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A CASE STUDY ON THE STRATEGY FOR PROMOTION OF HEAVY INDUSTRY IN DEVELOPING COUNTRIES - MEXICO*

by

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PREFACE

This presentation is based on the experience of the UNIDO/NAFINSA Team working in Mexico, on that country's Capital Goods Project.[1] It is effected by the conditions prevailing in that country; both the outlook of the businessmen and entreprunears and politicians, and the geographical location which is very close to the great industrial giant of the United States, and very remote from the rest of the fully developed world.

Whilst therefore some of the arguments presented are related to the individual approach required for Mexico, it is considered that the broad strategy could be of use in other applications.

Against the background of the overall plan, to give sound advice and assistance in the national programmes of the developing countries, the promotion of the capital goods sector has been found to have a major influence on the acceleration of technology acquisition, and this in turn on the more rapid advancement of the economies of those countries.[2]

The full implementation of a capital goods programme however depends in turn on the capability of the country to provide those components which are supplied by the heavy engineering industry and that is the subject of this paper.

INTRODUCTION

This paper concerned with the ways to develop heavy engineering industry, in the newly emerging industrial countries primarily in the metal working industries, since it is from here that most developed engineering stems. In particular it examines the way that some countries have developed and have created a gap between themselves and other less developed countries; more especially in the large and heavy engineering activities; and the ways which this gap can be closed. Although the gap was created slowlyand developed by stages it is not feasible to close it by the same mechanism. The costs, both of obtaining the required technology, and the capital investment which is involved in moving from small under developed industry to heavy and developed industry, requires that there must be a certain assured market to provide the demand which will recoup these expenses. This means that any country desirious of moving into the developed industrial world must make a quantum leap. It either equips itself to compete all or most of the way or it does not compete at all. In the later case it fails and retreats. The purpose of this paper is to help to try to avoid that failure.

HISTORICAL BACKGROUND

To see where the divisions of the world into developed and under developed groups began it is necessary to examine some of the developments of the eighteenth and the ninetenth centuries when the

industrial revolution was taking place.

The knowledge of the method of producing iron in the form of castings and as wrought iron had been practiced in many places in the world for several centuries, but the usual method of getting the metal from the ore employed charcoal as the reducing agent, and this meant that production was slow and quantities small. A primary impetus to the industrial revolution which was centred on Europe, was the development of coke to smelt iron and so produce easily cast iron, from which cheap strong machinery could be made.

Europe and the United States were blessed at that time, with plentiful supplies of both coal and iron ore and were quickly able to take advantage of this new process. The development of mechanical power went hand in hand with these discoveries and the demand for engineering products grew, promoting the growth of the engineering industries. Any organisations which aspired to make its mark in this new activity had to have a foundry where it could produce its own castings.

A natural extension of the easy smelting of large quantities of iron was the refining process to make steel, and as mild steel and alloy steels became available in greater quantities, the availability of these materials made it possible to produce stronger and better machinery

and this still further increased the demand for castings which formed the major part of all machinery. Thus any organisation which set up as an engineering industry had its foundry and its machine shop and its assembling areas. Each unit was as far as possible self sufficient, it designed its own machines and set out to make every part. This pattern was repeated in each town and in each country. Everything was produced as an individual item, it was made to last, to do a job. and when it was worn out it was replaced. The steps were simple the costs were low. Enterprises could be as small as one man and his family or as large as a group which could employ workers. Even as business developed and units became larger the individual self sufficient trend continued and so long as this continued there was no great difference between industrial countries. If needs required it a non industrial country could have easily started up an industrial function.

THE WIDENING GAP

It so happened however that these developments also coincided with the era of European Colonial competition; Britain, France, Holland, and Germany in particular were very active in laying claim to the right to rule over large parts of the Non-European world. As the citizens of these countries spread across the globe they took with them knowledge of all the latest engineering developments of their home countries. This had a twofold effect. First the colonisers could not always obtain all the

technical and other facilities necessary to repeat abroad the developments in their home countries. Secondly and perhaps more significant both the colonisers and more especially their governments saw the opportunity to add to the markets and activities of their homeland industries. This led to a more and more entrenched situation where the European countries became the suppliers and the colonial countries became the supplied. Even where imperial occupation of the territory did not take place, the commercial energy of the now industrialised countries of Europe meant that these countries controlled most of the commercial and financial institutions in the world, so that even in those parts of the world over which they did not actually rule the same pattern of supply from the European sources was followed.

Across the Atlantic in the United States the pattern was slightly different but the effect was the same. Although the U.S. did not embark on a major colonialisation policy there was a vast new territory to be developed and this huge new country was able to develop its new processes and create new markets within itself so the effective position was the same. Indeed the concentration of heavy industry in the east of the United States, even today bears witness to the trend of that time. Only the newer, oil and aircraft and electronics, industries show a more diverse distribution.

Although this trend itself meant that there was now a distinct segregation of areas of the world into industrial or supplier areas and non industrial or buyer areas, this in itself did not create an irreversable situation but other factors then added to the situation.

As the demand grew so did the need for larger plants larger products and larger production equipment. Alongside this came the realization that repair and maintenance should be quick and simplified and so the need to make repeatable replacement parts was created. Particularly things like bolts, nuts, screws, washers, bearings, gears, etc. These factors with other similar pressures lead to the next stage and further widening of the gap. Repeatabily of parts called for standardisation. An agreement that certain parts should be all be produced to a fixed set of dimensions and these standard items incorporated in all machines. Bolts screws and rivets are obvious items for such policies. Along with this came the realization that if these parts were to be all the same then it was worth making them on the same equipment and in large quantities at a time. This in turn led to the design of special equipment to do one thing or one series of things at low cost and high speed. In these circumstances it was better for one supplier to accumulate the demand from a number of sources and produce one large economical production batch, rather than several smaller less economical production batches. And so specialization and the embryo of an supply infrastructure was created. As parts became larger and production equipment more expensive it was no

longer possible for every engineering works to have every kind of production tool. It was too expensive and would be unprofitable to have had expensive equipment which only worked part of the time. But it was possible for one machine to be kept busy all or most of the time if it served several engineering factories in a general area, and so gradually the specialization and interdependant structure began to florish.

In particular the technology of the processes of manufacture began to develop so that specialists began to acquire a greater understanding of different facets of the manufacturing processes and became expert in that specialized field. As the field of knowledge grew it became more and more impossible for one organization to have all the knowledge and abilities required and so the specialist producer and the special supply service network grew.

This was particularly so in the case of the production of steel and larger and more sophisticated machinery. No longer was it possible to produce the quantity and quality required with small inexpensive facilities. The increasing size of the equipment meant large financial investments, and enterprises could no longer be family concerns but had to be the result of the investment from many sources and many people. Larger labour forces were necessary and the manufactururing enterprises became larger and now required deliberate forwards plans and defined markets before being embarked upon. No longer was it possible for a country not already in the industrial category to easily and cheaply enter the race. In particular it

was necessary to have a supply of the special standard parts from a local infrastructure as well as to have a demand for the finished product of any manufacturing plant considered. The quality of particular companies was begining to find recognition. Certain manufactured parts made by the specialist supply companies were acquiring recognition as the best parts to be used and so another obstacle was raised against any casual new suppliers entering the industrial world. The existing industrial countries would trade and consult with each other, but would be distrustful of encroachments from outside the established circle. The system was also self feeding. Since the only people with manufacturing knowledge and experience were the existing companies then the only organizations able to exploit and examine new developments were these same organisations. Thus all new inventions were either developed or investigated within the existing structure which therefore continued to cause the concentration of knowledge and manufacturing capability to intensify. Once this process gathered momentum it intensified the process. Anyone contemplating manufacture wanted to be where there was the skilled men, the technology, the availability of supply, and more important the supporting infrastructure and provision of the specialist facilities. Thus the industrialized countries became more industrialized and the non industrialized countries remained under developed. The natural economic and commercial pressures all ensured that it would remain that way even when the imperial influence of the colonial era passed.

