep. of)	4311	4373	286	260	4597	4634	+ 1
France	2773	3070	422	440	3195	3510	+ 10
Great Britain	1019	1142	229	247	1248	1389	+ 11
Italy	1652	1700	179	200	1832	1900	+ 4
Belgium	258	294	43	42	301	336	+ 12
Netherlands	119	125	15	18	134	143	+ 10
Spain	1282	1390	251	290	1533	1680	+ 10
EEC total	11414	12094	1425	1497	12840	13592	+ 8
Sweden	421	432	66	70	487	502	+ 3
Austria	7	7	5	4	12	11	- 8
Turkey	89	116	24	22	113	138	+ 22
Yugoslavia	240	295	42	37	292	332	+ 13
Total West Europe	12171	12944	1562	1630	15224	14575	+ 6
COMECON countries	2154	2200	1102	1150	3256	3350	+ 3
USA	7829	7099	3486	3806	11315	10905	- 4
Canada	1061	805	793	838	1854	1643	- 14
Latin America	1178	1115	390	375	1568	1490	- 5
Japan	7810	7800	4420	4370	12260	12250	0
Rep. of Korea	457	760	144	200	602	960	+ 59
Other countries	666	720	455	495	1121	1215	+ 8
Total	33326	33523	12382	12864	45750	46388	+ 1

Total Motorvehicle Registrations 1985

C o u n t r y	Cars	CV	Population	
			Per Car	Per Vehicle
1.	2.	3.	4.	5.
A f r i c a				
Algeria	600,000	300,000	36	24
Angola	50,000	100,000	155	78
Benin	15,000	12,000	261	145
Botswana	11,448	28,002	90	26
Cameroon	66,368	40,094	142	89
Central Afr. Rep.	7,000	5,000	369	215
Chad	7,000	7,000	731	365
Congo	23,000	16,000	79	45
Egypt	475,000	190,000	99	71
Ethiopia	39,627	19,661	808	542
Ghana	67,000	50,000	206	118
Guinea	12,000	12,000	460	230
Ivory Coast	160,000	87,000	57	37
Kenya	130,000	120,000	149	78
Libya	425,000	275,000	8.7	5.3
Madagascar	55,000	50,000	175	92
Malawi	15,000	15,000	455	228
Mali	17,060	5,000	445	344
Morocco	494,256	211,578	48	33
Mozambique	50,000	20,000	268	192
Niger	16,000	16,000	393	196
Nigeria	608,000	638,423	145	71
Senegal	35,000	20,000	187	119

Table cont.

1.	2.	3.	4.	5.
Somalia	4,862	2,533	1,332	876
Sudan	80,000	65,000	264	146
Tanzania	45,000	35,000	471	265
Tunisia	160,000	140,000	45	24
Uganda	30,000	15,000	476	317
Zaire	90,000	50,000	357	230
Zimbabwe	164,659	77,422	51	34
<hr/>				
T o t a l :	7,335,396	3,906,680	72	47
<hr/>				
A s i a				
Arab Emirates	179,000	51,000	8.5	6.6
Bahrein	73,724	23,759	5.6	4.2
Bangladesh	40,000	35,000	2,490	1,328
Burma	35,000	50,000	1,034	426
China	100,000	1,700,000	10,349	575
Hong Kong	242,213	85,590	21	15
India	1,210,750	1,837,200	617	245
Indonesia	800,000	1,200,000	212	85
Iran	1,591,290	512,658	27	21
Iraq	250,000	150,000	60	38
Rep. of Korea	465,149	483,170	90	44
Kuwait	519,548	178,670	3.4	2.5
Malaysia	900,000	200,000	17	14
Pakistan	339,803	140,779	285	201
Philippines	360,540	535,000	154	62

Table cont.

1.	2.	3.	4.	5.
Saudi Arabia	1,856,398	1,704,300	5.8	3.0
Singapore	232,340	119,542	11	7.2
Sri Lanka	141,730	125,655	113	60
Syria	96,398	193,118	105	35
Taiwan	585,734	389,124	33	20
Thailand	525,000	600,000	99	46

T o t a l :	11,616,956	10,763,615	2,158	1,120

Central America				
Bahamas	52,000	11,000	4.4	3.6
Barbados	30,984	2,036	8.2	7.6
Belize	3,098	3,424	53	24
Costa Rica	95,000	65,000	28	17
Dominican Rep.	105,000	65,000	61	38
Guatemala	175,000	100,000	46	29
Haiti	33,000	12,500	176	128
Honduras	27,000	50,000	164	58
Jamaica	105,000	28,000	23	18
Mexico	4,870,145	2,048,538	16	11
Nicaragua	40,000	35,000	73	39
Panama	110,000	45,000	19	14
Puerto Rico	1,000,000	200,000	3.4	2.8

T o t a l :	7,123,553	2,834,175	17.1	12.3

Table cont.

1.	2.	3.	4.	5.
South America				
Argentina	3,885,000	1,388,000	8.2	5.9
Bolivia	40,000	50,000	121	67
Brazil	10,461,704	1,122,415	13	12
Chile	618,731	248,846	19	14
Colombia	1,023,783	67,968	28	26
Ecuador	90,090	175,000	101	34
Guyana	33,000	12,500	24	17
Paraguay	40,000	25,000	91	56
Peru	381,457	204,261	50	33
Uruguay	190,000	100,000	15	10
Venezuela	1,955,000	961,000	9.5	6.4

a l :	18,548,476	4,356,476	14	12

i a	6,636,200	2,196,600	2.3	1.8
	1,427,058	279,686	2.3	1.9

	9,229,096	2,545,896	2.4	1.9

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