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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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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.

Prepared by

Mr J. J. KATONA

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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 hope for a better future. Nonetheless economic prospects for the nearly 4 billion people in developing countries are starting to brighten. If their governments seize the chance, they will soon be striking back at man's ancient enemies of poverty, ignorance and disease.

This sounds a sweeping generalisation in need of qualification, but the necessary complications should not obscure one broad truth: that the Third World's economic progress can be judged by whether its real gross domestic product grows by more than 5% a year, or less. Between 1965 and 1980, its annual GDP growth averaged 6%. Since 1980 it has slowed to 3 1/4%. As the first half of the 1980s brought the roughest economic times in half a century, the chances of a big improvement are good. The optimistic tone of this statement is motivated by three main reasons:

First, developing countries are gaining greatly from cheaper oil. Roughly 70 of them are net oil importers, and more than 3 billion people live in them. Their economic life has indeed become lighter as the dollar price of a barell of oil has tumbled towards $ 15 - in real terms where it was in 1973. This has already raised their expected GDP growth in the last two years to 3 - 3 1/4. Cheaper oil means more foreign exchange to spend on other things: roads, machines, fertilizer, schools, etc. It means also a chance to rebuild foreign reserves or pay off loans, both measures that 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 service their debts in full - start competing with eachother to look generous.

Japan has just announced debt forgiveness to 17 poor countries. America, which until recently dug in its heels against debt concessions, will soon follow suit, France has a plan which favours cancelling one-third of poor countries public and publicly guaranteed debt. England suggests that government aid in the form of loans should be converted into grants, debts should be rescheduled and interest rates cut.

It is generally agreed that debt relief can hinder reform and therefore it should be given only to countries that had adopted 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 money and try harder 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. Wars, drought, pestilence - the Old Testament horrors have plagued Africa, but they matter less than some crass government errors. Most African governments have done the opposite of their Asian - and successful - counterparts: they have gone for import substitution rather than exports, let their exchange rates become uncompetitive, shunned foreign investment, held down farm prices, preferred fancy hospitals and universities to local clinics and schools.

This message, repeated hundreds of times (most recently by World Bank) may slowly getting trough, governments start to realise that the root of the problem is bad economic policy, especially a 20 year African custom of discriminating against agriculture. There lies the biggest moral for the Third World as it seeks to push GDP growth above 5% a year again. 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 - and especially African - of developing countries depends on the performance of their agriculture. Rural sectors in these countries provide subsistence to the largest part of the population.

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

Roads and transport are vitel in linking up producing and consuming areas and contribute to improved living conditions for the hundreds of thousands of people living in the area of influence of the roads and in access to social services for tens of thousands of families.

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 is to:

2.1. Present at global level the situation of the inland transport sector and its impact on the other sectors of the economy of developing countries.

2.2. To define the situation prevailing in developing countries in the domain of motorised vehicle operation, maintenance, repair and spare parts supply.

2.3. Tu suggest possible new strategies, policies and programmes for developing an integrated medium- and long-term planning of the transport sector, with particular attention to the perceived requirements for transport equipment for rural development.

## 3. IMPORTANCE OF ROAD TRANSPORT

The continuing importance accredited to transport investments in all national plans is the clearest possible indication of the strength of the belief in its ability to foster development. Experience shows, that promotional transportation investments can be the agent of important economic developments. Statements are common indicating a widerspread belief in the role occupied by transport in the development process.

Under some conditions, it may turn out to be strategic but the same can be said about any specific investment or policy.

Transport is not only the means of moving goods but also a means 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 had showed 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. Often there are disbenefits which are usually overlooked and effect the poorest groups. (Reduction in labor demands.)

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 communications 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 reflected also by World Bank lending in transport sector. In the 1950s, about 35 per cent of all Bank lending was for transportation. In the 1960s and 1970s, the share declined to 25 and 15 per cent, respectively and the same trend persists in the early 1980s. During the same period, total worldwide lending by the Bank increased from about 0.5 billion USD per year in 1950s to the present (1980s) level of about 12 billion USD per year. Therefore the amount of money lent by the Bank for transportation has actually increased from 125 million USD in 1950 to more than 1 billion USD in 1980. Furthermore in recent years, a significant amount of lending for transport has been 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) have aggreagted some 3-4 per cent of all Bank lending.

The annual Bank lending during FY 1970-1980 for different modes of transport is shown on the table:

## Average Annual Lending by Transport Modes

(FY 1970-1980)

($ US Million)

| Transport modes | Number of projects (Annual average) | Modal-Total lent | | Approx. amount lent for project |
|---|---|---|---|---|
| | | Per average year | Percent of all modes | |
| (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 | |

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 Bank loans for roads with low traffic volumes. Some of these road-works can cost as little as 10,000 USD per km in contrast to much higher costs per km for on 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. Fhe first is resource scarcity. In most African development plans the construction of transport infrastructure absorbed 30 to 40 per cent of total investment over the past two decades. 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 escpecially in the African setting 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 goernments in the decade ahead, 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 communications, large scale capital-intensive projects should be examined very critically by donors and governments, whether highways, airports, railways, seaports or telecommunications systems are invalved. Tendencies in LD 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 on the existing facilities, rehabilitation of the existing infrastructure, improvement of traffic flow by 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 to maintenance a such - construction of regional offices and workshops, procurement of equipment, periodic maintenance and training - 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 such a way as 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 nonurban roads which link with the trunk network.

Most of the national roads in developing countries were built between 1942 and 1981. Since they were constructed traffic volume has increased markedly, in same instances from 50 to 500 per cent. As a result, many of the roads are now in poor condition and are unsafe for driving. These roads have been 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 food self--sufficiency plan will require as much as 25,000 kms of new rural roads.

Such roads need particularly careful 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 paid a comparatively low part-time 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 $ 250 per km. 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 feature of investment in developing countires since the Second World War has been the importance accredited to transport. Figures show, that transport has 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, 1987 (in millions of US dollars)

| | IBRD loans to borrowers, by region | | | |
|---|---|---|---|---|
| | Sub-Sahara | Asia | Middle East | Latin America |
| Agriculture and rural dev. | | | | |
| Area development | 1276.4 | 1462.4 | 914.5 | 2919.6 |
| Transportation | | | | |
| 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 |

Note: For sources not indicated on tables, see References on page 85.

Table 2

IDA cumulative lending operation, by major purpose and region, 1987 (in millions of US dollars)

| | 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 the construction of roads.

Goods movement by truck and passenger movement by bus and taxi have become major new elements in the transport system. Most railways are carrying mor than ever 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 the highways. The result is that railways are in a state of decline and there seems little immediate prospect of road transport's supremacy being challenged by rail.

## 4.2. Road Trends

Investments over the parst three decades produced considerable changes in the 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 past road improvements have favored the construction or improvement of major rural highways rather than urban or minor roads. Emphasis is being given to rural roads, by which low volume, low cost feeder or tertiary roads are understood.

In many developing countries the end of the 1960's saw the completion of basic trunk road network and attention naturally 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 people will increase very rapidly in the future. This is because of the still high cost of road construction and the limited resources at the disposal of the poorer countries.

Despite the emphasis placed on investment in roads, the 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 from motor vehicle road system.

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 somewaht slower. All the available data implies that the result of past growth is that the transport facilities available to the rural poor remain few and primitive. There are large numbers of people living in developing countries with very limited access to motor vehicles. These people are dependant on traditional means of transport. These are walking or headloading, backloading for goods, with a shoulderpole or yoke as a less common alternative. Sporadic use is to be found of bicycles and primitive hand-charts and wheelbarrows, in some areas animals and animal-charts 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 its lack of involvement with vehicles means that a major and indeed crucial part of the transport needs of the rural people is not being met. Most developing countries lack low-cost private vehicles widely disseminated among the majority of the population of industrial workers, small businessmen and in particular rural farmers.

## 5. BASIC REQUIREMENTS TOWARDS 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 communications priority must be to provide reliable connections between capital and the main ports, administrative centers, agrimetural productive areas for a variety of strategic, political, economic and social reasons.

The expected economic results of transport improvements 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 realted to the amount of traffic, existing and expected, the process worked in favor of main roads. These factors have unnecessarily increased the cost of road construction.

## 5.1. Road Design Standards

Geometric design of modern highways have 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 better. Slower and lighter vehicles would allow the alignment, strength and width of roads to be reduced relative to present standards with, at least potentially, 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.

## 6. 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 also capabilities of developing countries.

As there is a clear relationship between the industrialization level of a country and the effectiveness of the road transport as a whole, the term "appropriate" is used here to indicate such a technical level incorporated in the vehicles, which is 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 infrastructure, low technical skills, etc.) the manufacturers in developed countries should consider underdeveloped 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 as partners which once will really 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 intermadiate level of technical sophistication (i.e. somewhere between a traditional and modern technology).

Given the variations in incomes, in topographical, road, farming and social systems, and in local resources and capabilities, there cannot be an "universal vehicle" appropriate to all the rural

transport needs of the developing countries. In most of the 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 type of vehicles to those 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.

For improving 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 variations in operating environment, loads, cost, technical simplicity and use of local resources leads logically to a progression of human, animal and at extreme, simple motorized means of movement. These are named collectively as "basic vehicles".

Such "basic vehicles" already exist and are used in different parts of the developing world, though their use is often localized. Some are primitive, being traditional devices which have remained effectively 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 people are the "road" sys-

tem. All the vehicles could be operated on roads of a lower standard, and at a cost lower, then 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 by applying the legs to rotating cranks has been shown 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, for the majority of countries the number of bicycles per 1000 persons exceeding the number of commercial vehicles per 1000 persons. The bicycle is probably the most widely used wheeled vehicle in the world. The best estimate is that world bicycle production has increased by approximately 31% since 1970 to an annual total of some 43 million. In comparison, production of all motor vehicles has increased by 16% 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 the 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 the developed countries produced thirty-forty years ago. It has a very strong heavy frame, usually painted black, with sturdy wheels of 710 mm diameter and 38 mm or 44 mm rim width.

This type of bicycle remains popular because of its robustness and longevity which result in its coming closer to meeting the needs of developing countries more than modern designs. These are operated on rough, unsurfaced tracks and paths for several years and are used 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 in wood or in steel and are suitable for production in small workshops. However the use of these trailers - except in French speaking countries of Africa and Indo-China - is uncommon.

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 already widely used in Asian cities as passenger carrier, where it is commonly known as a cycle rickshaw or trishaw. Where used, they are an important form of employment. A significant trend in recent years is the penetration of tricycles into rural areas. (Bangladesh)

## 6.2. Animal Power

The next stage of basic vehicles is the use of animals as source of power. A number of animals allow greater loads to be moved (horse, mule, donkey, ox, buffalo, camel), though speeds are low, being rextricted to the natural walking pace of the animal.

Animals play an important role in the agricultural system of most developing countries. This is particularly so in the Asian countries, where agriculture is dominantly animal based. This is not so in Africa, where the use of animals is rather scattered.

It is generally agreed that efforts should be directed towards introducing mechanized, rather than animal based agriculture. Thus while there is likely to be 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, 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 though they do cause damage to surfaced roads because of the very high contact pressure at the rim.

Because of the 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, running on ball bearings, the whole assembly being fitted to a specially fabricated steel axle. Such carts can on good surfaces carry loads up to 2.5 tonnes.

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

## 6.3. Motor Vehicles

Motorvehicles by their use can be divided into four groups:

1. Goods transport vehicles,
   - lorries and trailers
   - refrigerator vans
   - road tankers

2. Passenger transport vehicles,
   - busses
   - passenger cars
   - small delivery vans
   - motorcycles and motor-rickshaws

3. Public utility vehicles,
   - garbage collectors
   - sweepers
   - sprinklers (watering trucks)

4. Agricultural transport vehicles
   - harvest collectors (vehicles specially designed or modified and made suitable for transport of grain, sacks, etc.)
   - special purpose (transport of flour, milk, beverages, fertilizers, etc.)
   - 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 here.

## 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 deserve a broader rewiew.

World production of motorcycles is estimated to have increased by approximately 23% 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 car and commercial vehicle production increased by an estimated 14 and 22% 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 motor-cycle technology, such as the Indian autorickshaw 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 four-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 requirement for the motorcycle is analogous to that of the bicycle: it must be rugged, 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 a means of personal transport.

In the Philippines some 90% of the motorcycle population is fitted with sidecars. These combinations are based on Japanese motorcycles with power units in the range of 80-125 c.c. $cm^3$, the complete vehicle being capable of carrying a payload a 250-400 kg 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. The simplest means of doing this is to fit 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 passanger-carrying variation.

The intention is that these vehicles should be cheap to produce with - a significant local manufacturing content - durable, economical to run and simple to maintain.

Since their introduction in the Philippines in 1972 the AUV's have grown rapidly in popularity. AUV's are now produced in smaller numbers in other Asian countries, but have not 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 total demand for cars exceeds 10,000 and 50,000 for commercial vehicles a year.

Assembly of semi-knocked down (SKD) or completely knocked down (CKD) vehicles can be envisaged in countries where the annual demand for cars is in the range of 10,000 to 100,000 and that for commercial vehicles in the range of 5,000 to 50,000. On the basis of these figures most of the poor developing countries ought, 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, joruney 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, distance of travel and operational con-

ditions. Up to this time few vehicles have ever 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 from those in the developing countries. Transport equipment that is more suitable to the conditions in developing countries is needed, and can be provided by 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 the traffic jams are commonplace, the traffic density on these roads is extremely high, often exceeding that in the towns in the developed countries. The problems being aggravated by inadequate traffic control and traffic discipline which is far from satisfactory.

Passanger transport

With few exceptions buses are the sole form of public transport and usually run at a loss. The municipalities, constantly worried by urgent 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, these are poorly maintained and continually overloaded, staff are badly paid, therefore difficult to recruit and not sufficiently skilled. The chronic shortage of spare parts and the poor maintenance of the vehicles reduces their service life to 3 years on average and the number of vehicles in service often to less than 50% 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 it rarely exceeds 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. Few municipalities decide to set up a municipal bus network to find that this network instead of being profitable, 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 pre-requisite for their existence.

## 7. FUEL SUPPLY AND DISTRIBUTION

The operation of motorvehicles being dependent exclusively on fuel, the supply, transport, storage and distribution of different kinds of fuel is of vital importance and in developing countries this has some specific problems. It should be assumed that the growth and thus the proper and satisfactory supply and redistribution of fuel in this countries was never in step with the increase in traffic and in the number of motorvehicles. In fact it has always lagged and is still lagging behind, in spite of the stunning reality that motorvehicles keep running and the traffic goes on.

The major problem lays not with the momentary satisfaction of demand, which by some miracles is generally met, but with the difficulties and expenses, at which this is done, and with the obstacles it poses to further transport development.

Developing, and especially the poorest, countries dispose of only very modest railway grid and thus transport of fuel from oil ports to distribution centres and further to filling stations or redistributing storages is done with 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 roadworthyness is essential. If not satisfactory, may adversely affect the functionment of the transport system in whole regions.