This then is the reason and result of these events of the past and without any other intervening factors there is no reason to suppose that the situation should change. Now however the political and natural national policies of the non-industrial nations has required that this state of affairs should change and it is the best way of effecting this which is the main interest of this paper. To do this effectively however it is necessary first to examine the situation as it now applies in the older and most developed nations.

THE PRESENT SITUATION IN FULLY DEVELOPED ECONOMIES

Perhaps the most significant factor which examination of the manufacturing sector of the industrial nations reveals is the fact that it forms a complete interlocking complex, and that whilst some companies stand out because of their size, and the popularity of their end products, the whole of industry is interdependent and no single unit comes near to being self supporting or independant. In amongst the giant and large companies there is a great complex of supporting organisations without which the system could not exist, and the big companies also need to interact with each other as well as with the smaller companies. It is only by such a system that industry can operate efficiently and competitively The spectrum of technology and knowledge in all the branches of physics, chemistry, electric and electronic manufacturing techniques and metalurgy is so wide and complex that specialist services in the several different aspects are now necessary not only to continue with the reseach and development of each aspect of widening knowledge, but also to understand and properly apply the existing knowledge. No company could properly obtain the best results by trying to do all things and so the total complex infrastructure is formed and lives.

The field is so wide that it is impossible to do justice

by trying to cover every facet, but some examples will illustrate the significance of the situation. First, refering again to the basic material of all this industry we look at today's production of steel. In place of small enterprise producing a few thousand tons of iron and a few hundred tons of steel per year we have integrated steel works producing millions of tons of hot metal and converting the majority of this straight into steel. Complex computer systems control the quality of the metal and add chemical alloys. The metal is cast continuously into slabs or billets so there is practically no waste and the slab or billet is cut up and sent straight to the rolling mills. Such a complex will serve many industries; indeed the output of one such large steel works could supply the whole needs of some countries, and no company in direct manufacture would consider making it's own steel.

The same thing now applies with castings and forgings.[3] As the size of these items has become larger and the metal quality more demanding the specialist foundry and forge have developed. Companies of great size and capability recognise that it is better to purchase castings, die castings, stampings and forgings from specialised suppliers rather than to try to be self sufficent. This has two advantages, one, it saves them the very large investment required to set up such facilities, two, it means that they have not to worry about acquiring the technology or achieving the quality standards. The purchasing company lays down its quality standards and rejects anything which does not meet the standard. The problem of achieving that standard is for the supply company.

Even when a very large company decides to provide its own supply of certain components it now more usually does it by setting up a completely separate enterprise for this specialist supply. In effect therefore whilst the specialist company may be owned by the parent organisation it supplies, it is truly a separate enterprise and in time often shows that it operates as such, often suppling the parent company's competitors whilst the parent company in turn byys its supplies from other sources as well as its subsidiary.

There are indeed several companies which exist supplying goods to the market who buy their components from a competitor who is also serving that same market. Examples are auto suppliers who purchase their engines and transmissions from Ford or General Motors. In the earth moving field Caterpillar is established as the number one company but there are competitors who are in the same business who buy their engines and transmissions from Caterpillar, Clark Construction similarly supply transmissions and final drive units to their competitiors.

The giant auto companies, which rank amongst the largest in the world, buy their brakes and electrics from specialist producers; and so the list goes on showing that industry is huge interdependant complex in the developed world. The interdependence does not stop at national boundries either, it now exists world wide.

The following short list is only a fraction of the components which are now usually purchased by companies from specialist suppliers.

Castings, more especially large castings,

Forgings; almost all forgings are purchased and especially large items are supplied by only a few sources in the world.

Stampings

Die castings

Electronic equipment

Bearings

Oil Seals

Large Fabrications

Gears and Gear Boxes

Cables. (both electrical and for tension)

Steel

Alloy Steels

Hydraulic Equipment such as valves and Pumps

Tools for cutting and forming and stamping.

The list goes on but these few items are listed to emphsize that in the developed countries no industry is independant, but now forms part of a vast infrastructure.

The same infrastructure requires the supply of electric power, water for process and life support, roads and railways, and in many cases docks and ships, trucks and trains and most important of all people. People to manage, people to supply the technology, people to operate and perform all the manufacturing process. This in turn requires shops and services and entertainment and social activities to keep the people fed, happy and interested. For convenence therefore we call such a structure a "horizontal" structure. This is because different things exist side by side but are in constant interplay with each other the links are therefore horizontal between totally separate enterprises. In contrast a "vertical" structure is one in which each enterprise is individual and separate with little or no interplay. Here the only links are vertical within the same organisation.

It can be seen therefore that the structure of the modern developed industrial society is very strongly horizontally structured. It commenced by being very vertically structured and companies even owned the property in which their employees were accomodated; provided food and stores, and the whole community lived as a separate closed society; but today in Europe and North America in particular, where the greatest development is still centred, the cross integrated horizontal structure is now firmly established.

GENERAL STRUCTURE IN LESS DEVELOPED AREAS

The most striking difference observed when looking at the industrial structure of many countries with small or recently developed manufacturing industry is the strongly verticial orientated formation. Companies operate in complete isolation from other industries making contact only with restricted suppliers and their customers with virtually no inter-relation with other contemporary manufacturers. There are great gaps in the supply infrastucture and therefore a significant reliance on imports and foreign support. Often the foreign support goes to the point where a company claiming to be a manufacturer is no more than an importer of parts. There is a chronic distrust of local supply which intensifies and prolongs the period of vertical structure and stultifies the very process which will enable companies and their countries to develop the strong infrastructure which will enable the transition from developing to developed state.

The usual pattern is that a foreign company will set up a selling agency or an enterprising national company will seek a foreign agency so that goods not produced in the country can be imported and sold. After a time some assembly work may be done in the country and later still some simple components may be produced.

This is a perfectly logical and sensible development so far as it goes, but it often does not progress beyond this point. Even if the

national participation increases it does so only within the vertical structure. More manufacturing facilities may be added as it is decided more parts can be made in the country but always by expanding the activities of the same company unit; rarely ever by encouraging existing local enterprises to provide the requirements. Even nuts, bolts and other basic supplies will be imported if they can not economically be made on the site instead of developing the national infrastructure.

If volume justifies it a foundry or a forge or a machine shop may be established but if this is not economically possible then this work continues to be performed outside the country and the results imported. Because of this vertical insularity therefore the situation can develop where several organisations exist side by side, all purchasing similar components from overseas, each too small to justify, on their own, a new national manufacturing facility, but which in total could provide sufficient demand to support one, two or even more national manufacturing supply facilities. The foreign supplier is well satisfied with this situation since it helps his own trading position but it does nothing to help the development of the country question. Undoubtedly, one of the reasons for a reluctance to support and trade with any nationally developed supplier, who was to start up to try to satisfy the internal demand, would be a distrust by both the national user and the foreign partner of the quality of the products to be supplied. However this is a problem which must be faced and overcome by any country which hopes to advance as a manufacturing nation; and it only by taking the necessary actions to enable such national supply or

infrastructure companies to germinate and florish that countries can break out of this circle which confines them. This remains true of all aspects of the construction of the necessary infrastructure base.

It is, as already stated, a circle which is self confining unless some factor is introduced to make the break. Companies will not consider starting to manufacture those things which need a strong infrastructure of supply unless the supply is seen to be there and guarranteed to be sufficient and of the right quality. Companies which wish to start up essential infrastructure supply factories will only be prepared to do so if they can see an assured market for the products. Each is waiting for the other and as a result nothing happens. This is particularly true in the case where high initial investment is required just to start the operation. An activity where initial investment is small and can be gradually added to as the demand and justification grow can be started with small risk. It can succeed in developing due to its own success, attracting customers by its presence, and encouraging new organisations to start up since it is there to supply the needs of those new companies. But in the case where a large initial commitment in land, buildings and machinery is required then this is a risk which few are prepared to take.

These cases are those which require high technology equipment and machine tools, such as the making of bearings, seals, etc., but the most special cases are those where the infrastructure is to provide

large heavy components such as large castings, forgings and fabrications. These things in particular need a very high initial commitment just to provide the minimum essential equipment.

It is for this reason that it is unlikely that a country will naturally and spontaneously move from an under developed state to a developed state. To enable the transision to take place there must usually be a catalyst; usually a well defined government policy which recognizes the problems and is prepared to give the necessary support and incentives to enable its businessmen to make the jump; because that is what it is. There are of course a few cases of extreme enterpruerial flair where the whole decision and risk have been taken by one organisation or even by one man, but these are rare, and countries cannot wait hoping that such a person will emerge just at the right time.

PROBLEMS FACING THE DEVELOPING COUNTRY.

The immediate problems facing a country planning to develop its own industries therefore are numerous and fall into different categories.

Lack of Basic Infrastructure

A good basic infrastructure of supply, transport communication and social services is essential. For example there is the problem that anyone wishing to start manufacture finds that is may not be possible to get within the country the essential supplies for this needs. This means that if he is to manufacture at all then he must either supply everything himself or purchase his requirements from foreign sources. If he is starting completely new then he has no established reputation and can therefore only obtain his supplies for cash. He has to pay top price, he has to pay for freight and insurance.. He therefore has to pay more and pay sooner for his raw supplies. The lack of a suitable infrastructure can also effect his ability to receive his supplies and despatch his goods since a good transport system is also essential.

Then there are the services which normally can be expected from an infrastructure, electrical supplies and water services. In every organisation, in addition to the main supplies which can often be projected and secured in advance, there are a myriad of small requirements which are not so easily predicted. Nevertheless these small requirements are

essential to the smooth sucessful running of to plant and their lack can cause serious disruption and hold up. Without a back-up supply such as is so readily forthcoming from a sound matrix of an established supply infrastructure serious disruption of production can arise decreasing the effectiveness, efficiency and competitiveness of any national enterprise.

Quality and Acceptance in the Market.

Any new company entering a market which is already being served by other enterprises can expect to encounter problems with the quality and standard of performance with its products. This is true of any company in any country. It is particularly the case where the new company is establishing itself in a previously under developed country and is trying to compete with imports from large companies from fully developed countries which may have years of experience of product development. In these cases the new manufacturer is trying to train his labour, gain experience with his product, and improve his quality all the same time. Inevitability some problems are experienced until a full operating period has elapsed, but this is not the concern of his potential customers and his goods have to compete and stand comparison with his competitors.

To make matters worse there is usually a dichotmy of thinking in the development countries. On the one hand people are staunchly for the development of the national product, but on the other hand when it

comes to a choice of purchasing goods from a national manufacturer or from an established foreign supplier, they find reasons why the national product is not acceptable or reasons why they must stay with the foreign supply. The reaction is natural and understandable but the problem remains nevertheless. Often unfortunately it is justified by the quality of the national produced goods, but the only way national supplier is going to overcome his problem is to have more operational experience which is the very thing he is often being denied.

Investment

Whilst investment can be a problem at any time and in any country it can be a serious problem in an under developed country, especially if that country has a foreign exchange problem. Practically all manufacturing equipment, tools, machines, and machine tools must be purchased abroad — after all that is the reason why development is necessary — and this requires foreign currency. Then there is the actual funding which can be quite high if the product to be produced is large and or sophisticated. Obtaining the necessary financial support for what must be in the early stages a risk can be a substantial obstacle, discouraging support or at least making it difficult to attract.

Opposition From Established Organisations

Often this can be the greatest problem. Established businesses such as importers and agents for foreign companies see the build up of indigenous industry as a threat to their activities and often indulge in intrigues to obstruct new venture. A common ploy to block a new venture is to hastily produce a counter proposal, usually in cooperation with the foreign supplier which can be made sufficiently impressive so that either.

a) *The intending investor is put off by what seems to be a new strong competition for the market;*

b) *Supporting investors are alarmed by the counter proposals and withdraw their support even if the main investor wishes to proceed;*

c) *If there are government regulations to protect embryonic industries, the counter proposal can claim protection under the ruling by perporting to be a logical extention of an existing business; and so block the new proposals.*

In case (c) since the established importing company is already in the market it can easily produce quickly a reasonable looking proposals with its foreign technical partners. Since it has no real intention of proceeding with the proposals it need not be accurate so long as it looks good. The effect of this ploy is to baulk the new proposals and

avert the competition. By the time it is realised that the ploy was just manoeuver to prevent a new competition entering the field the support for the new proposal has gone. In any case it is always difficult to prove the counter proposal was just a manoeuver since it can always be claimed that detailed examination showed that circumstances had changed or that the venture was not viable on closer investigation.)

There are several other strategies similar to this which make the task of the developer very difficult.

Damaged Reputation

A country's reputation can be damaged during the early stages of development, and once this occours it takes a long time for confidence to be restored. This can happen for several reasons, but to take only two.

i) A company may simply turn out cheap shoddy work, taking advantage perhaps of low labour costs and some cheap second hand equipment. The company makes a quick profit selling simply on low price and then gets out of the business as problems appear.

ii) *A company sets off with a genuine attempt to establish itself in the market, but because of ignorance or over enthusiasm turns out products which fail in service.*

In either case damage is done to the whole country. In the case of the large developed industrial countries the country reputation has been established over a long time. No longer are products related to the country as a whole, but identification is with individual companies. If therefore, for example, a company in western Europe acquires a bad reputation — even if just for a short time — this does not effect the standing of any other well established companies in Western Europe, but only the individual company. In the case of a developing country however since it may have only a few representative companies, the reputation of any one of them can reflect upon the others, and poor goods from one outlet can tarnish the reputation of the whole country.

The lack of standards, and of an inspection agency to see that these are maintained and enforced, can be a severe restraint of any country progress.

GENERAL PREFERED SOLUTIONS

Since the primary purpose of any development programme is to increase the national manufacturing capability then this must be a National Programme, sponsored in some way by the government of the country. Although the actual action will probably be carried out by individuals and individual companies it must be part of a fully orchestrated strategy and whilst the government cannot dictate every small manoeuver it must ensure that each action taken confirms with and does not conflict with the national pattern. The task of organising a National Programme is perhaps simpler in a state controlled economy where all industry is in government control, but the evidence shows that this is no guarrantee of sucess. The most successful countries in world trading terms have been those which have essentially mixed economies with a minimum of government control but with considerable government coordination and cooperation with private industry.

A typical situation for the government or an under developed country which has decided to industrialize is likely to be the following:

a) *There will be a large number of small industries; mostly poorly equiped, producing small numbers of relatively small unsophisticated items, and serving a market relatively local to the point of origin.*

b) *These industries will be largely independent except for their raw material supplies, unintegrated with each other, and repeating the same function separately. They will have low technology, and practically no common standards of quality or of dimensions other than those which enable them to utilize international components. Machines will be overworked in some plants and relatively idle for long periods in others. There will be duplication of facilities, especially for casting and simple machine operations.*

c) *There will be several companies which claim to make certain things, but which are little more than importers of foreign parts on which little or no work will be done.*

d) *There will be a large number of foreign agencies for the import of foreign goods — depending only upon any import controls which the government has found prudent or necessary to impose.*

e) *There will be a few larger concerns. Most of these will be foreign owned or controlled, but some in the hands of good national entrepuners, and these companies will be producing goods of reasonable to good quality in good conditions with*

reasonably good plant and equipment. These companies will still be largely vertically integrated and obtaining all their supplies either from within their own facilities or from imported supply, but they will be making some use of local firms to obtain some of their needs.

f) Notwithstanding these few larger companies, the country generally will not have the existing capabilities to produce large, high technology, high quality goods; or more importantly to produce the components of which these large sophisticated products are comprised

g) Technology and educational facilities will be at a low level and national quality standards will probably be non-existant or at an elementary level.