It is not hard to imagine what losses and impairs may be caused by a single broken-down tanker not reaching its destination in a remote area. Its missing cargo of, say, 10,000 litres of gasoline, diesel fuel or petroleum may immobilise for days tens of motorvehicles, bringing to standstill power plants or make useless a row of household appliances (cooking ranges, refrigerators, lamps, etc.) all dependant on fuel. Here becomes evident why basic models of road tankers should possibly be of the same make as the fleet of trucks or busses served by them. Their regular service, maintenance, and eventually repair should be performed along with other vehicles of the fleet.

It can be concluede that without a sound fuel supply system, based on reliable road tankers and appropriate network of filling stations, no efficient and satisfactory road transport and traffic 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 at indesigned (unplanned) distances and mainly in towns or bigger villages. Their equipment is obsolete and cannot 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 may have other role than refuelling vehicles. In developing countries they may make many a "technical oasis" where road travellers can get technical assistance, minor repairs can be performed, fast moving parts and accessories are available. Cafeterias, lavatories and public telephones are expected, or at least should be, even in remote, scarcely populated areas.

The capacity of fuel filling stations is determined by the number of filling columns. The capacity of individual columns vary between 20 to 30 cars per hour. One column in one month may pump around 30-40 $m^3$ of fuel. In populated areas, the required capacity is determined by the number of inhabitants and the density of traffic.

Filling stations along outside roads should be located on the base of forecasts for 10 years. Experience shows that around 10 per cent of the two-way traffic flow will 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

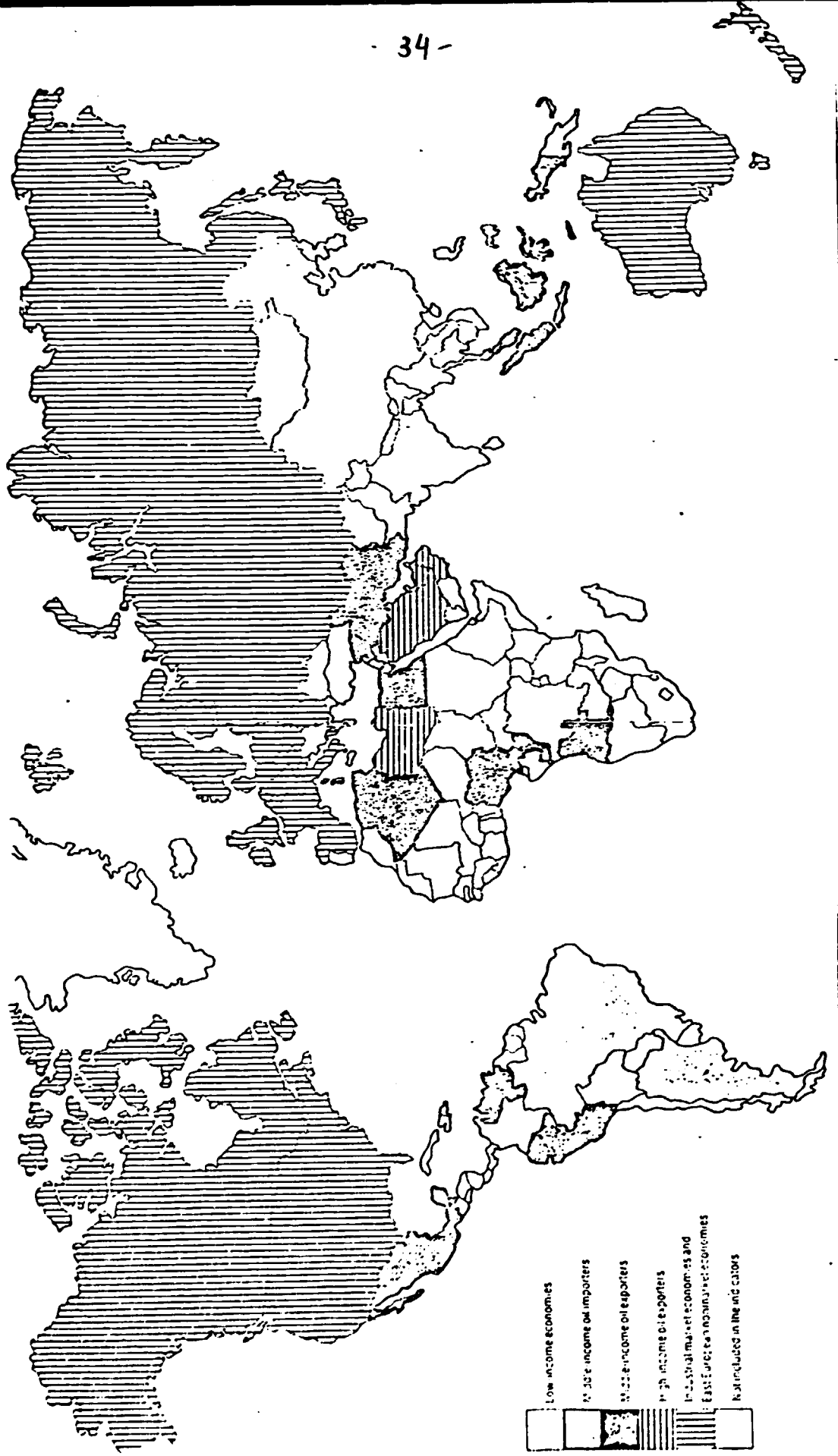
For analysis of trends in the vehicle industry in this chapter, the Third World is defined as comprising high income oil exporters and developing countries in the following geographic regions:

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

Remark: Countries are often classified in two groupings-developing and developed countries. This classification is not however very convincing.

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.


Groups of economies
Low-income economies
Middle-income oil importers
Middle-income oil exporters
High-income oil exporters
Industrial market economies and
East European nonmarket economies
Not included in the indicators

## 8.2. Recent economic developments

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

The general effect was exacerbate 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$70bn to US$686bn. Lendings to LDCs did in fact decline, but those made in the early 1970s were scheduled in such a way that substantial repayments became due in the early 1980s. Events since 1980 diminished the ability of 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 also have to respond, particularly their financial institutions. In this respect, the 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 well over 90% of world vehicle exports.

Data on MPC exports to the Third World and its constituent regions is 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 usually being subject to a time lag.

Import volumes for the leading markets in the Third World are presented in Table 5. This data illustrates 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 decline in vehicle imports between 1981 and 1984, due to increased local assembling activities and slightly increase between 1984 and 1986, after reckoning that total demand cannot 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 A. | 145.7 | 112.2 | 120.9 | 193.1 | 167.3 | 184.3 |

Table 5, Cont.

| | Passenger Cars | | | Commercial Vehicles | | |
|---|---|---|---|---|---|---|
| | 1981 | 1984 | 1986 | 1981 | 1984 | 1986 |
| 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 unfavorable. In 1981, this market ranked second only to Saudi Arabia within the Third World. Oil market developments affected Nigeria particularly badly. Its oil revenues are not adequate in relation to the very large population which has 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 - such as Malaysia and Thailand - showing growth. The main exception was the Philippines, also suffer 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 has still attractive market than Latin America. Here, Chile and other major markets performed very badly 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 degree of industrialisation, 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 in individual levels, and the impact of these individual 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.

Third world vehicle production - in the sense of virtual full manufacture - was established in Latin America and India well before the 1970s. In East Asia, there were important developments in vehicle industries which resulted in greater value added in production from local sources. Here, South Korea - under Japanese, American and European influences - was the 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 |
| South 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 |
| South 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 there - Brazil and Argentina - achived higher car output, though their CV output declined, the new producers suffered major decline in both car and CV output. Mexico, for instance, had mortgaged its oil revenues against an overvalued peso during 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.

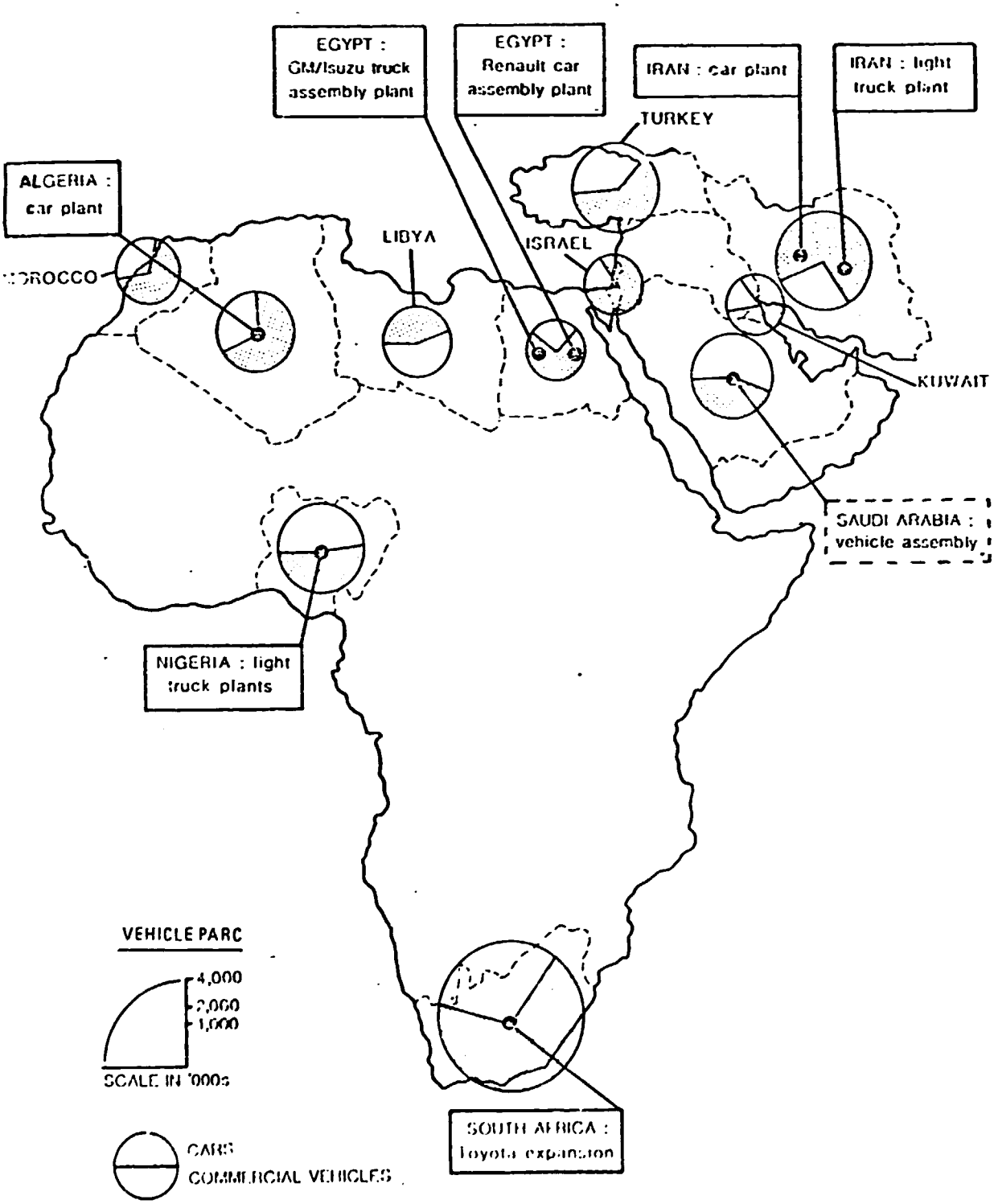
In contrast, the Asian producers were successful in expanding their output. India achived substantially increased vehicle production, whilst South Korea - the new producer - forged ahead with much higher levels of output, thanks to its status as a closed economy with a relatively large domestic market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

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 LDC, rapidly expanded output during the early 1980s. The ASEAN countries, particularly Malaysia and Indonesia, have large volume assembly operation. In line vith other developments, however, output by the Latin American assemblers has fallen sharply.

Output in two 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 numbers 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.

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



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

Major Vehicle Assemblers in the Third World

| Latin America | Sub-Sahara Africa |
|---|---|
| Chile | |
| Columbia | Nigeria |
| Peru | |
| **North Africa** | **South Asia** |
| Algeria | Pakistan |
| Egypt | India |
| Morocco | |
| Tunisia | |
| **Middle East** | **East Asia** |
| | Indonesia |
| Iran | Malaysia |
| | Philippines |
| | Taiwan |
| | Thailand |

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 Japansese 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 of the 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 numbers 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 | W.Germany |

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

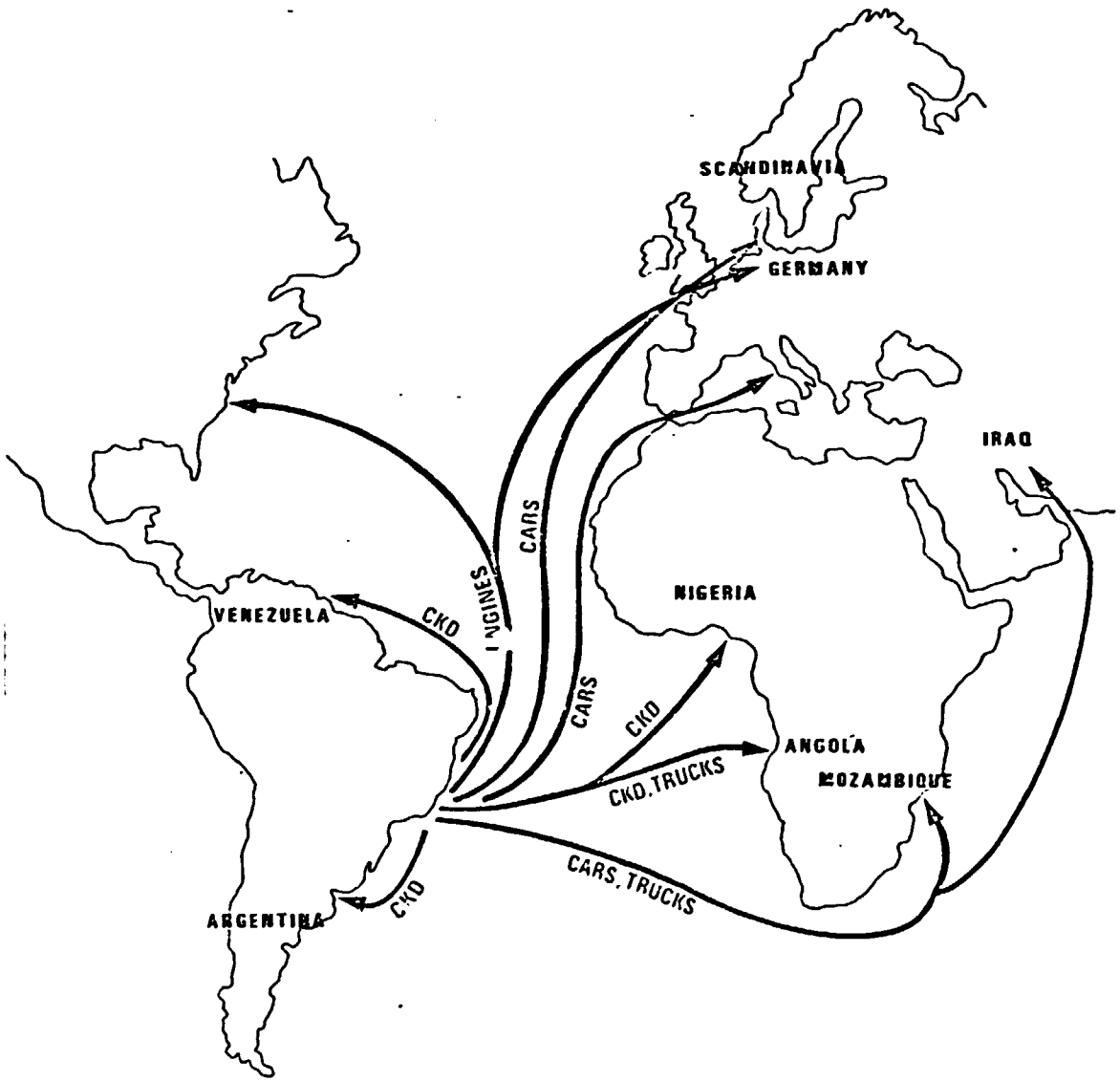
## 8.5. New Factors of International Trade in Vehicle Industry in the Third World

The developing country's share of world trade remains minimal as you could realize it in the previous paragraphs. The limited number of developing countries who are really in the market at present time. By far the most important trade is from Brazil, Mexico and South Korea, with these countries concentrating their exports strongly towards North America. Brazil automotive export is aiming also Europe and Africa. (See graph)

A good proportion of this trade is now in components, and that share too will rise in the next few years. In any event, 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 goreign 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 the 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 GM, 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 seems to make sense, though of course the critical issue is the terms under which such barter takes place. Algeria has similarly conducted deals with Honda involving the exchange of oil for vehicles; once again the term of this exchange have not been divulged.