It is against this kind of general background that most under-developed countries have to start to build their economies.

Without question the education of young people and those already in industry and commerce and the general raising of the technological education level in the country is a pre-requisite of any national campaign to improve industrial ability of the country. This however is a whole subject in itself and this paper does not have the scope to cover that

aspect but must concentrate on the industrial strategy.

Essentially there are three courses open to the government of the country and in each case a choice of two strategies.

The courses are:

1) *Develop large state controlled manufacturing complexes;*
2) *Induce by various means, private individuals to start up industries;*
3) *Adopt a mixure of the first two;*

The strategies available are:

a) *Construct large, independent, vertical type of enterprises with totally integrated supporting functions to be largely self sustaining.*

b) *Create a large integrated horizontally organised infrustructure on which all present and future industrial development can be established.*

Which of the first three alternatives is taken is largely dependant upon the political nature of the country and government and it is not the purpose of this paper to become involved in this aspect of the problem.

It is the strategy which is the concern of this paper and so that this can be examined we will shortly consider the specific case of Mexico which is a typical example of a mixed economy where some essential functions are performed under direct government control, but where general industry is a mix of state enterprise existing side by side with wholly private companies, and with other companies in which the state has some financial participation.

Before considering the strategy however it is first necessary to decide how to obtain the technology, since it is accepted that there is no existing technology sufficiently advanced in the country at present, and time and economics do not allow the country to develop its own experience repeating what has happened over several years in the more developed countries. The requirement is that the country should be able to produce fully developed products at internationally competitive prices in a reasonably short time. Clearly therefore it is sensible to obtain the technology and information from an existing source. Fortunately due to the great competition existing in the world and with several companies in various countries wishing to create good business relations with developing countries there is no great problem in finding partners for technology either through a licencing agreement or by an agreement to form a joint venture in which the technical partners will participate.

The decision which way to go on this point depends upon the degree of special technology required and the difficulty of transference of information and the technical skills available in the receiving company. There is no general rule, each case must be decided individually . However, experience shows that quite often under purely licensing agreements only the initial transfer of technology is truely effective and that the arrangements for follow up information are not fullfilled (interestingly enough more often due to the lack of proper action by the receiving company and not by the giving company as night be supposed.) Often license payments are made for years with little new information being given after the initial period. For true involved development therefore it has been generally decided that in the case of Mexico a substantial participation by the technological partner is required. This involvement must be sufficient so that the partner has a real financial participation such that he will very much be concerned in the success of the enterprise and ensures that it pays dividends on his investment.

However this point is decided it is now possible to decide the strategy of the company, which it will be (a) or (b)

a) <u>The individual company alternative</u>

If the country were to decide to take alternative (a) then each venture can and must be considered in isolation. The whole process of manufacture must be analysed and provision made

to provide the whole of the means of manufacture. If the products to be produced are small and inexpensive then such a possibility may be feasible but if the products are large and heavy, and most of those things which are necessary to take a country into the truly developed state are, then problems emerge immediately.

All engineering products involve considerable use of iron and steel. It can be remarked at this juncture that if this is not so and the products involve non-ferrous or special alloy materials then the problem will be even greater. The steel and iron must be provided as sheet or bar, and castings and or forgings of various kinds. It must be cut and shaped and accurately prepared to size. If it is required only in sheet or bar form it is possible to buy economically any steel products needed from other countries, therefore it is not essential that every country should have its own steel plant; but if castings and forgings are needed then problems of cost and utilization are immediately apparent. It must also be remarked that is is a rare product indeed that does not require either or both casting and forgings. Finally regardless of how the basic structure is constructed the components must be machined and here lies an equal or more important problem.

Consider first castings. If castings are large, such as those of the steel and cement industry, the power generation industry, the

transport industry, the mining, mineral, and petrochemical industries , then the equipment to produce them is large and expensive. This is true whether one casting is required or many. If there are many required this may be no problem, but it is unusual that in a developing country many castings of one size are required for any industry, which is the case we are considering.

If the demand is low therefore then only a few castings are needed and it is not economic to provide large furnaces, workshops, lifting equipment moulding and core making facilities for a small number of large castings, so either someone has to subsidise a large under utilized foundry or the new company buys its castings in a foreign market and the prime object of the national plan is undermined. The problem of heavy forgings is even more vexed since proportionately the cost of forge equipment for large forgings is even more disparate for small quantities than it is in the case of the castings.

Finally and even more important we consider the large machines for the machining of the components. Large machine tools are very expensive, the only way to justify the cost of such items is to utilize them intensively, but with a small work load this is not possible. Unfortunately, versatile though many modern machines tools are, they still divide into specific types and it is unusual to find large products which will not involve the use of three or four types or more. Even individual components often requires the use of more than one type of machine

tool. Hence a company trying to set up on an individual basis will find itself having to provide a full range of expensive machine tools to perform only a small volume of work. And here lies the complication; if a company cannot machine its components, then even if it can cast them and forge them then it is of no avail unless they can also machine them. Especially today with the rising cost of transport, it is not logical or financially possible to cast or forge something then ship it hundreds or thousands of miles to have it machined then ship it back for further work. As a result unless a company (and in the case being considered, country) can machine its own large components at or near to point of production it is much cheaper to purchase the finished machined component initially, and be without the basic production process.

As a result of these three factors, the most important amongst a number of others, many potential projects are stillborn or at best go ahead with imported components with an indefinate promise that sometime in the future when the demand is greater the additional facilities to produce the components will be installed. This of course rarely happens and the company becomes purely an assembly unit with little or no technology advance and remains totally dependant upon the foreign supply link Unless he has to, a foreign supplier usually has no interest in producing supply facilities in the developing country; he has a good export outlet so why spend risk capital and also jepordise his market at the same time. Within the underdeveloped country the company management often find it easier to

use imported supplies, and its is always difficult once commited to a policy to change it. Economically there are always good reasons why the production of self made components should be delayed.

The only alternative to this state of affairs is that the government of the developing country insist on the provision of all facilities regardless of the investment cost, as part of the inevitable expense of getting into an advanced stage, but if it does so then it does nothing to help the same problem when it has to be faced once again for another industry.

In some cases it may be possible for a particular industry to support all its own investment but if so this solves only one problem and does little or nothing to solve the problem of other less supportable projects. Hence in a country where the policy of developing individual companies on a vertical structure system is adopted, the country must either.

a) *Continue to obtain a lot of its major parts from abroad and so stultify the development of its own higher technology;*
b) *Spend very large sums of money to provide large expensive under utilized facilities so that the full manufacturing technique and technologies can be developed, in the expectation that the facilities will eventually be used as business develops.*

c) *Decide not to proceed with a project at this stage and wait until the demand is larger and then risk a large investment all at once.*

d) *Create a closed market and forbid all imports of foreign competition so that the country enterprise can call on the whole market to support its investment.*

In cases (b) and (d) the government must become clearly involved since in (b) no comercial company could adopt such policies and in (d) this must of course be a matter of law.

Regardless of whichever of these steps are taken, any new venture which appears to be worth developing in the future, has to face the same examination and decision making process. Since each company or industry is vertically structured it does little or nothing to solve the problems for the next industry contemplated and so the problem is perpetuated until the country's industry becomes so developed that all the necessary support in the form of technology, market size, potential demand and guarranteed manufacturing capability are clearly assured. By that stage however we are not talking about a developing country, but a fully developed one. The cost of proceeding by this means however must be truly enormous.

b) *The infrastructure route*

Consider now the general situation where the policy is to develop a horizontally integrated infrastructure. Here the problem is to decide which comes first.

i) The installation of substantial infrastructure facilities without the guarrantee of the end user for the ensuing unfinished product components or;

ii) The planning of the end products without the assurance in the first instance that the promised infrastructure of supply will be provided.

There can be no doubt that this poses a difficult question and considerable determination and vision are needed to overcome the problem. Consider the first policy (i), if the economy is state dominated then some political figure must comit himself to a policy which will undoubtedly be contended and invite some critisism and if the venture is to be sponsored by the private sector then again the government of the country must give some very firm guarrantees or some pretty powerful incentives to get private companies to commit funds to such an open ended possible use of a very large investment.

Policy (ii) is no easier since it will be most difficult to persuade national investors and foreign companies to invest substantial sums to construct various products in the country if they cannot see the plants

which are to supply the essential components and, just as important, judge the quality of those components. The foreign technology supplier is under no obligation to the national government and he has no faith in promises of things to come because past experience has taught him caution. National investors likewise will be slow to engage in a business until they can see a supply structure established.

However if it is the avowed policy of the government to develop the country's technology, then it must act decisively, and delaying the decision will only intensify the problems. A commitment must come from somewhere and this is a responsibility which must be faced by any government which truly wishes to promote the country's advancement. So now let us examine the situation assuming the decision is taken and facilities are provided with a suitable form of support from the government for the provision of large castings, forgings, fabrication and machine facilities.

Any company which now wishes to commence activity in the heavy engineering field is now confident of obtaining supplies of all the large heavy items it requires. Not only is it able to evaluate its costs without having to face large import costs and duties but much more important, the capital outlay which may be required is substantially reduced. If necessary the infrastructure facility can supply fully machined castings or forgings, ready for incorporation into the finished product. Similarly, large and expensive fabrications, again fully machined can be supplied.

The freedom of choice for the prospective new enterprise is greatly widened. The contemplated company can supply all, some, or none of the machining, fabricating, and foundry facilities depending entirely upon the demand, and economic use, and return on investment, of such provision, confident that anything it decides not to provide internally can be provided by the infrastructure now in the country.

A new company even making large products can start with a relatively small investment and then, as and when it finds the market to support the provision of more internal manufacture, switch to the internal supply of certain facilities. The confidence to develop is much stronger since the risk has been reduced. This in turn encourages more investment. The infrastructure plants themselves need not fear the loss of demand. As fledgling companies grow and provide their own facilities, the confidence that their presence engenders, generally leads to more business developing from new sources than is lost from older companies growing up to be self sufficient. In any case many companies decide there is no point in invest ing in space and machinery when the supply is assured.

The size and versatily of the infrastructure plants tends to make them very price competitive in any case, making them more attractive than the provision of alternative "in house" facilities with all the problems which can bring. The large scale activities of the infrastructure supply plants enables them to develop skills and technologies which few individual companies could hope to achieve, so making them reliable and attractive

sources of supply. More probably the problem will be that demand will outstrip supply. This too should cause no concern, it will be a clear sign that the policy is correct and either existing infrastructure facilities can be expanded, or, what is likely to be more beneficial, new facilities in a new location can be established - whether affiliated to the original plant or not, so providing a more convenient supply base for industries which are perhaps located remotely from the original supply plants.

The situation is therefore self perpetutating and although the initial decision requires courage and an element of risk and character, all subsequent decisions are rendered much simpler, with a substantially reduced element of risk. The more industrial enterprises which are established the wider becomes the infra-structure base and the simpler it is to add more activities and widen still further the field of the country's experience. Hence as outlined in the earlier chapter a strong industrial base is established and the developing country moves fully into the developed state with an economic structure identicial to those of the fully developed nations existing today.

Even where there seems to be a contradiction of the pattern of general supply-infrastructure such as occours with some of the very large international conglomerate companies, closer examination of these enterprises will show that.

a) *These are really a series of loosely connected individual enterprises suppling each other but subsidiary to the same holding company.*

b) *In most cases they not only trade internally but also externally often buying supplies from a competitor which they could obtain within the company organisation.*

c) *There is often internal competition within the whole structure which is not the monolith it first appears.*

It would seem therefore that any country wishing to advance from a small under developed state, to a fully developed manufacturing nation, capable of producing the largest and most sophisticated engineering products must,

i) *Be prepared to develop a reliable supply, infra-structure particularly for the larger and more capital intensive goods*

ii) *Promote the use of this supply system by fiscal incentives up to a point where it is fully established.*

iii) *Notwithstanding the establishment of an infra-structure it must continue to foster its industries by various means until they are all able to compete in a free market.*

Having looked at the alternatives methods of approach, let us now examine the situation for Mexico and the logic of the proposals there.

THE COMPARATIVE ANALYSIS FOR MEXICO

In order to illustrate the difference in terms of employment, investment, and annual foreign exchange cost for the alternative approaches an actual comparison was taken for this country to find the best solution for the manufacture of identified products. The figures used in the examples are of necessity broad estimates and can be subject to some variation but the general picture it illustrated will not vary.

The country has already a good technology base with a substantial proportion of national demand being supplied by domestic industry, but it lacks the basic infrastructure to enable the larger, heavier and more sophisticated products to be produced. The national development plans enable the country to estimate with reasonable accuracy the trends of future demand so that it can readily identify those things which are reaching the point where production of all or a substantial portion of the end products should be built in the country.

These items were identified as follows:

a)	*For the petroleum industry:*	*Large volume pumps*
		High pressure pumps
		Turbo-compressors
		Turbo-generators sets for general use

b)	*For the paper and celulode industry:*	*General machinery of all types for the production of paper and celulose products.*
c)	*For the steel industry:*	*All types of steel works machinery*
d)	*For the power generating industry:*	*Steam, hydraulic, and nuclear turbines, and the generators to match the turbines, steam generating equipment, etc.*
e)	*For the mineral and consturction industry:*	*Earth moving equipment of all kinds, i.e. scrapers, tractors, loaders, cranes, shovels, excavators, etc.*

In addition to enable the country to become truly emancipated the demand for further infra-structure support was investigated which called for such things as: [4/]

Gears and gearboxes

Electric motors of all types

Diesel engines of between 300 to 1000 HP (smaller units were already being made)

Larger diesel upto 6000 HP and larger if possible

Metal working machinery i.e. presses, rolls, benders, [5/] *etc.*

Machine tools of various kinds [5/]

These later items whilst strengthening the country's own productive abilities also add to the total demand.

The two alternative methods adopted were,

a) To evaluate the figures for investment, manpower, and imports for the case where each industry would be set up as being individual and separate.

b) To consider the demand as a whole and to establish a common infra-structure supply source so that the large castings, forgings, and fabrications, could be supplied from service plants and this relieve the individual product plants of the large capital investment which the provision of these capabilities would entail.

Under the second concept the activities in the individual product manufacturing plants would be less than if they were vertically structured but all the components would still be nationally produced.

Case (a) Without infrastructure

It was planned that each of the activities previously listed would be a separate independent enterprise and have its own contribution to investment, manpower, and import expenditure. However an immediate problem encountered when trying to consider each enterprise as a totally separate entity was that several of the proposed industries would not form a viable underaking if they had to stand on their own.