## BRAZILIAN AUTOMOTIVE EXPORTS



The extent to which barter trade may expand depends above all 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 system and in particular the increasing use of inputs which depend on substantial technological effort the chances are that developing countries will not find it so easy to conclude the barter deals.

Barter deals imply restrictions and vica 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 show up strongest in those countries where operations of foreign producers are substantial.

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 |
| South 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 LDCs 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 LDC debt has to be rolled over or amortized. Thus, 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 50s, however, scientific planning, through which traffic demands were related to land use and modal choice was introduced.

Good planning methode and practice are critical in the transport sector because of the large volume of resources it absorbs and the complex problems of intermodal complementary and competitiveness which have to be assessed

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

Choices must be made about whether to favor 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 mroe advanced countries the urban transport problem in its modern form was hardly recognized in the developing world. Traffic, however, 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. As there was little expertise in those countries, particularly Britain and the US. But although the transport problem had a much longer history in the latter countries, the methods of transport planning were more recent and were still in an early stage of development. Methods designed for Europe and North America were applied in 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 rejected in developed countries, too. 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 by 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 then planning and programming efforts. The aim of the assistance was to estabilish 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 leds 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 throughout mainly the metropolitan area for 25-30 years into the future.

## 9.1. "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 analyzed 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 landuse, household characteristics and the available transport facilities, could estimate 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 is also produced defective or inadequate results, some of which were inherent in the method itself. Particularly, these 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 world recession that followed it, 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 gradually dawning that most demographic forecasts in the industrial countries were also inaccurate.

There was an understandable feeling that the big plans are a waste of time and money, attempting the impossible by being too ambitious, without doing what might be possible, making some modest, but real, improvements in the existing situation, which usually bordered on chaos.

The incremental improvement approach was based on the following:

- there were many pressing problems in the existing situation, it was not necessary to look 25 years ahead to find them;
- there was very little money to spend on solutions;
- a great deal could be done without heavy investment, mainly 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 favor of "imemdiate action" or "short term improvements" programs, with the emphasis on low-cost measures, which necessarily meant management improvements or minor structural changes. The theory behind this approach is that it is unnecessary to make forecasts for next year, since one can see what would be an improvement next year. If the focus is thus shifted to making small, but sure, improvements, rather than trying to make a quantum leap through 25 years, progress will be made.

The planning of incermental improvements is a process of looking for problems that already exist 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. For example, it may be used to study different ways of routing a fixed pattern of trips distribution and modal split as well. The problems of land use and long-term forecasting are avoided but, on the other hand, a higher level of detail and accuracy is needed.

The advantages of this approach are obvious. It leads rapidly to results which can be seen to be good, 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 shown repeatedly 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 penalize projects such as railways, fly-over and multi-level car parks, in that they are accorded insufficient 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 favor of inefficient stop-gap measures.

The longer that 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 were lacking in 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 or their impor-

tant parts, have failed to obtain 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 have been 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 development of the structures 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.

The above factors, operating together, will lead to an overflowing of existing cities throughout the world, or where the pressure is very great, to the establishing of new settlings. 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 the year 1800 barely 3% of the world's population lived in towns with over 5000 inhabitants. In 1920 the figure was 14% and in 1970

30%. During this period the world's population had increased twenty-five fold. This process is continuing, and by the end of the century more than half of mankind 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 the same rate in order to maintain urban services. It is obvious that this effort is usually beyond the annual investment equal to at least 10% of the entire urban infrastrucure in the existing roads, buildings, markets, sewers and electric cables, not to mention the construction of dwellings and workplaces.

## 10.2. Special Effects in the Developing Countries

In the 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 conti-

nue 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 would not be enough to effect an improvement on present conditions, however.

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 settlings, above all, the historic inner areas, with their high population densities, are problem areas with correspondingly poor living conditions for the inhabitants.

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 infrastructures and equipment, will intensify the problems of the viability of the large cities in the developing countries between now and the turn of the millennium will take the form of shanty towns in the outer suburbs or on the urban fringes; in these locations the sanitary arrangements and other main services will largely be inadequate.

Building efforts will have to be concentrated 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 had the greater the degree of division of labor practiced within it the greater will be the volume of traffic generated. Mobility and standard of living are mutually dependent. A high living standard results in high mobility and vice versa. In the developing countries in particular the growth of mobility is faster than the growth of incomes.

In the cities of a million-plus inhabitants in the developing countries 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.

Vastly increasing transport needs as a result of the steep increase in population; the increasing separation of the functions of the residence, work and recreation accompanying the increasing division of labor and the further increase in mobility of the urban population as incomes improve.

An increase in the numbers of the motor vehicles in the conurbations despite a relatively low gross of national product and corresponding standard of living and oil prices.

Lack of financial resources to expand transport infrastructures which are already inadequate now, both in the field of private transport - and more particularly - 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 only 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 the use.

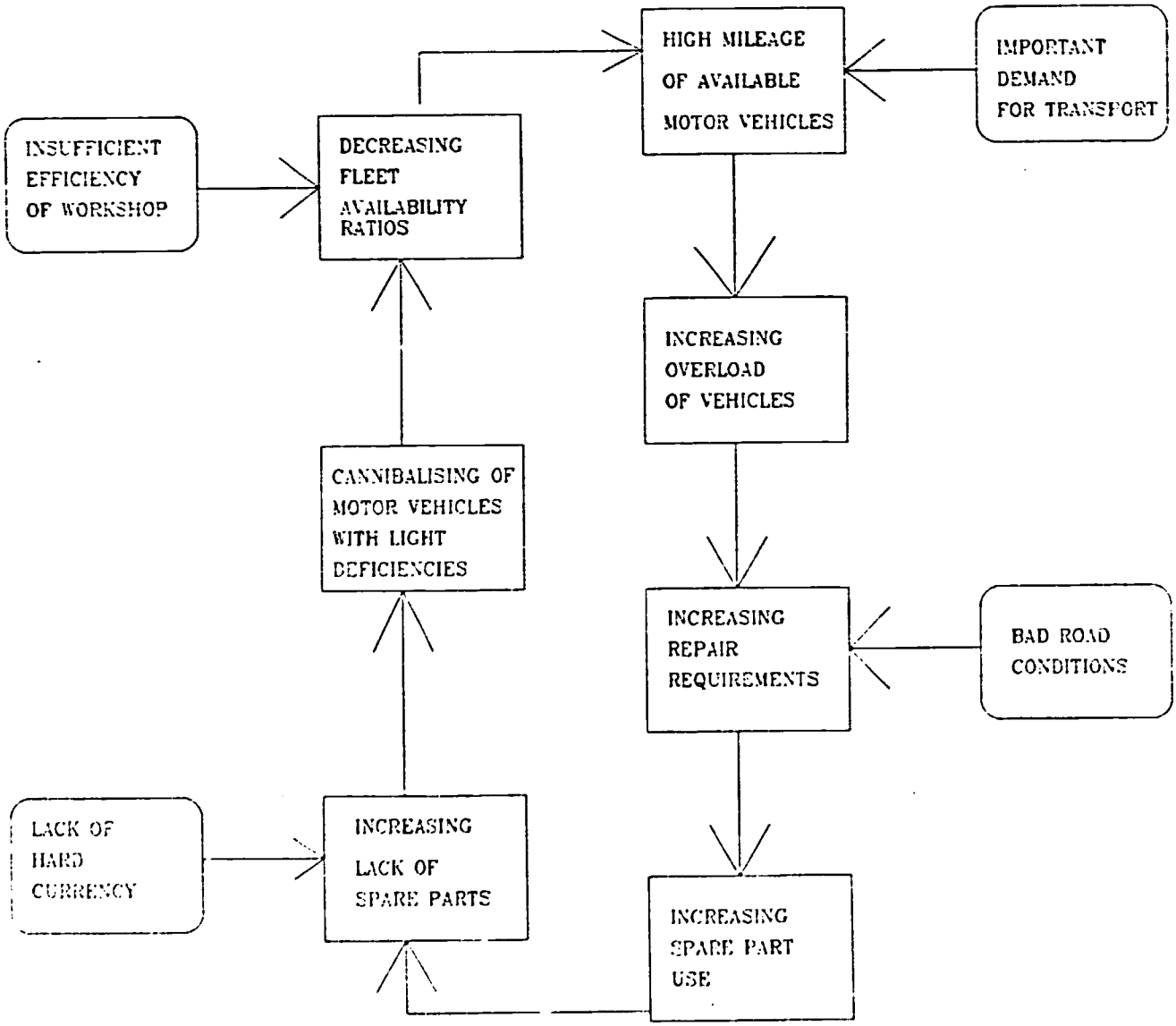
The - in some cases - low level of efficiency of the transport workshops, which in many instances is aggravated by a shortage of spare parts (as a result of lack of indigenous spare part industries or a lack of foreign currency for purchasing spares from industrial countries) frequently leads to internal "cannibalising": for instance, whole vehicles - 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 los employee/operational vehicle ratios, a low level - in some cases - 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 be not an improvement in transport conditions, but a general deterioration, resulting moreover in a substantial impairment of the environment and adverse repercussions for the inhabitants. An attempt to reach comparable standards to those achieved in the local public transport in Europe would certainly be desirable in these countries but will only be partially feasible.

## CIRCULUS VITIOSUS OF MOTOR VEHICLE TRANSPORT IN DEVELOPING COUNTRIES




Legend: ( ) = external factors

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, it is true, 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 the bus (both standard size and minibus). In addition alternative types of transport (e.g. rickshaws, samlors, bemos), powered by very small motors or by human strenght, together with taxi in its 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 which, 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 grows more pronounced owing to the fact that the distances between the home and the workplace become even greater as the city overflows its original boundaries and consequently the cost of travel becomes 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 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).

## 10.4. 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-pricing 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 inbuilt 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:

- Coordinating the spatial function of supply areas at subsidiary supply points located concentrically at various distances from the city center.

- 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 centers.

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 centers (establishment of centers 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 simply to transfer the industrial countries transport strategies and planning methods 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.

## 11. 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 has started in the seventies, producing 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 international co-operation is live. But, the majority is 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 be changed, therefore from a methods-oriented approach to more of a problem-oriented approach. More emphasis should be laid on selective co-operation based on sutdies of real facts.

Any demands or requirements for co-operation from 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 will be a tragic error if they want to satisfy this demand by local production.

Self-reliance is great, but many instances have shown that the build-up of an industry cannot start with establishing automobile manufacturing or assembling plants.

Today's automobile production is concentrated in some highly developed and industrialized countries and is characterized by high automation (e.g. robotization) and sophisticated technology. There is also a distinct overproduction, a sharpening competition and there are so 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 finding 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 LD countries. Regional co-operation in geographical areas (parts of Latin America, Asia, Africa) contains many possibilities yet unexplored.

## 11.1. 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. Its role 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 the projects, making their contribution in the form of 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 a continued and recurrent imbalance between agricultural food production and ever-growing population both in the 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 both in production and transport working sector.

A satisfactory correlation between the various forms of farming and appropriate means of mechanization together with transport development is the vital point which should be considered to insure that agriculture matches the needs to which reference has been made in this study and which cannot be postponed.

Technical assistance aimed to solve the problem of producing the machinery that will optimize the use of inputs to agricultural production, and to run a rather complex transport system and to up--keep an array of, sometimes obsolete, transport equipment, is the kind of help developing countries expect.

It should be noted here that technical assistance offered to developing countries, may not be the exclusive privilege of international organizations or donor governments. Large manufacturers of transport equipment and other companies dealing with transport can have their rewarding share in this activity. As part of their

marketing acitivity they also can provide in certain branches advisors, experts and other personnel which, while introducing certain products or systems and training local manpower, may gain precious market information helpful in designing appropriate equipment for the specific needs of respective developing countries.

Experts and advisers, whether delegated by international organizations or private companies, 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 manufacturer's 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 busses, 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 the local experiences 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 in transport;

- Assist in formulating and conducting "in-plant" training programme and in defining the outside fellowship training;

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

- 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 pros and cons 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 the 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 structure 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 evolvement, the process of technology transfer is thus naturally directed from advanced countries to developing ones.

The term "technology transfer" has been variously 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 beforehand (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 tiem for the changes in the world technological scene and in that context helping them to stregthen their technological capabilities.

The process of technology transfer is a complex one which is basically aimed 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 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 mechanism which has helped to reduce the technical and managerial gap amongst the industrialized countries. On the contrary, it has contributed to widen the gap of comparative wealth of the richest and poorest nations. That is one of the reasons which has lead to negotiations on international codes of conduct for technology transfer and multinational corporations. In this sense, the UNCTAD and other United Nations agencies became the focus of developing countries' efforts to obtain a new economic order in which they could acquire better terms of trade, increased access to technology, an increased flow of recources from industrialized countries, and a code of conduct regulating international technology transfer.

It is worth adding to the aforesaid 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 replicated 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 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 goernment. Transport assistance is more affective if it is designed to adress the sector as a whole, rather than focus on individual parts of it.

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 entreprises. 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. Investinent of financial resources is a necessary but not sufficient condition for achieving development. It is essential from the government part 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 better move in the direction of reducing protection, regulation, 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: such operations are highly decentralized, geographically scattered, and utilizing 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 government or institution action. Conversely, the benefits of road construction or purchase of a batch of new busses 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. Government really devoted to the economic growth of their respective country should resolutely avoid such pitfalls and make all efforts 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 contest reconditioning of motorvehicle parts, - as an immediate action, should be promoted owing to the nature of this activity characterised by low unit investment and its indiscutable role in keeping traffic on the move.

National institution 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 motorvehicles 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)

| | Cars | | Commercial vehicles | | Total | | % 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 |
| Belgien | 258 | 294 | 43 | 42 | 301 | 336 | + 12 |
| Netherland | 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 | + 18 |
| 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 |
| South 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

| Country | Cars | CV | Population Per Car | Population Per Vehicle |
|---|---|---|---|---|
| 1. | 2. | 3. | 4. | 5. |
| **Africa** | | | | |
| 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 | 66,868 | 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 |
| Lybia | 425,000 | 275,000 | 8.7 | 5.3 |
| Madagascar | 55,000 | 50,000 | 175 | 92 |
| Malawi | 15,000 | 15,000 | 455 | 228 |
| Mali | 17,000 | 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 |
| T o t a l : | 7,335,396 | 3,906,680 | 72 | 47 |
| 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 |
| Homg 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 |
| Korea, South | 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 | 90,000 | 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 |
| T o t a l : | 18,548,476 | 4,366,476 | 14 | 12 |
| O c e a n i a | | | | |
| Australia | 6,636,200 | 2,196,600 | 2.3 | 1.8 |
| New Zealand | 1,427,058 | 279,686 | 2.3 | 1.9 |
| T o t a l : | 8,229,096 | 2,545,896 | 2.4 | 1.9 |

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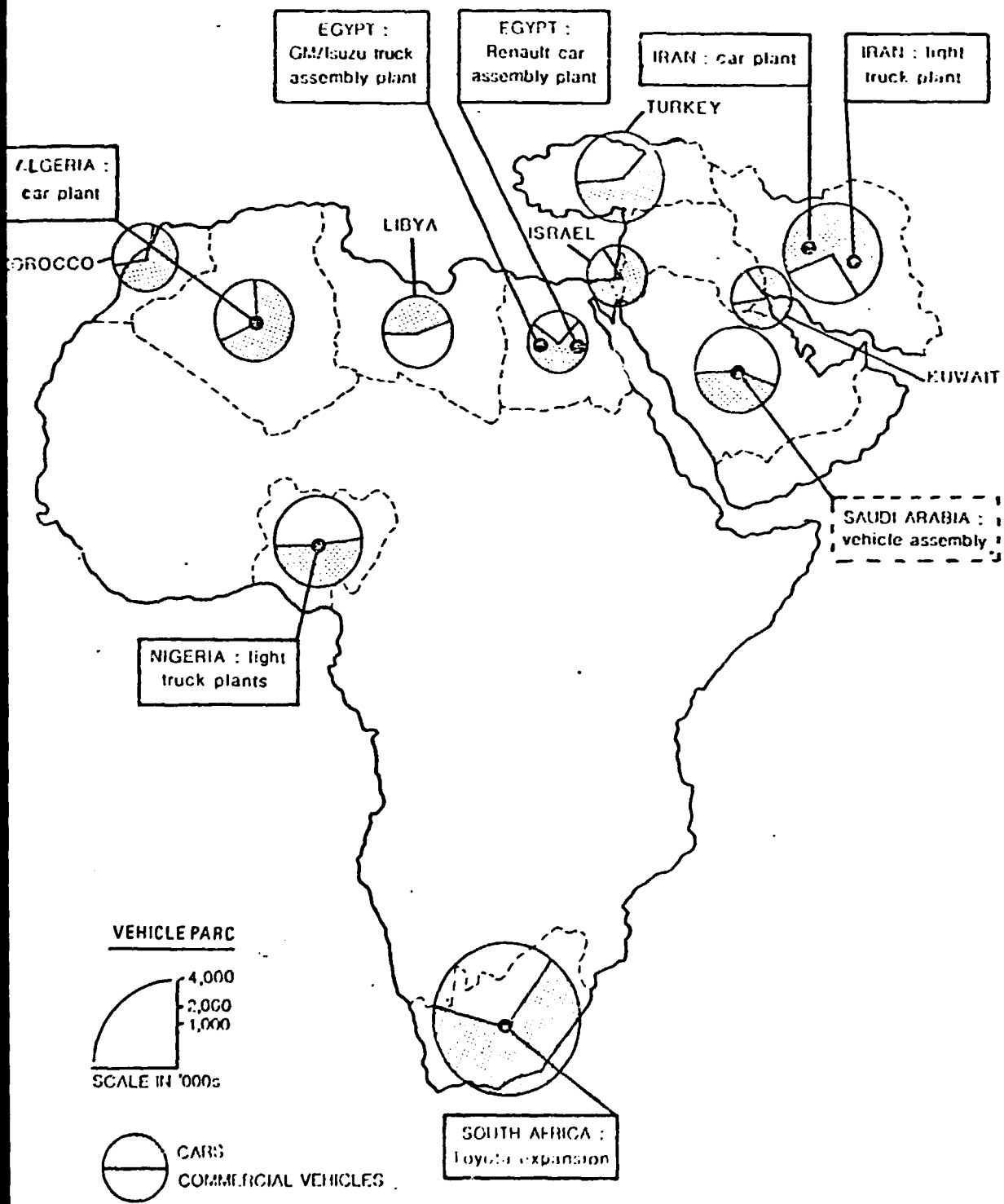
# MAJOR VEHICLE ASSEMBLY PLANT DEVELOPMENTS PLANNED IN AFRICA AND THE MIDDLE EAST AND VEHICLE PARCS



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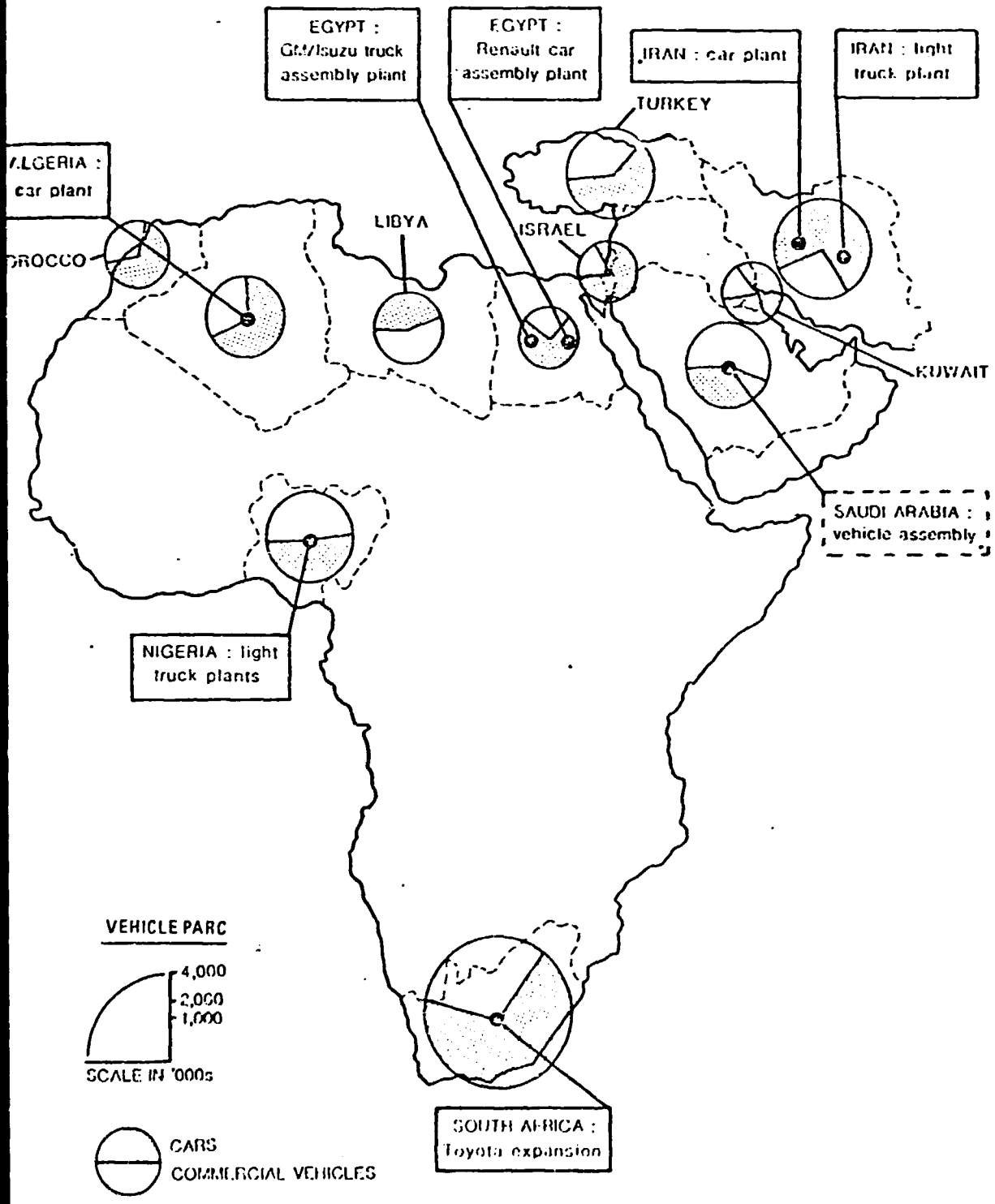

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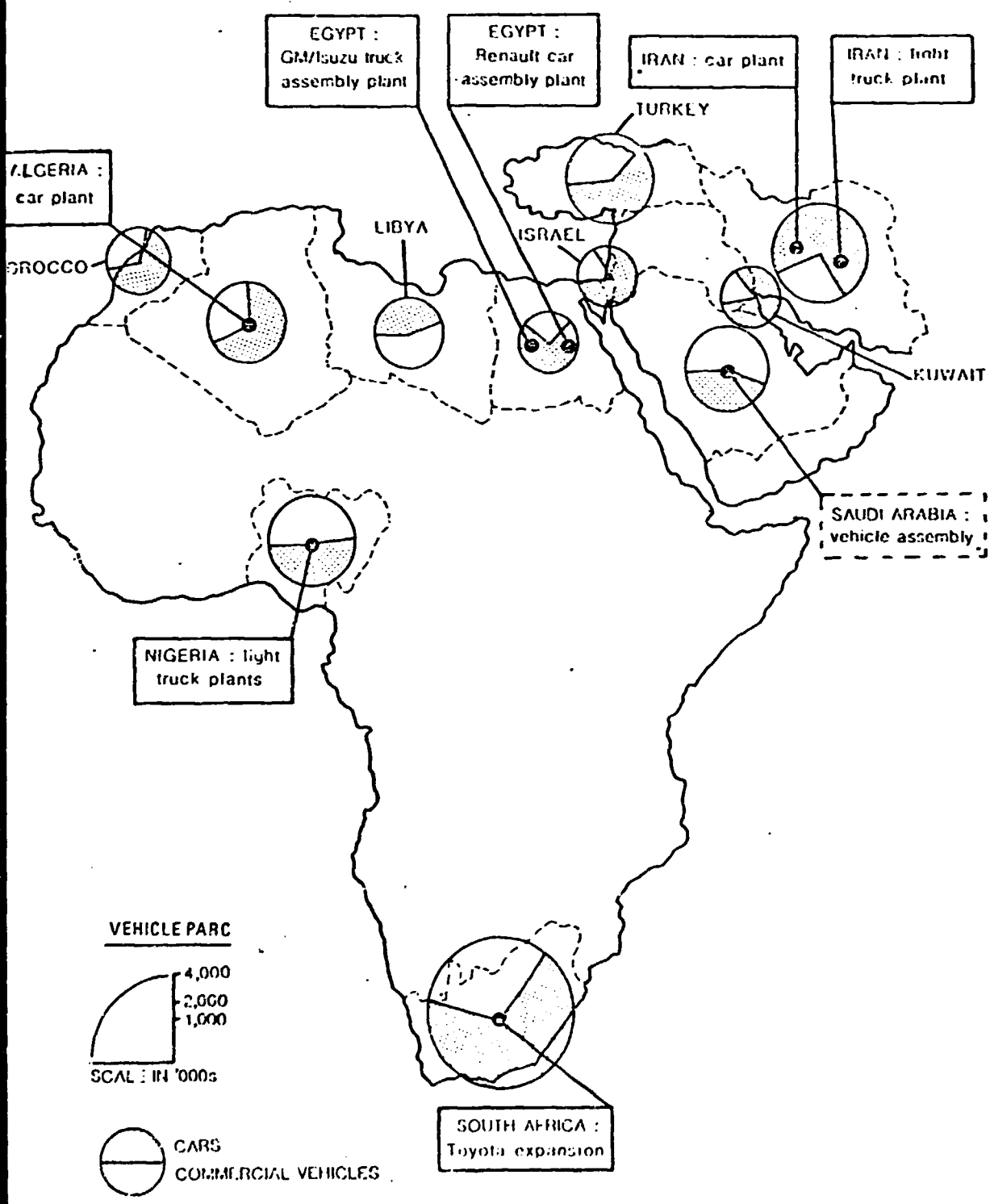