The volume of business which could be obtained for these units would not support the investment for the minum essential equipment necessary. In these cases therefore it was necessary to immediately change the plant from a fully integrated vertically structured manufacturing unit into what was purely an assembly unit obtaining its supplies from national sources where possible, but obtaining the majority of its supplies from import sources. In this case the following industries were found to be not viable as separate enterprises.

Steam turbines and hydraulic turbine and generators. Both for general power supply and for industrial applications:

Turbo compressors

Earth moving machinery

Equipment for crushing and grinding of minerals

Trenching and excavating machines

Large gearboxes

Large diesel engines

In these case therefore only the investment for an assembly plant could be taken. Also the labour employed showed the same adjustment. These cases also gave rise to increased imports.

In other cases of course the analysis showed that a fully integrated plant would be justified and so in these cases the full investment for a fully national integrated production unit was calculated.

Taking each activity at a time therefore the case for the separate enterprise mode of economy was built up taking for those companies which could be fully self sufficient the following figures:

i) Number of employees

ii) Cost of investment

iii) Cost of imports which could be necessary even with a developed plant

In the case of those industries which could not justify a full plant and which therefore could only operate with licence agreements and import supplies the numbers taken were:

i) Number of employees

ii) Cost of investment

iii) Cost of imports necessary with a fully developed plant

iv) Cost of extra imports, necessary because the plant could not supply its own components, and there would be no infra-structure to supply nationally.

Adding all these numbers together the following was the result:

Employment	*One Time*	*Annual*
No. of jobs	*Investment 397*	*Cost of imports*
10 495	*million USA*	*251 million USA*

Case (b) With infrastructure

Refering now to the type of economy in which a central basis of infra-structure is provided. Whilst it is true that in some cases some of the individual companies could provide all their own facilities, the calculations were made on the basis that where the infra-structure could provide the service it would not be necessary to provide facilities twice; one in the infra-structure and once in the product company. As a result of course it is true many units become essentially assembly plants as for case one, but not all cases, and in most cases considerable equipment is necessary over and above the equipment in the infrastructure plants.

In this type of economy of course all the products considered were able to be made using national supply since the infrastructure could supply from a common source all the large expensive components requiring large capital expenditure.

The figures which resulted from this approach to the economy are as below:

Employment	*One Time*	*Annual*
No. of Jobs	*Investment 606*	*Cost of imports*
12 832	*million USA*	*91 million USA*

Comparison of figures

If we now compare these figures we get the following:

No. of Jobs	*Investment*	*Imports (annual)*
With infra-structure	*Million of Dollars*	*Million of Dollars*
12 832	*606*	*91*
Without infra-structure		
10 495	*397*	*251*

Let us now examine those figures in greater detail. First it is clear that using the principle of a national infrastructure leads to a greaterprovision of employment opportunity. This difference is over 22% compared to the case without infrastructure. The provision of adequate employment is a major problem in all developed countries and is particularly important in the developing countries including Mexico.

Next we look at the costs. At first examination it would seem that the extra jobs and the infrastructure provision is purchased at considerable extra cost $ 606 M as opposed to $ 397 M. If however, we consider the costs in terms of national spending of foreign exchange the numbers undergo a significant change of emphasis.

Allowing for construction of plants, purchase of land and provision of nationally supplied materials and goods, at least 30% of the investment will be from national sources. This means that a maximum of 70% will be spent in foreign currency or provided in the form of foreign loans.

On this basis the foreign cost of investment will be:

With infrastructure	*Withoutinfrastructure*
$ M	*$ M*
424.2	*278*

If we assume that ALL the cost of investment falls in ONE year which would in itself be remarkable and unlikely, and take into account the foreign exchange cost of imports we get Foreign Expenditure in one year.

With infrastructure	*Withoutinfrastructure*
$ M	*$*
515	*529*

If as is more probable the investment is incurred over 3 years the figure are more diverse.

Foreign expenditure over 3 years.

Withinfrastructure	*Withoutinfrastructure*
$ M	*$ M*
697	*1081*

It is important to appreciate that the capital cost is a "once and for all" expenditure but that the cost of imports is a continuing one and in each year that passes that country spends an extra 160 million dollars in foreign exchange in the case without infrastructure.

Furthermore with inflation the import figures will go higher and higher whereas investment costs having been incurred will not.

These figures of course are very crude numbers and could be subjected to a much more refined financial analysis, but the clear message they convey would not be radically altered by a more detailed study. It appears therefore that there is little doubt that the decision to create a national infrastructure not only leads to a better national structure but creates more jobs and costs less.

It is important to stress that this is the case for one country and that a different set of figures would appear for a different country, but it is suggested that the same pattern would emerge in every case with a similar state of advancement.

It is, therefore on this basis that Mexico has proceeded to develop its heavy capital goods industries along these guidelines.

As a direct result of this policy Mexico will, within the next two years, have the foundation of a major heavy industry. Already there are steel production facilities in Mexico which yield approximately 7 million tons, per year and new planned extension will raise this figure to 20,000 M tons in the next 10 years.

Soon a new plant will be in operation 6/ *which will produce steel castings of 70 tons and in qualities upto high alloy steels.*

The same facility will be able to supply steel forgings weighing as much as 70 tons and on the same site there will be comprehensive machining facilities able to machine the large castings and forgings which are produced in the adjacent workshops. 6/

A number of projects are either started or planned for large fabrications for the more sophisticated components for the steel, cement, and power industries, as well as the plants for the supply of the important equipment for the Petroleum and Petrochemical industries. The general pace of industrialisation in Mexico has quickened distinctly as a result of the direct action policy of the government.

The effects are both primary due to the direct projects sponsored by the government, and just as important the secondary stimulation of the private sectors of industry. The secondary effect may in the end provide a greater enlargement of the economic base since in such a large country there are great opportunities for the entrepunerial companies which can provide the large capital investment needed, whereas goverments always have many other calls on their resources.

However it must not to be overlooked that it is because of the initial stimulation provided by the government strategy and policy, that the process is initiated. By its actions the government either

promotes directly the existance of enterprises which either did not exist or existed only in limited scope, or, by making its policy clear, precipitates the private enterprise in the country into taking action which might otherwise have remained dormant for many years.

Nevertheless in the case of Mexico the major plants with the largest investments and the major influence on the infrastructure base are being founded by direct government participation.

As a consequence of all of this, it is forseen that all the products previously listed as chosen at this stage for manufacture, in whole, or in major part in Mexico, will be made in the next three or four years. Even more significant, private investment will be adding to the list.

GENERAL GUIDELINES AND MISTAKES TO BE AVOIDED

The foregoing sections have outlined the preferred policies to be pursued but the whole situation has to be taken into account and this section tries to point out some guidelines and recommendations with a view to avoiding problems.

Internal Demand 7/

Before any country can seriously think about creating its own major manufacturing industry it is important to ensure that the internal demand will be adequate to support the industry. The likelihood of export business to supplement home demand is becoming increasingly remote, partly because of the number of countries which are now pursuing a developed programme, partly because of some of the recommendations which are here outlined, but mainly because exports can only be won on performance and that requires a reputation and that in turn needs time. Time is the one comodity which is not available in this case. Costs must be recovered quickly and that generally requires volume, so it is repeated that, to begin with, the domestic market must be able to support the new enterprise.

Quality

It must be recognized at the outset that the goods produced must meet the highest quality standards which would be considered necessary for their class of work. Apart from the obvious reasons, this is necessary

because of the following:

(a) The most frequent criticism of products from developing countries is that the goods do not have the quality of the products from more established sources.

(b) This criticism is usually most loudly proclaimed by the nationals of their own developing country as an argument as to why they should not switch to the national production.