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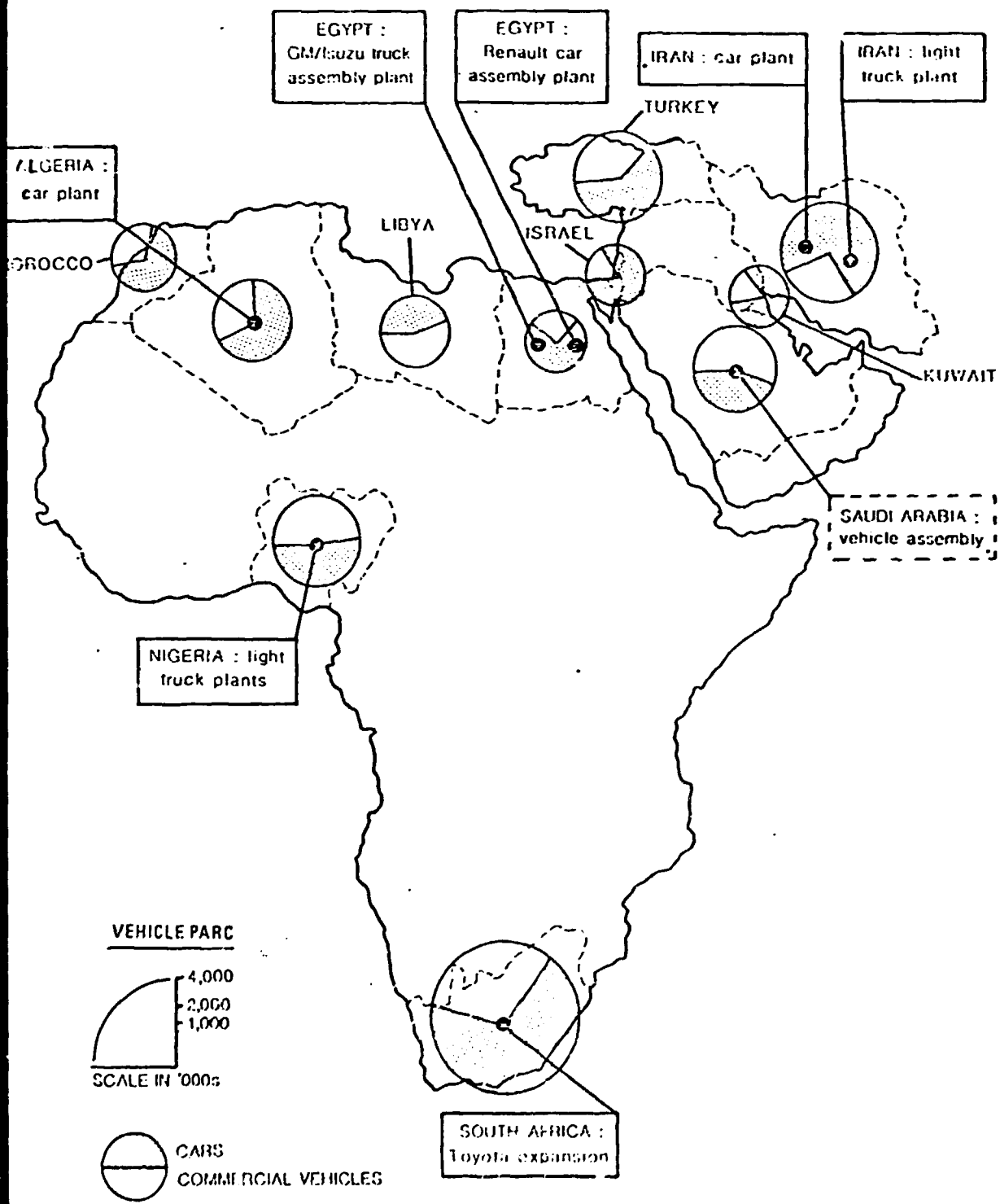

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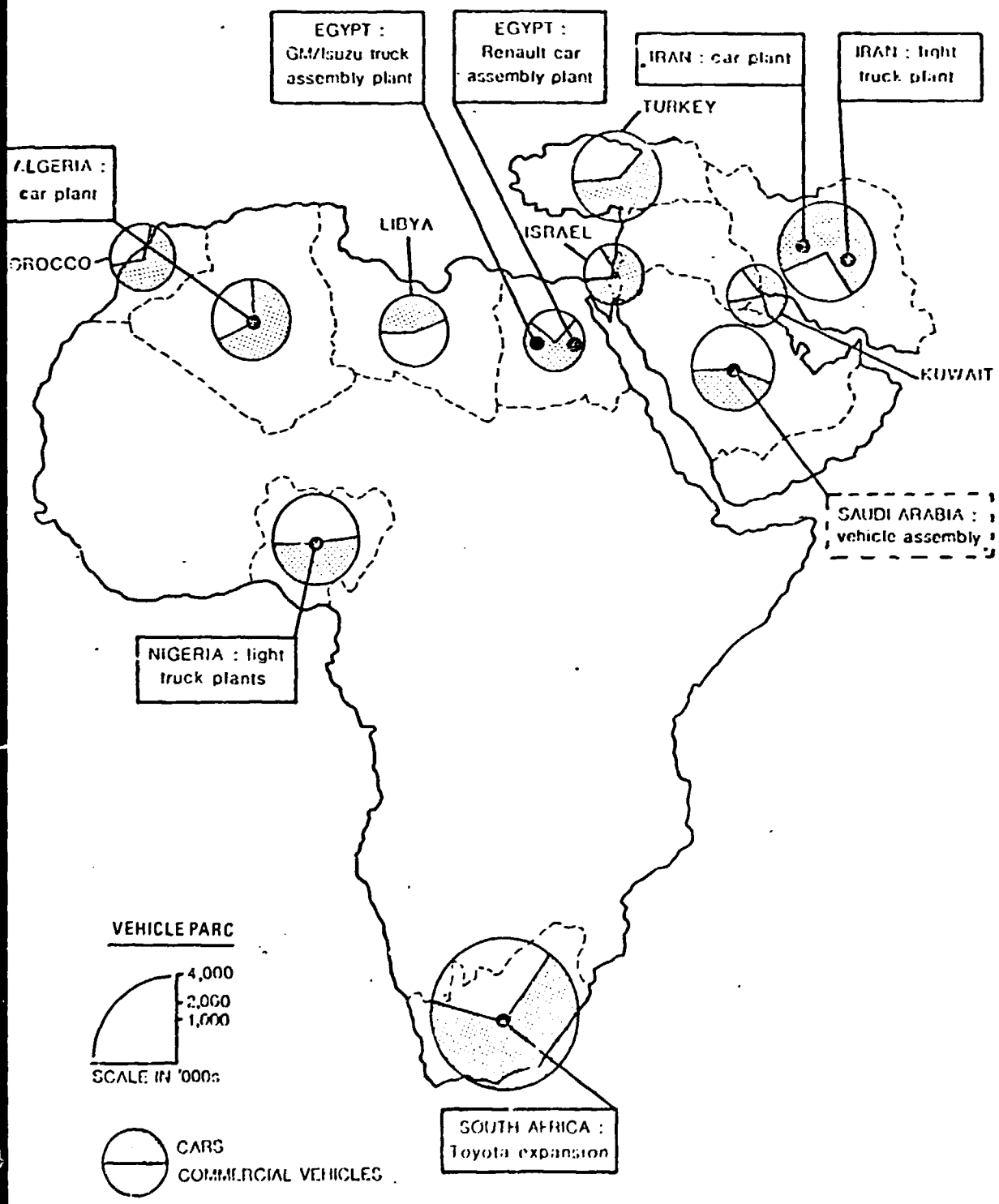

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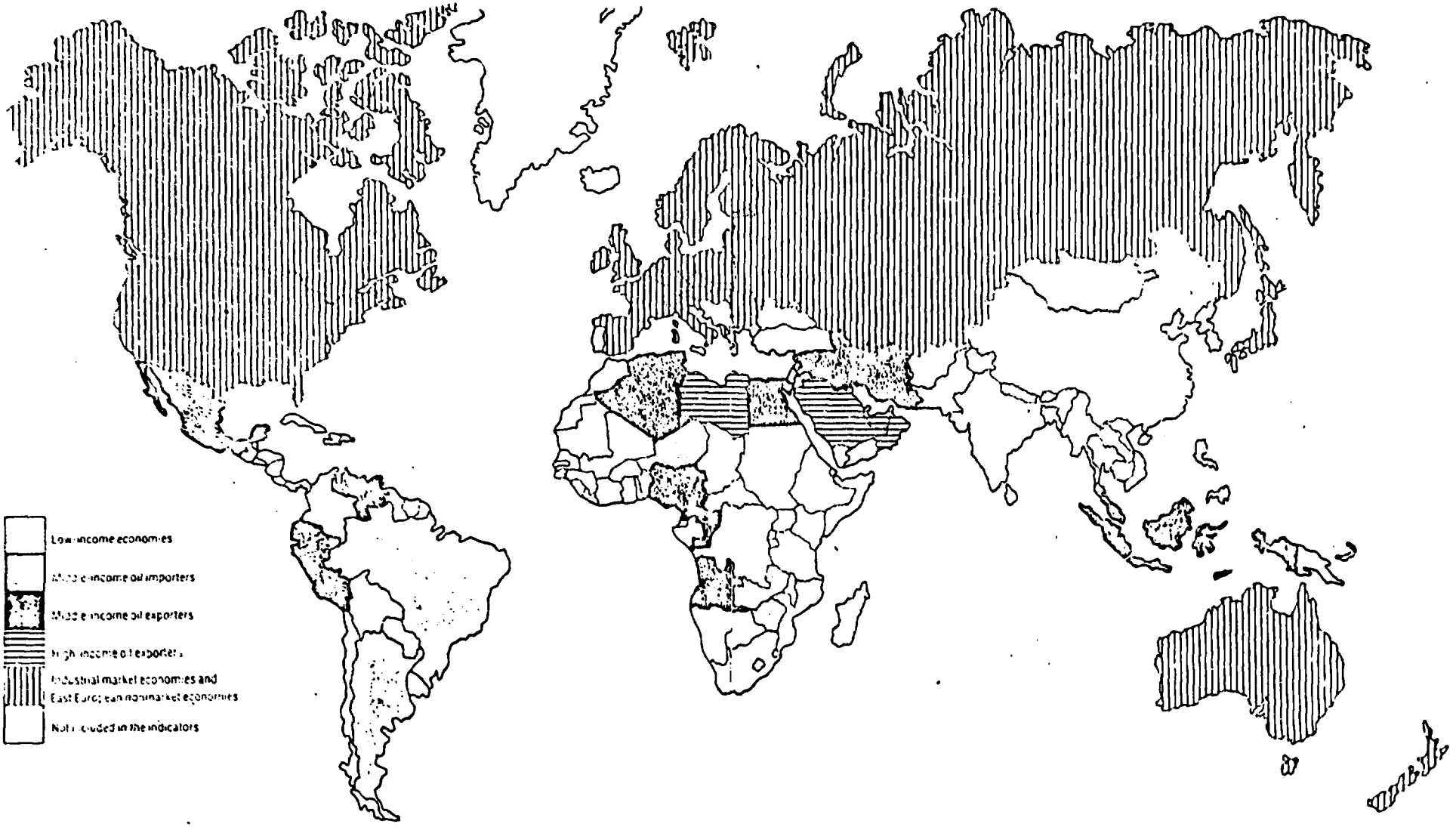
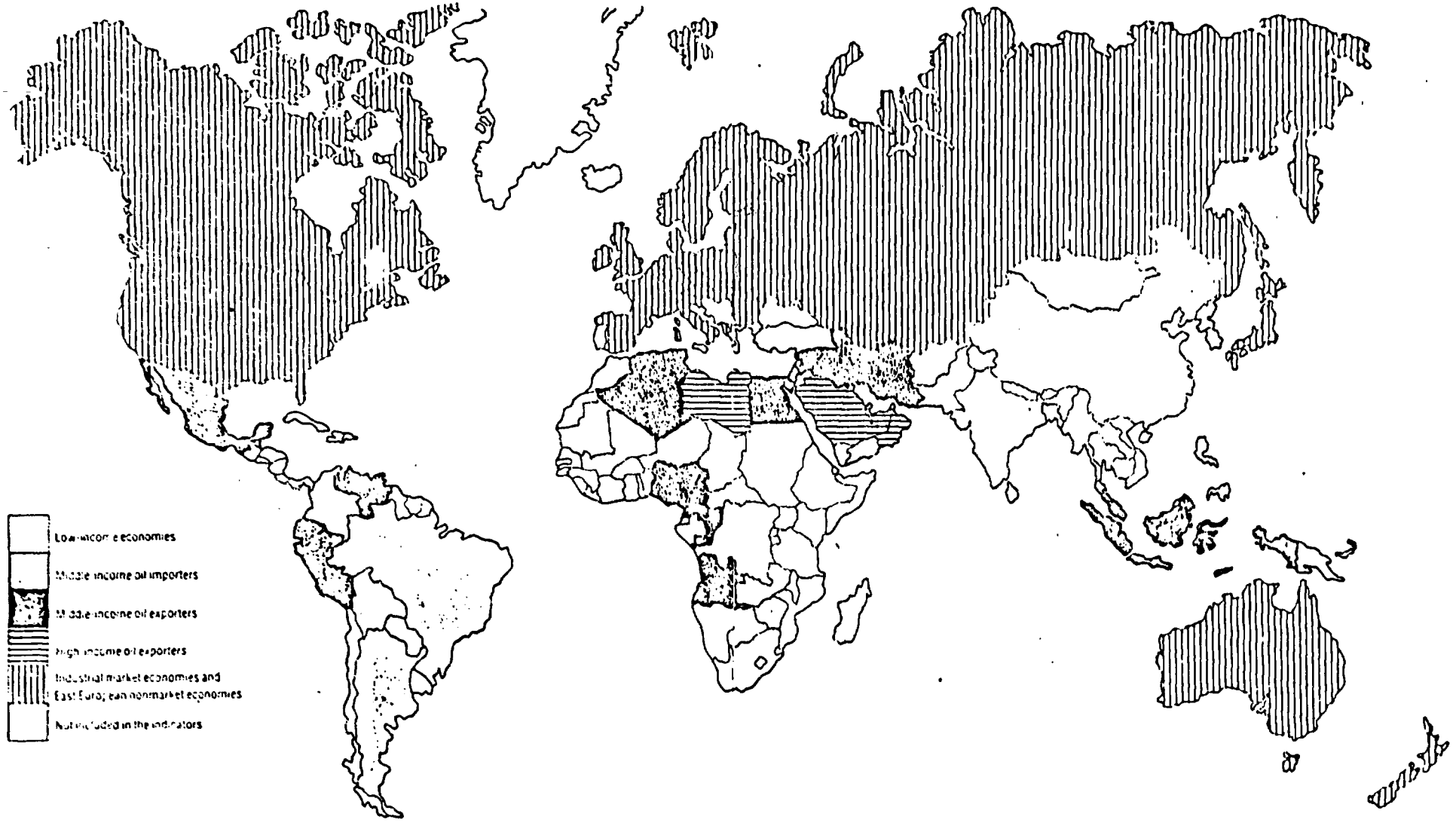
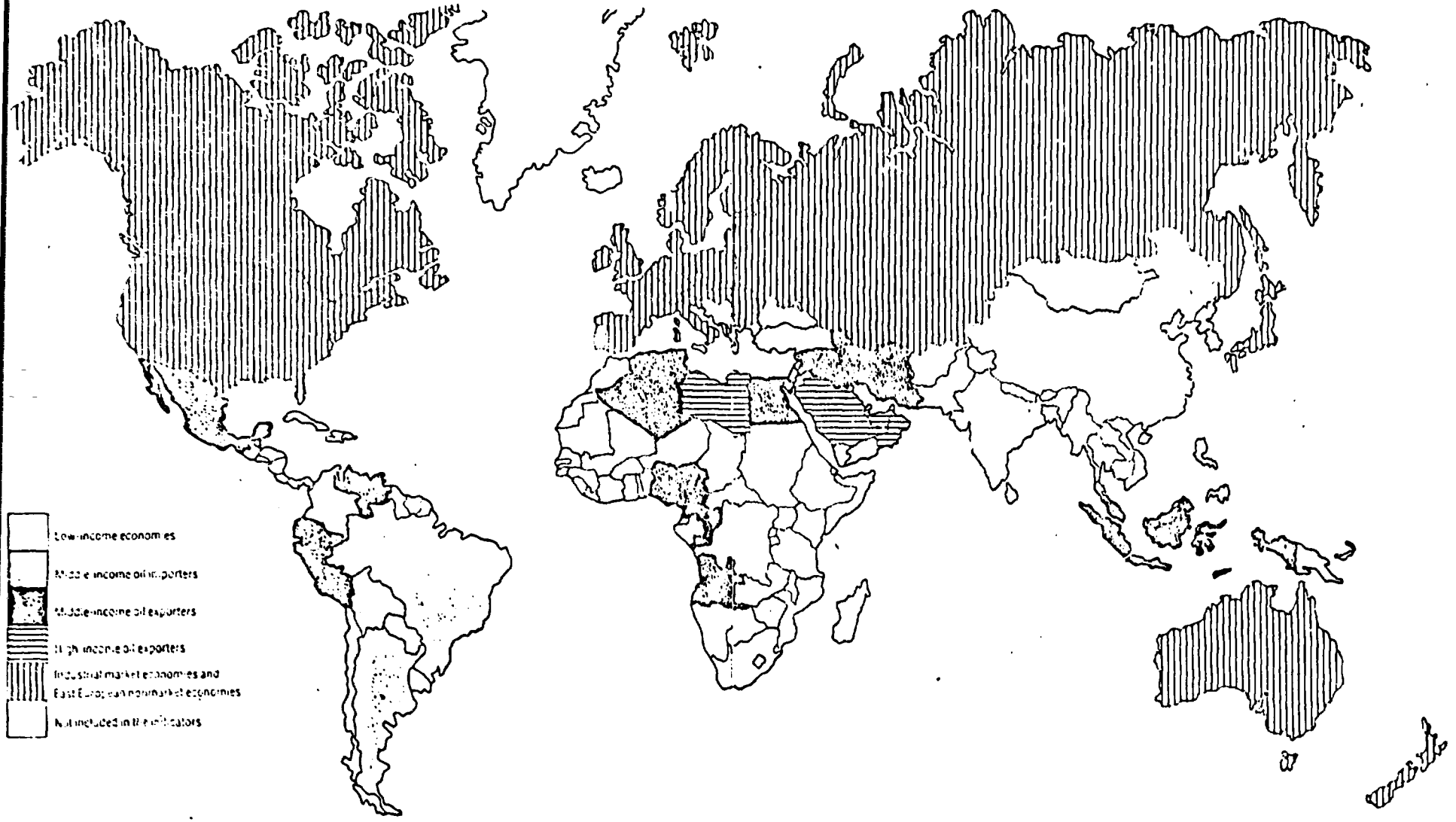


## Groups of economies



## Groups of economies

Groups of economies



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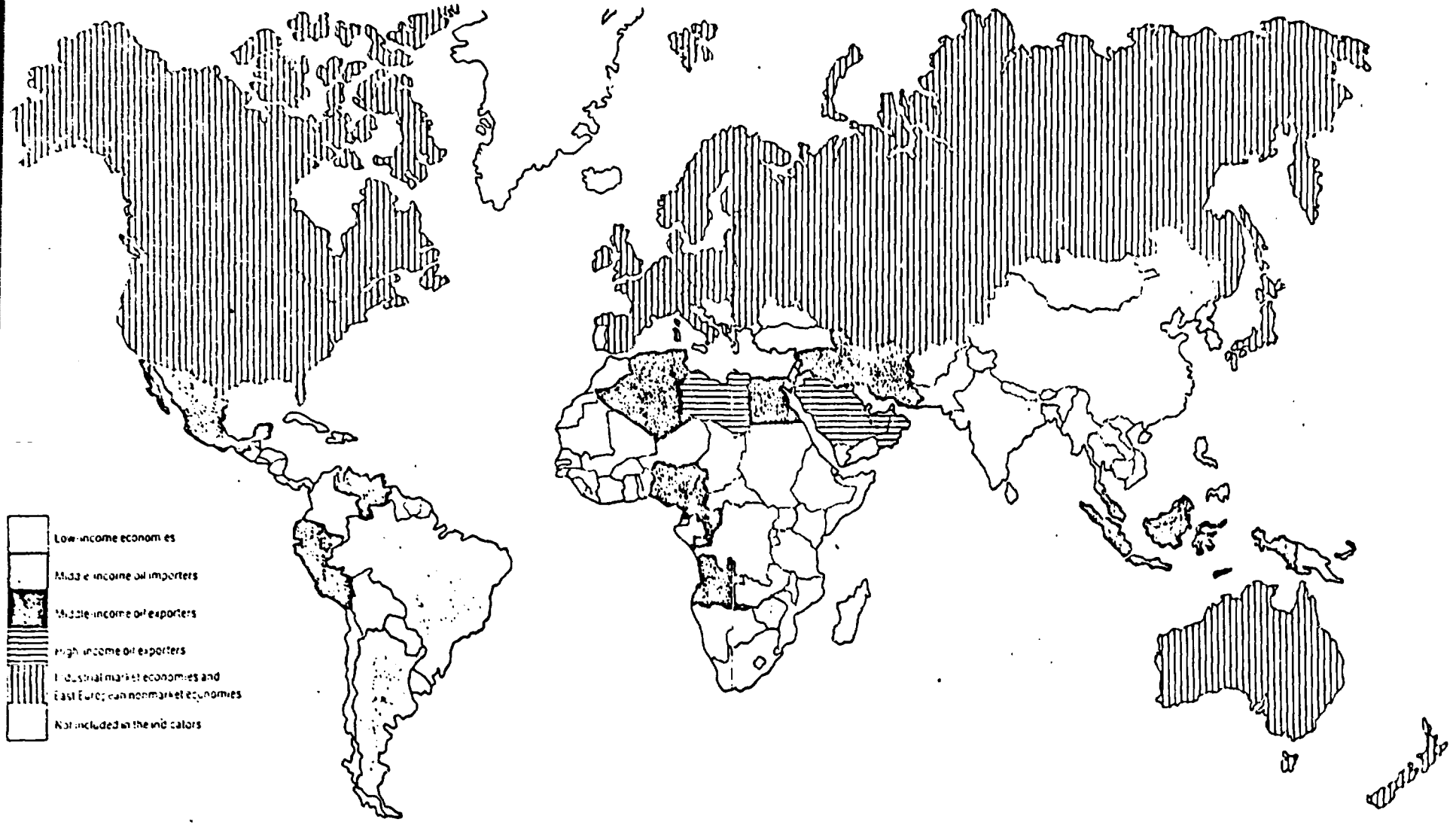