(c) If the criticism is justified it can set back the progress of the developing country by many years.

(d) Foreign partners and licencers will use poor quality as a reason to continue to import their own products.

(e) If the country hopes to establish itself in the international market it must be sure that its products will stand up to the stricter and closer quality examination to which the goods will be subject in the early years.

Adopt Standards

This is tied in with the last subject. All of the developed counties have laid down, either through central goverment, often backed by the force of law, or though trade associations, standards with which products must comply. It is not necessary for every country to create

new standards, indeed it is better to adopt international standards where they exist, or to adopt the standards or codes of practice from one of the leading industrial countries, but in each country some official body should be created, to lay down the standards which will be adopted in the country, and establish a means or inspectorate, or some other organisation, through which these standards are maintained. This will do the following:

(1) Establish confidence on the part of the user, that parts conforming with the standard, will perform required duties.

(2) Enable goods to be easily compared if they are made to approved standards.

(3) Enable manufacturers to know where they stand on dimensional and performance tolerances.

(4) Rapidly eliminate companies who cannot perform up to standard and so establish the reputation of those who can. The creation of a national standards institution is a whole subject in itself so the paper will confine itself to only this reference.

Provide National Support

This is also a whole topic initself and can provide considerable debate as to the methods to be used. It is not proposed to enter into detail on this subject therefore, but only to outline the salient principles.

These are in turn.

Firstly it must be stated as a principle that if the government wishes to promote its industrial development it must do just that, ie. promote.

As already stated, in the early days new industries will have many problems of acceptance so some means must be found to overcome these problems.

One of the first obstacles is price. Any new organisation anywhere in the world needs time to develop its processes and methods, to train its labour, and to increase its efficiency and so produce its costs. Since every existing company is striving always to improve its performance each year and do better than the last year then it is obvious that a new company entering the race, cannot at first compete on equal terms with one which has been improvising its performance for several years. This improvement in performance is reflected in the price which an established company can charge, as well as in the quality of its products, and so in the early years a new company may make loses in order to compete on pricing. If the competition comes from a foreign company then the government has several options.

a) It can close the borders to foreign imports of the goods which the new company produces and make all national users use the product of the new company.

b) It can introduce quotas or import licenses so the imports are only permitted when the internal company states it has sold its own production and cannot meet all demand.

c) It can impose import duties which raise the price of imported goods either above the internal price or which increase the imported price by a fixed percentage so as to allow a margain of protection.

d) It can either subsidise the new company so as to keep its prices down or it can allow subsidies or rebates to companies buying the new companies products.

These and many other methods or indeed sometimes combinations of these methods are all used and the relative methods are not debated but what is strongly advocated is:

(1) Government must provide protection by some means to its embryo industries.

(2) This support must be clearly understood from the outset to be finite and of specific duration and must eventually cease.

Only by the first point will a company emerge and survive in the kind of time span which is desired only by the second will companies become truly efficient and competitive on a world basis. These statements are not intended to conflict with any national policy which is

another thing altogether but apertain only to the subject of establishing national industries which will be equal and competitive on a world wide basis.

Provide capital

Even if a business possibility is seen to be sound and the systems outlined in this previous section are in being it may still be difficult for an organization to find or raise the capital to promote the venture, especially if funds are limited and other investments in higher return and less risk business is available. In a fully industrialised country with active finance markets and a fully developed commercial system the government of the country can sit back and allow the normal financial systems to operate. In that case only financially sound promotions or those which can present a very attractive prospectus to the market will succed and others will not. However a developing country cannot afford to waste any vigour, enterpunerial flair, or sound proposals which it may generate. In many cases it may be that the money is not available from private commercial sources no matter how sound or attractive the proposals. In other cases the cost of borrowing on the open market may be too expensive. Whatever the reason the government must provide a means to overcome the problem and release the potential available to the country. This can be in the form of cheap, long or short term loans, direct grants, albeit with certain provisions, tax relief or rebates, employment subsidies or direct government support and participation. The ways are

many and again this topic is a whole debating point in itself. The point to be made is:

a) *It is necessary to do something*

b) *It again must be a one shot or finite duration type of assistance (direct participation in equity excepted) so that the company does not have an everlasting prop against inefficiency.*

Foreign Financing

This point is perhaps part of the last subject and in any case is directly connected to it but with a different emphasis.

Invariably the cost of foreign exchange arises as a country converts to heavy industry. This is because the machines, machine tools and equipment and the technology must all be obtained at least at first, from the other developed countries, and these countries in turn are usually the ones with strong international currencies. Some under developed or developing countries have no exchange problems but the great majority do and therefore however much finance may be available to an aspiring company within its own country, arrangements must be available to provide a supply of foreign money for purchases outside the country. In some cases this is forthcoming through the direct financing by foreign companies in an enterprise when the foreign company is wishing to

invest in the developing country. In other cases it forms part of a total package where the foreign company is arranging a turnkey contract, but inevitably, in most cases, it has to be found by other means. This is especially true where the government decrees non-participation or low participation of foreign companies in its national enterprises. In these cases the usual thing is to arrange for long term foreign loans from the international banking organisations. Again the subject now becomes a complex and wide issue which cannot be debated further in this paper but the World Bank, IFC the IMF and the Asian Development Bank are amongst the leading international organisations which provide funds for this purpose, as well as the large International Commercial Banks.

The point at issue however is that usually it is only Governments which can provide the required collatoral to raise large loans from these sources, and so again active government participation in its country's development programme is essential.

Technology

It is recommended that a developing country recognizes that it will be necessary to import technology from an existing source. It is just not possible to establish a large competitive industry without enlisting the assistance of experienced technologists in the products and the manufacturing techniques involved. No amount of technical literature or of "book learning" will replace the practical experience which comes from

the actual involment in the building and selling of industrial products, and it is not possible to sell equipment with technology from 10 or 20 years ago when the latest technologies are available. There are notable exceptions to this, but as a general rule this statement is true. Even if it was possible to go through all the development phases of manufacture which a product has previously pursued elsewhere, there is no point in a country trying to repeat the development curve of a particular product and so follow the path which others have already trodden, and learn by all the old mistakes, when the latest methods of manufacture has been determined. It is better, quicker and eventually cheaper to obtain the essential technology from a proven operator in the field. This is not to suggest that a developing country cannot match existing producers indeed there are clear examples where the pupil has outstripped the tutor but it is better to build on the work done by others than to try to do it all again. Innovations and original work can then be tried on a solid basis.

It is equally recommended that whilst a country tries to ensure that it gets a good start by importing a technology which is modern and advanced, that it does not try leap forward to the very forefront of a technology, if that technology has not already been tried and proved. Try to be up at the front, but don't try to be in the van; let the experimenting and development be done by others more able to sustain the disapointment of a failure of a new technique. Later when the new industry is fully established and has financial resources and a good repu-

tation behind it, then it can experiment with innovatory processes, but not just as it is establishing itself.

License or Partnership

The next question is by what means should the technology be acquired", licensing or partnership?. There is no doubt that there are some techniques which are best obtained by license agreement . All that is required is a right to use a propretary process, its agreement , description, drawings and perhaps some direct instructions.

This is especially true of simple but proprietary processes where it is mainly the permission to use or sell the knowledge which is at issue.

For the majority of the major developments however it is strongly recommended that a full and substantial participation of the technical partner is required.

With only a license agreement the technology supplier has no real obligation to see that a venture is sucessful. He issues his license and waits to collect his royalties. He wants the business to succeed of course. The more successful the license the greater the royalties, whereas if a license was to be unsuccessful the licensor will

earn no royalties, may acquired a bad reflection because of his association with a bad partner, and will have to extracate himself and start again. But usually licenses are issued for areas where the technology supplier has little or no direct sales and has no firm plans for direct participation and so it represents an option to extend his sales at little cost, and all that is at risk is his reputation in an area where be has previously done little trade. The main risk and financial outlay is with the licencee and often the support he gets is minumal, although it must be repeated as stated earier that this is more often the fault of the licencesee.