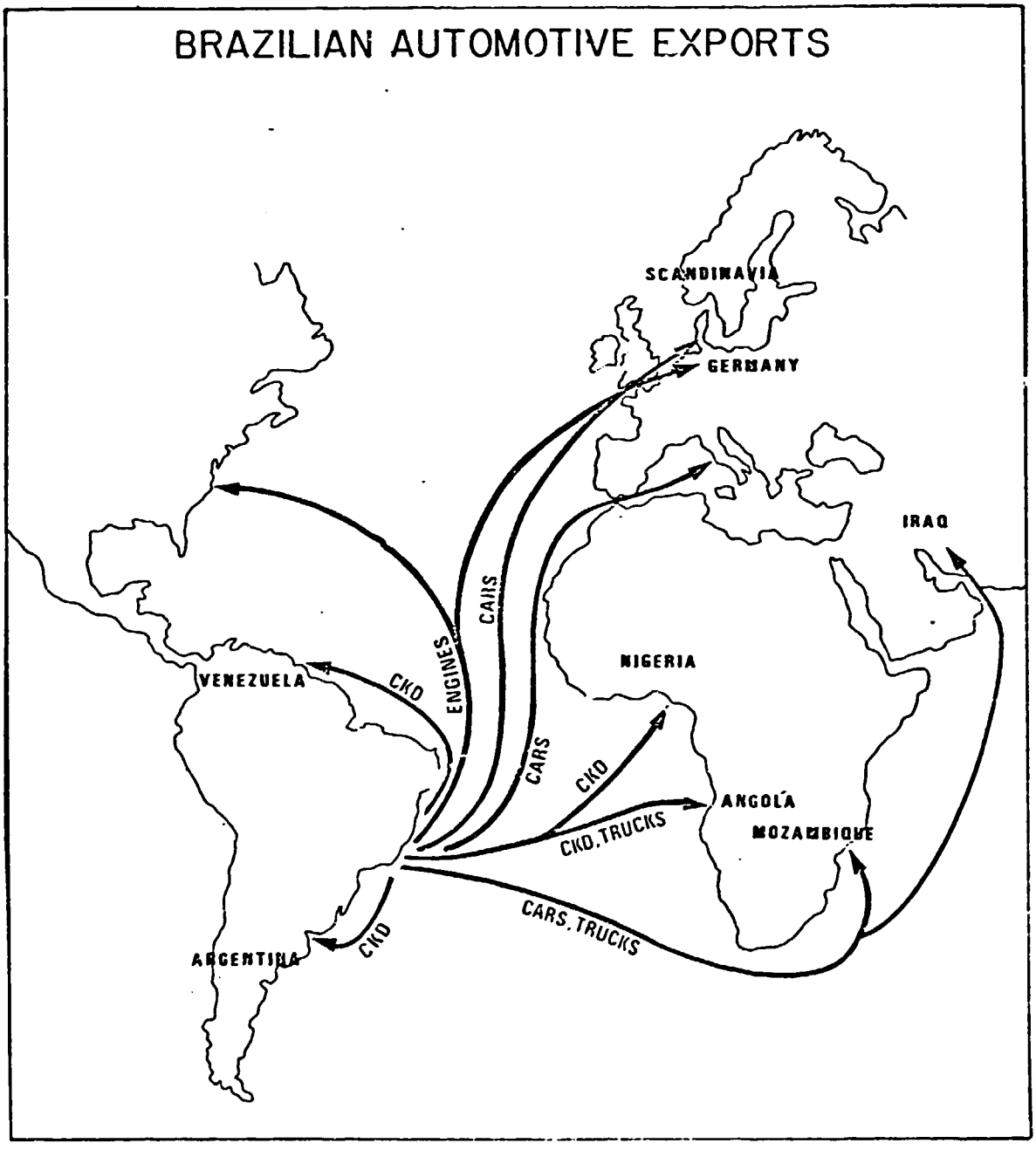
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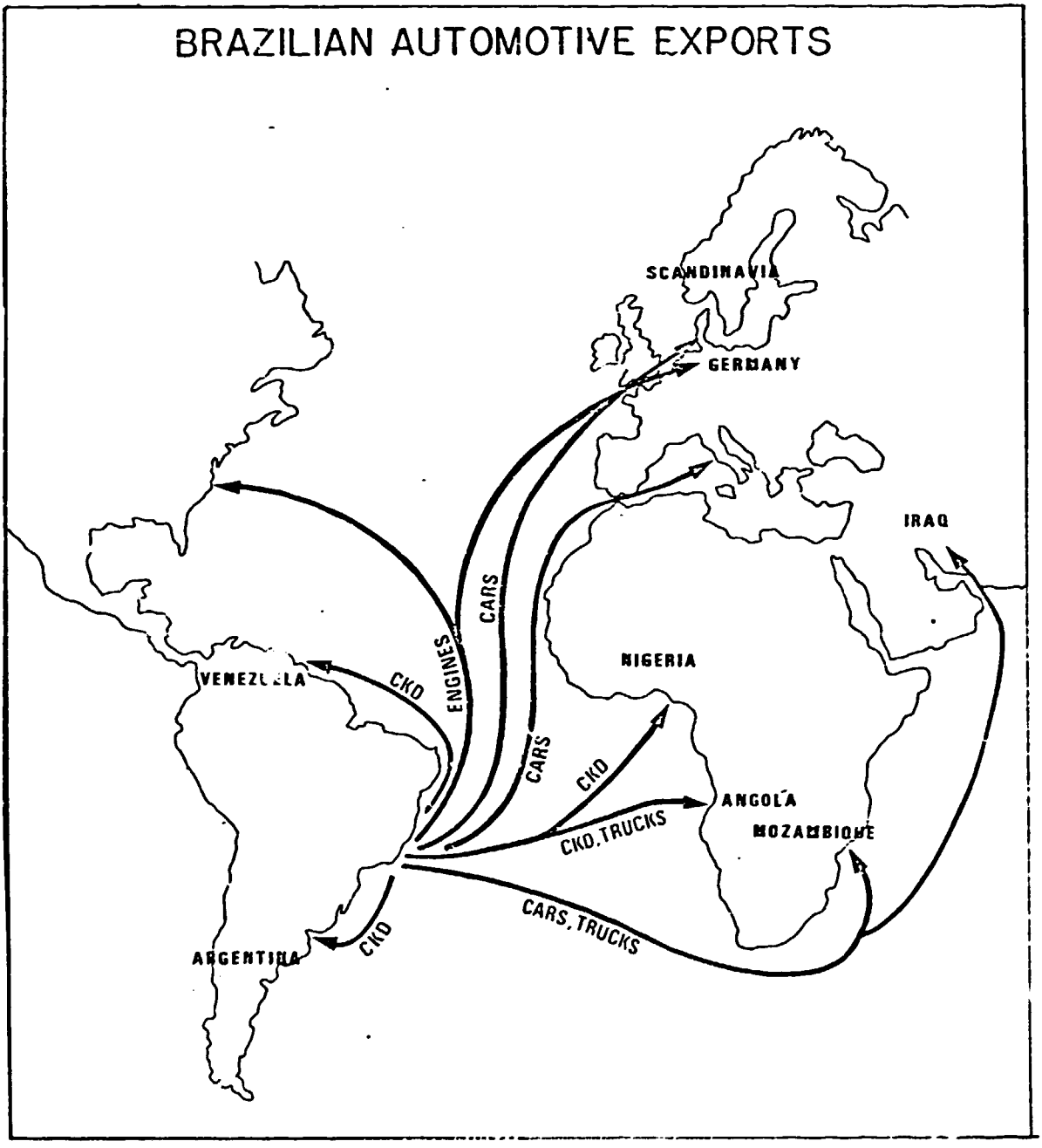
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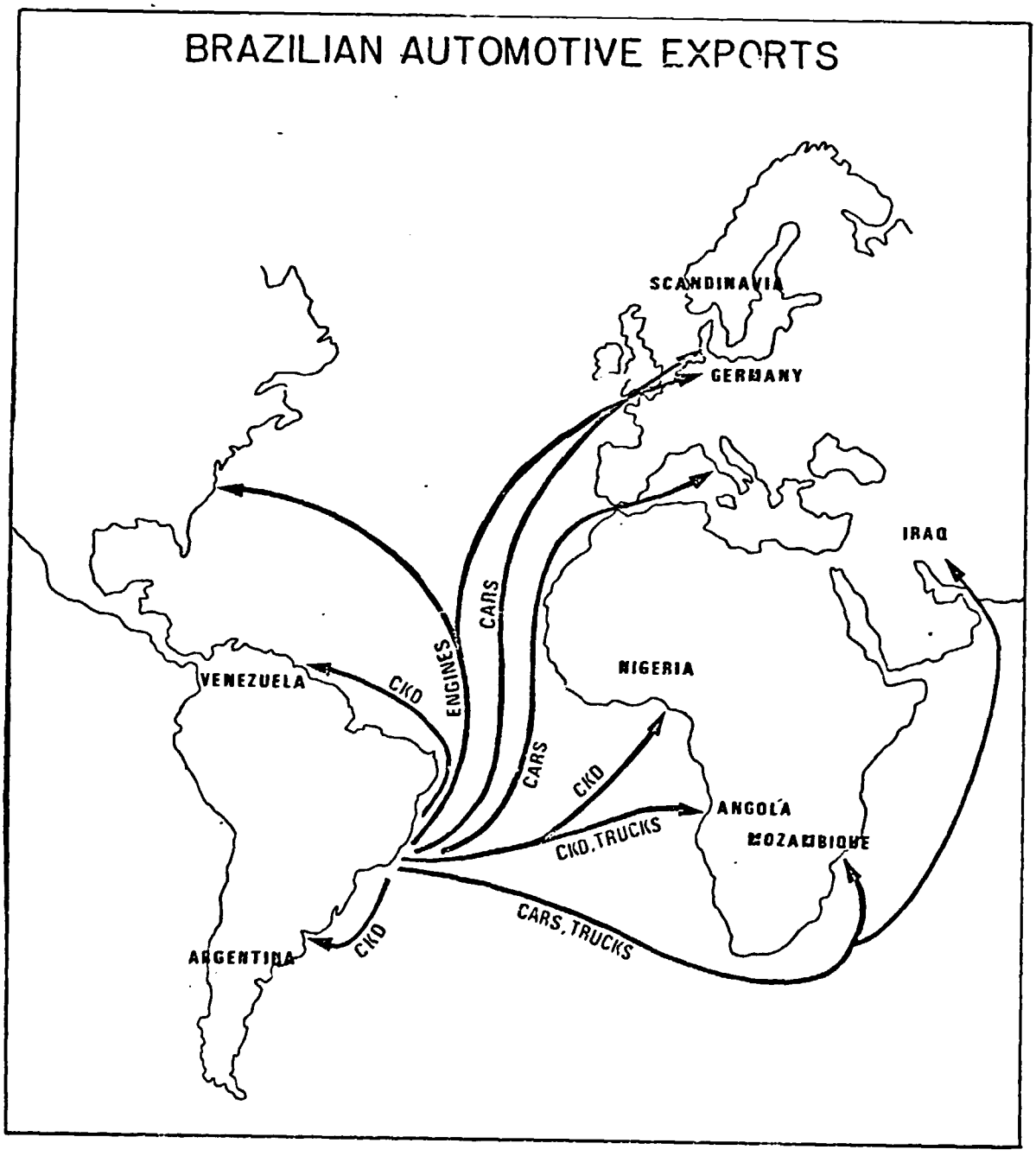
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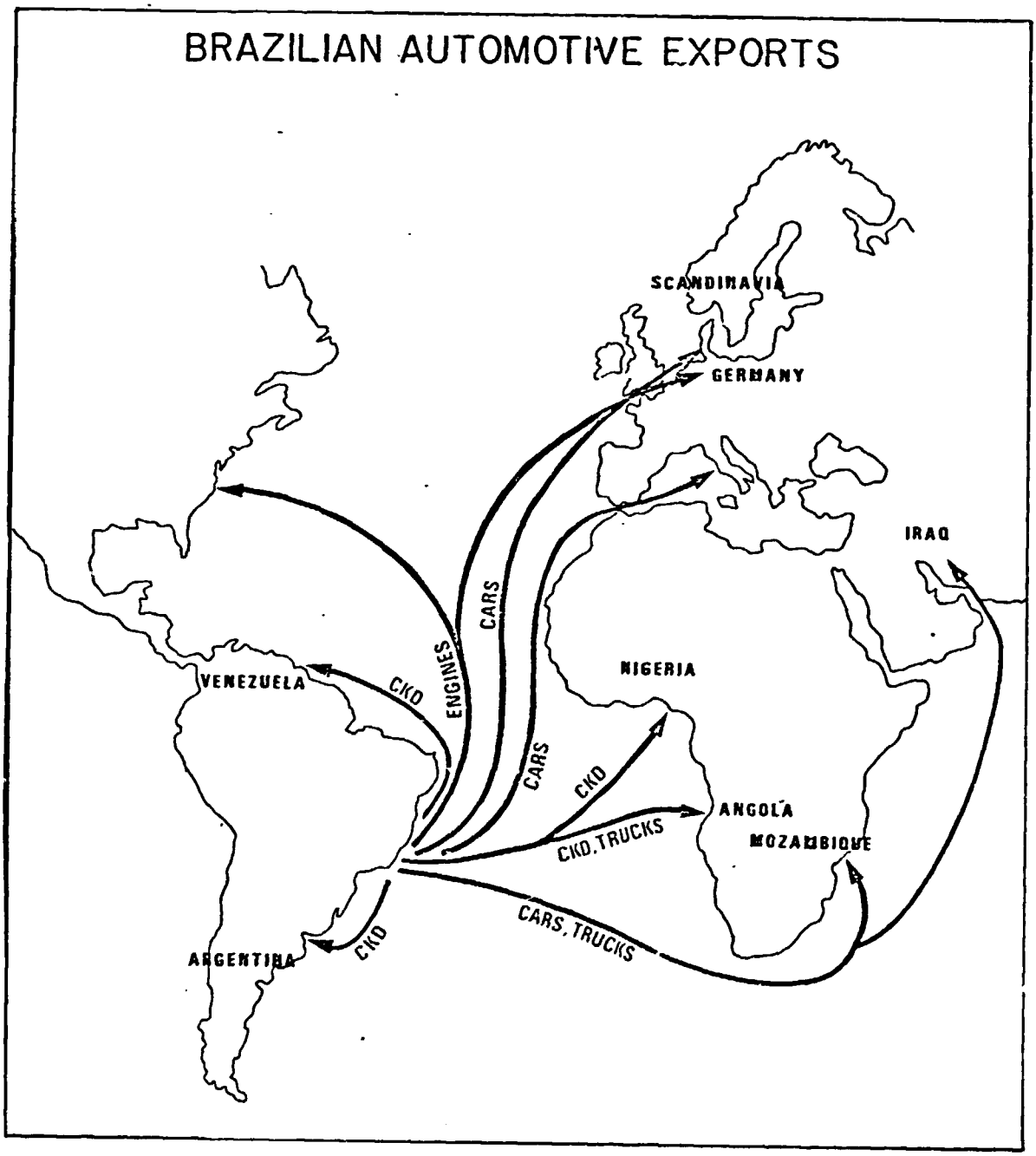
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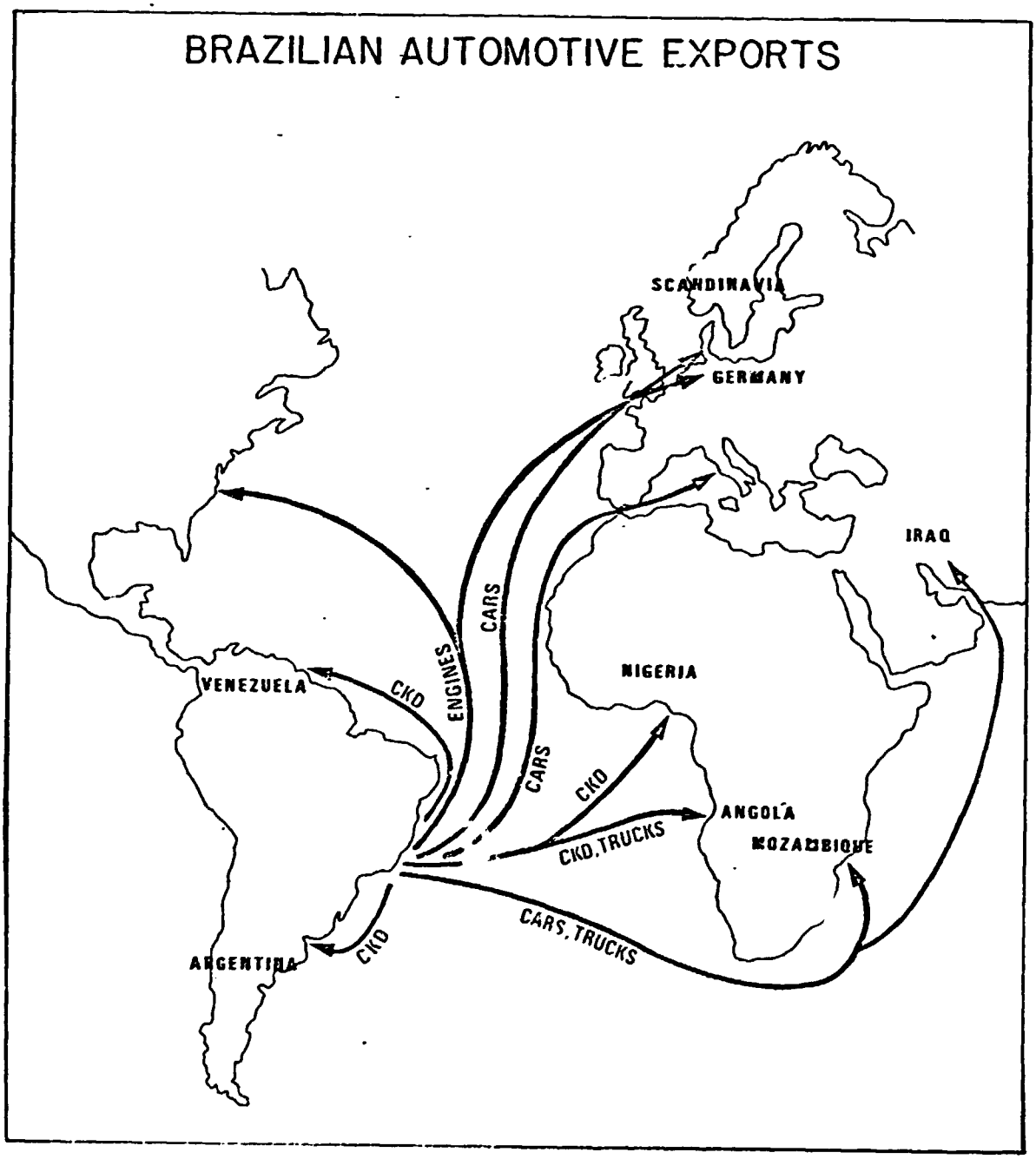
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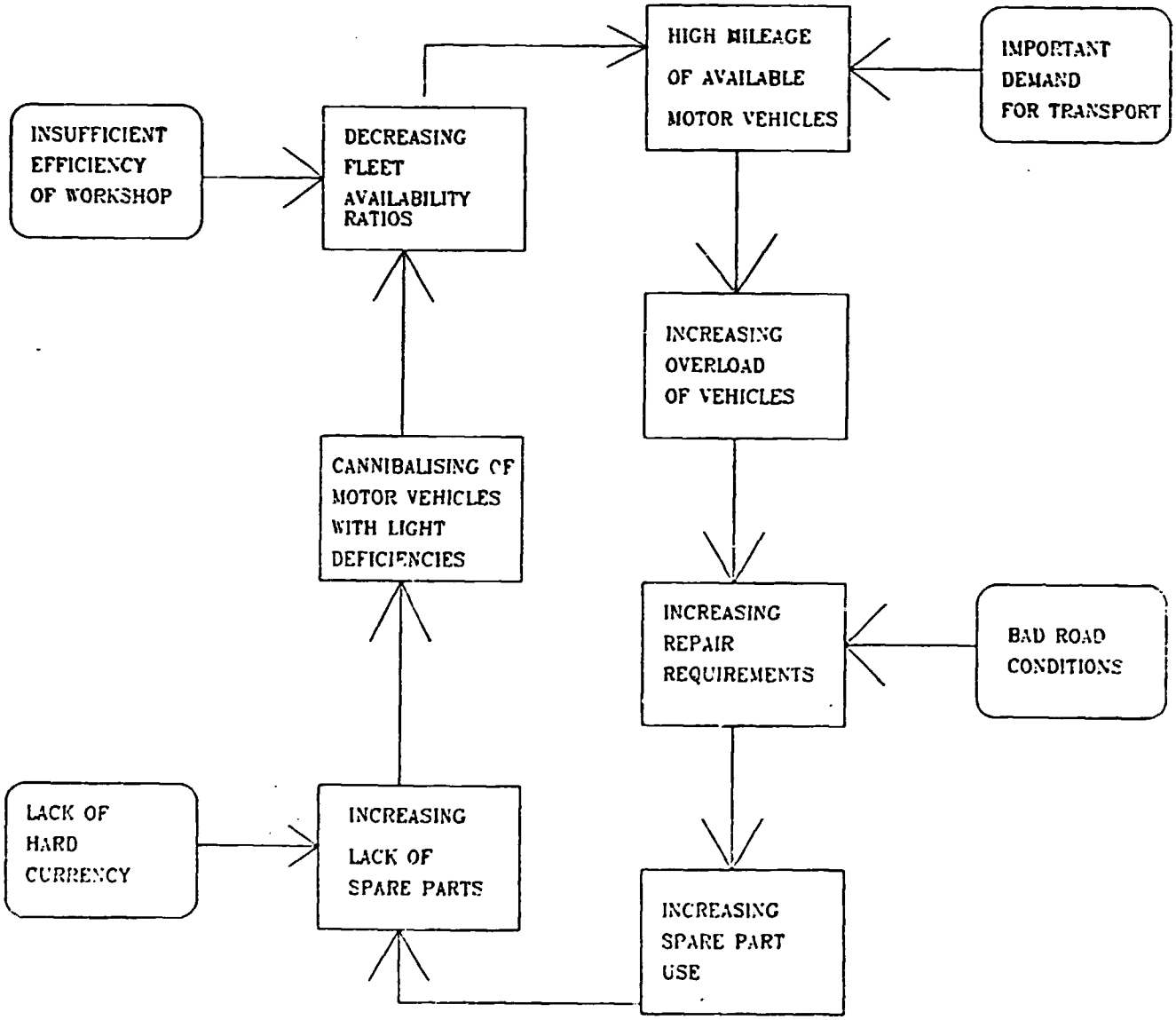
# CIRCULUS VITIOSUS OF MOTOR VEHICLE TRANSPORT IN DEVELOPING COUNTRIES




Legend: ( ) = external factors

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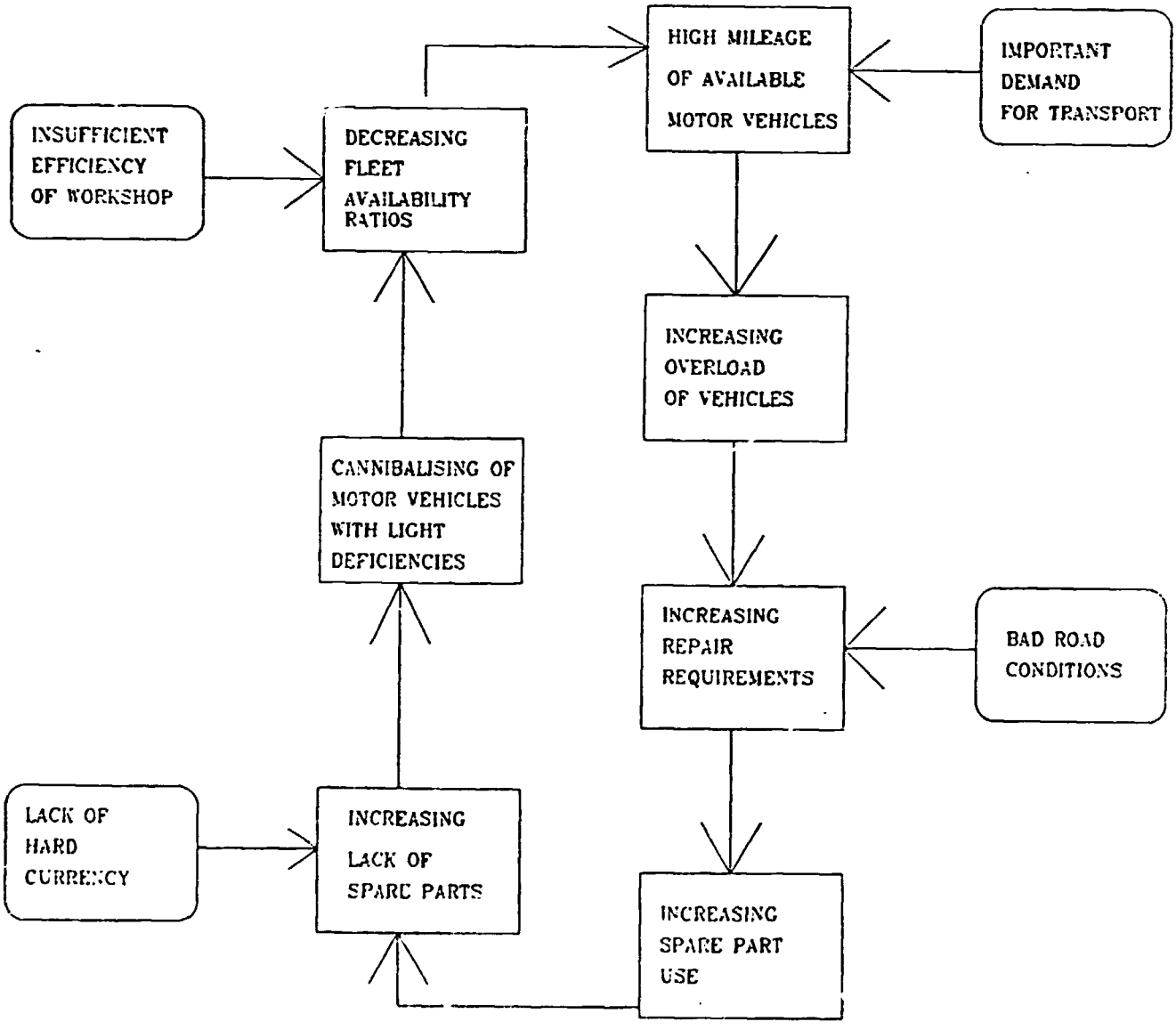


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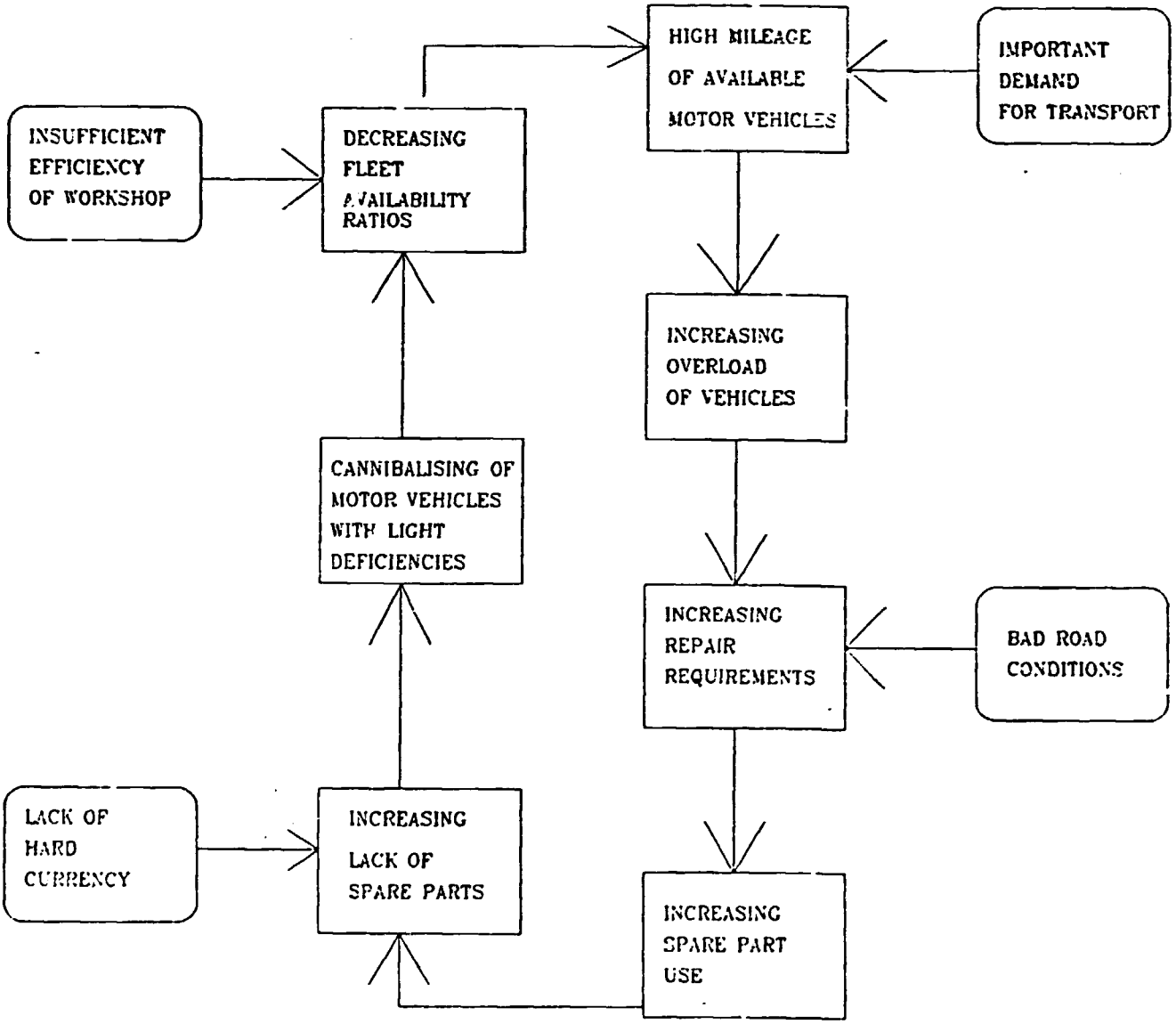


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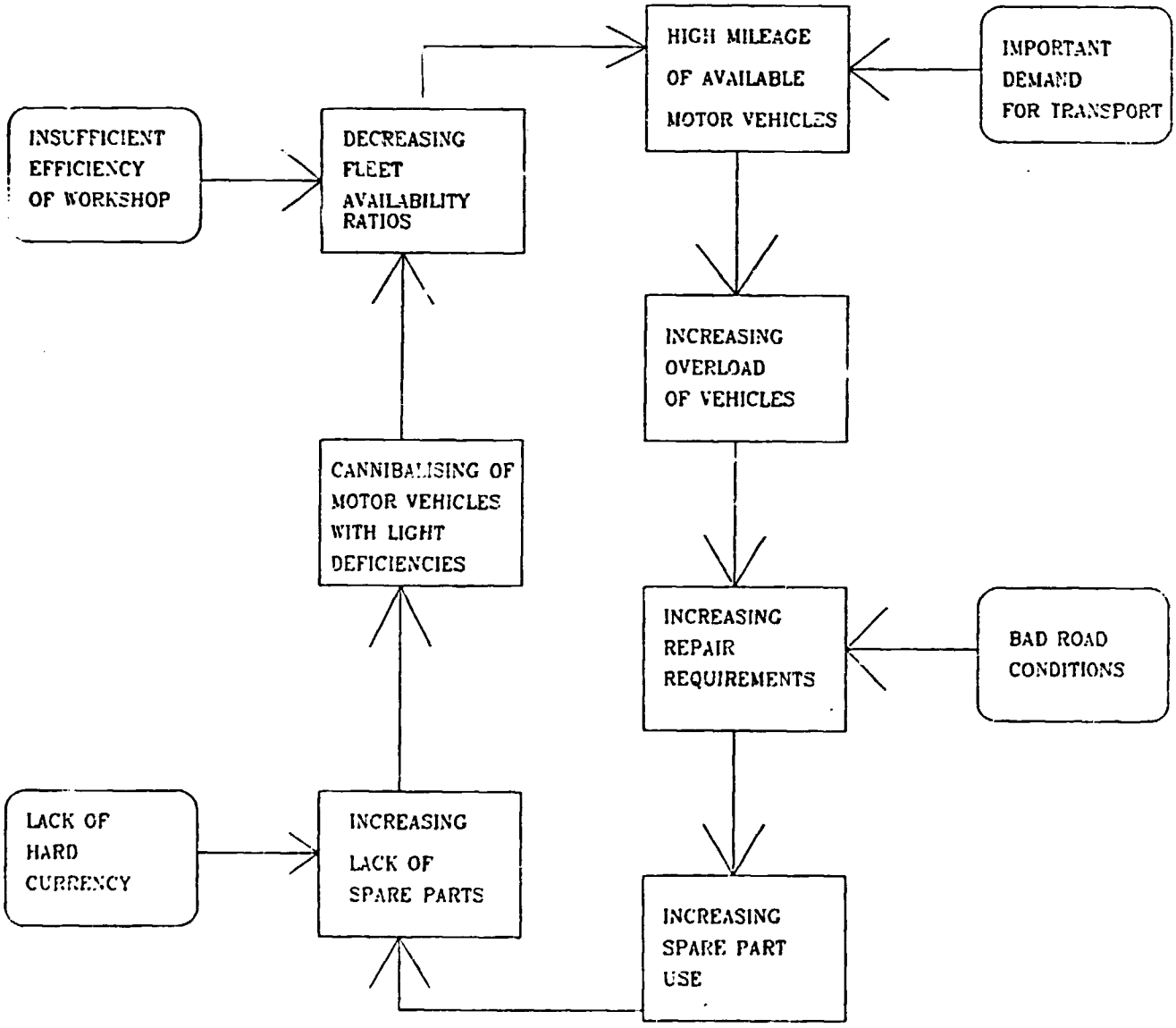


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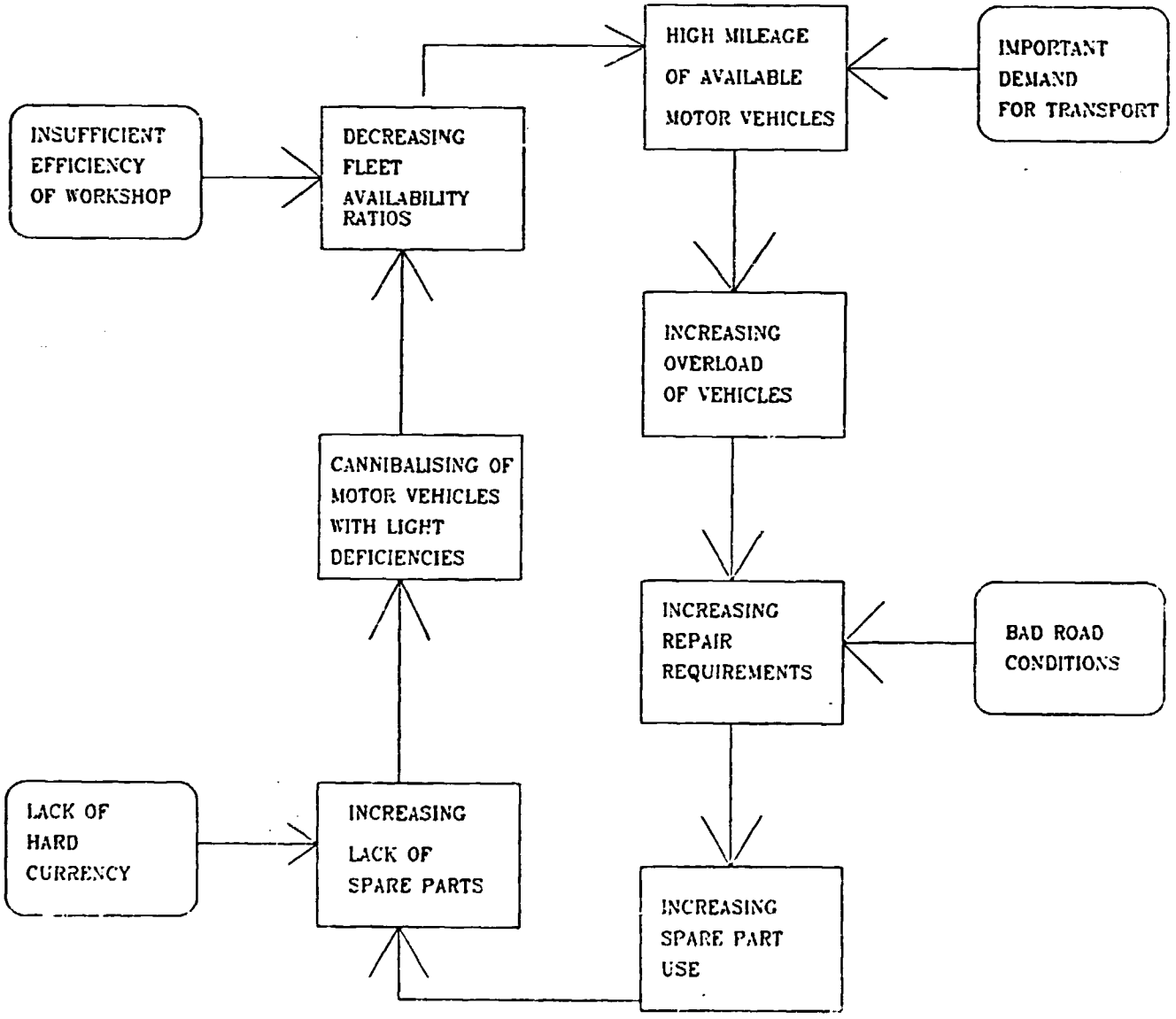


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