If however the technology supplier has a direct and meaningful investment in the company producing his goods; if he shares in the profit and sustains the loses, if he has invested hard cash and he is going to lose it if the company winds up, then he is going to have a real incentive to ensure that all goes well. For this reason it is prefered that technology transfer is achieved through partnership rather than by license.

A note of additional caution on those points however,

(1) The developing country must ensure that it has good knowledgable, national partners to ensure the business is conducted in the best interest of the developing country;

(2) The investment of the foreign partner must be a real one not an artificialone which really costs him little or nothing (For example a foreign partner may "invest" $15 000,000, in a

joint venture but, after charging $ 5 000,000 for technology transfer, $ 5 000,000 for training and education. $ 5,000,000 for the selection installation and commisioning of machinery, and then perhaps making a profit of a further $ 5,000,000 on the sale of propiatary machinery, jigs, fixtures, his actual cost outlay may be little or nothing). This example may be even further embelished if some of the investment is in the form of long term loans and financing (with interest charges) instead of direct investment.

It must not be impunged by this that all technology partners are not wholly sincere or that all the intrigue is one sided.

Training

This heading covers two distinct and separate but connected aspects.

First there is a general programme of training and education of both the young people of the country for the future, and the additional training of the existing generation of people already in the industrial sector who will have to learn control and master the technologies of the new process.

Second there is the specific training of the selected people who will be educated by and at the works of the technology partners so as to form the nucleus of knowledgable people in the new plants for the transfer of

the specific technology. Again training is a subject for a whole separate presentation so this is only a brief reference to stress that this is an essential element in the process of industrialization and development. Indeed it is considered the most important aspect of them all. It is wholly on the training and trainability of the nationals of any country that the success or failure of that country's future hinges. All the rest may be important but nevertheless superficial. The veneer of material acomplishment may or may not be transitory but it is the quality of the people which represents the true wealth and potential of the nation. The rest may come and go but it is the inherent capabilities of the people which will mark the true success of the country.

The time interval

Finally it must be accepted that no matter how great the urge or desire or even the energy of the country, or the people involved, the transition from underdeveloped to fully developed condition takes time. Time to train the people, time to build the plants and install the equipment, time to learn the technique of production and the achievment of quality, time to prove the products and to ensure they will meet the performance required of them, but most of all time to be accepted. All the rest can be hastened to some extent because all to some extent are in the hands of the instegators and promotors of the projects, but acceptance is in the control of the

user and he will not be hurried, he will make his own pace, he will change from his traditional source of supply when he is ready and not before. It is perhaps the hardest thing for a developing nation to accept but it is important that it is recognized; not necessarily acceded to, but recognized otherwise discouragement will replace enthusiasm and that must not happen.

CONCLUSION

The conclusions presented by this paper are, that for any government which wishes to develop its economy and be numbered in the ranks of the developed countries, a defined policy of development must be declared and backed by measures which will stimulate the actions to fulfull that policy.

That that policy fully recognises the important role of the capital goods industry in both the technological and the economic advancement of the country. That the policy recognises in turn that a successful capital goods industry must be supported by sound foundation of a heavy mechanical electrical engineering industry, and that, except perhaps in a country blessed with especially agressive independent entrepuners, the government takes a direct role in initiating the essential basic infrastructure on which that heavy industry will be dependant.

It is also the conclusion of thisreview that, as indicated by the development in the existing industrialised countries, the role of government must be to stimulate as priority the infrastructure base so that the product industries have fertile ground in which to florish. This should be the first priority even though the establishment of the find end product production units must to some extent go hand in hand. Finally some dos and don'ts which may be helpful.

Do *try to interest and involve established business and business men in the country in the proposals to enlist their support and experience. Governments and their agencies can stimulate and propose but they are not expert in business and manufacture or knowledgable in all fields. Involved businessmen - if they are successful - know their fields of operation. So use them, they can provide useful information and avoid costly mistakes.*

Do *use assistance from world organisations such as U.N. etc. but remember that help is usually provided by individuals who must of necessity have a broad background and can not always be hand picked for a specific narrow application. They are able to provide valuable support over the broad industrial field but for detailed work on a particular subject it may still be advisable to seek more specialist help. Therefore.*

Do *not hestitate to use professional consulting services when seeking specialised advice on large, complicated, and costly projects. Their fees may seem high in money terms but often the cost is no more than 1% of the cost of a project and good advice can save ten or twenty times that amount as well as obviate costly mistakes later. Furthermore the costly fee is in itself often a form of guarrantee.*

Since the companies are in business to earn money they must give sound advice to preserve their reputations. They cannot afford to indulge in politics and subversive liasons.

Do *ensure that incentives are truly adequate and stimulating. If the promotion policy is one which gives grants or relieves tax payments it is important to ensure that the proposals are effective in their purpose. Whilst it may seem obvious that too generous a policy will cost more than necessary it is perhaps not so obvious that too frugal a policy can be even more expensive. This is because once a policy is introduced, all companies, whether new or existing will apply for the benefits. If however the policy is not generous enough to encourage companies to take significant steps and make a real contribution to the principle of the policy then a considerable sum may be given in grants without the really meaningful progress desired being achieved. Hence a double disadvantage ensues. First the country is paying for a meaningless policy and second since the country thinks it has a policy it is blind to the fact that it really does not.*

Do not *let politics play too large a part in the actual technical negotiations. The country politicians and leaders should decide the broad policy and guide lines but usually it is better than they*

stay clear of the detailed technical decisions. Often trying to satisfy too many parameters at one time can lead to unsatisfactory results in which no one is pleased or accepts responsibility.

Remember it has been stated that the camel, is a horse, designed by a committee.

Do not be deceived into allowing companies to pretend to set up operations which purport to be manufacturing operations but which are only disguised, protected, import operations. Not only can this cost a country considerable foreign exchange but in certain circumstances be used to prevent the establishment of a true national manufacturing unit. The presence of a workshop, lots of components and a busy assembly operation does not necessarilly mean that the country has a manufacturing operation.

Remember, that by the time a country has errected buildings using national materials and labour, purchased some local machinery, paid for local electricity, fuel, services, local taxes and some local supplies; then paid for local assembly labour, transport charges and interest payments, the "NATIONAL CONTENT" can be as high as 35% and still not a single part of any significance, not a single contribution to the national technology, not a single contribution to national

independence will have made in the country. The foreign importer will still be supplying all the parts of real significance and technological competence, and will still obtaining his full export (import) target and probably at least the same profit as he would have done if the national plant had not been established.

Do not *create national monopolies protected against competition, but also guard against dividing a small market so that the supply companies cannot be viable. This is often a difficult problem especially in the early years of industrialisation. Too small a market may be uneconomic to support more than one company. Each case must be decided individually. In the early years it may be necessary to support only one supplier but this must not be allowed to progress beyond the stage where a competition would also be viable.*

This problem is often overcome by creating companies with a range of products so that even if one product is not sufficient to support on investment on its own the combination of activities is.

Do not *create an enviroment there companies can only exist with national patronage. Whilst it has been emphasised that support*

assistance, and even protection may be necessary to help establish new companies and industries, this should be discontinued as soon as possible. The only successful companies are those who, after initial establishment, can survive in a free competitive world market . The only way to prove that a company can do this is to let it exist in a totally free market situation.

The list can continue of course, but it is hoped that this outline and the experience of Mexico will provide a useful and living example of (a successful approach to) the industrialisation of important nation.

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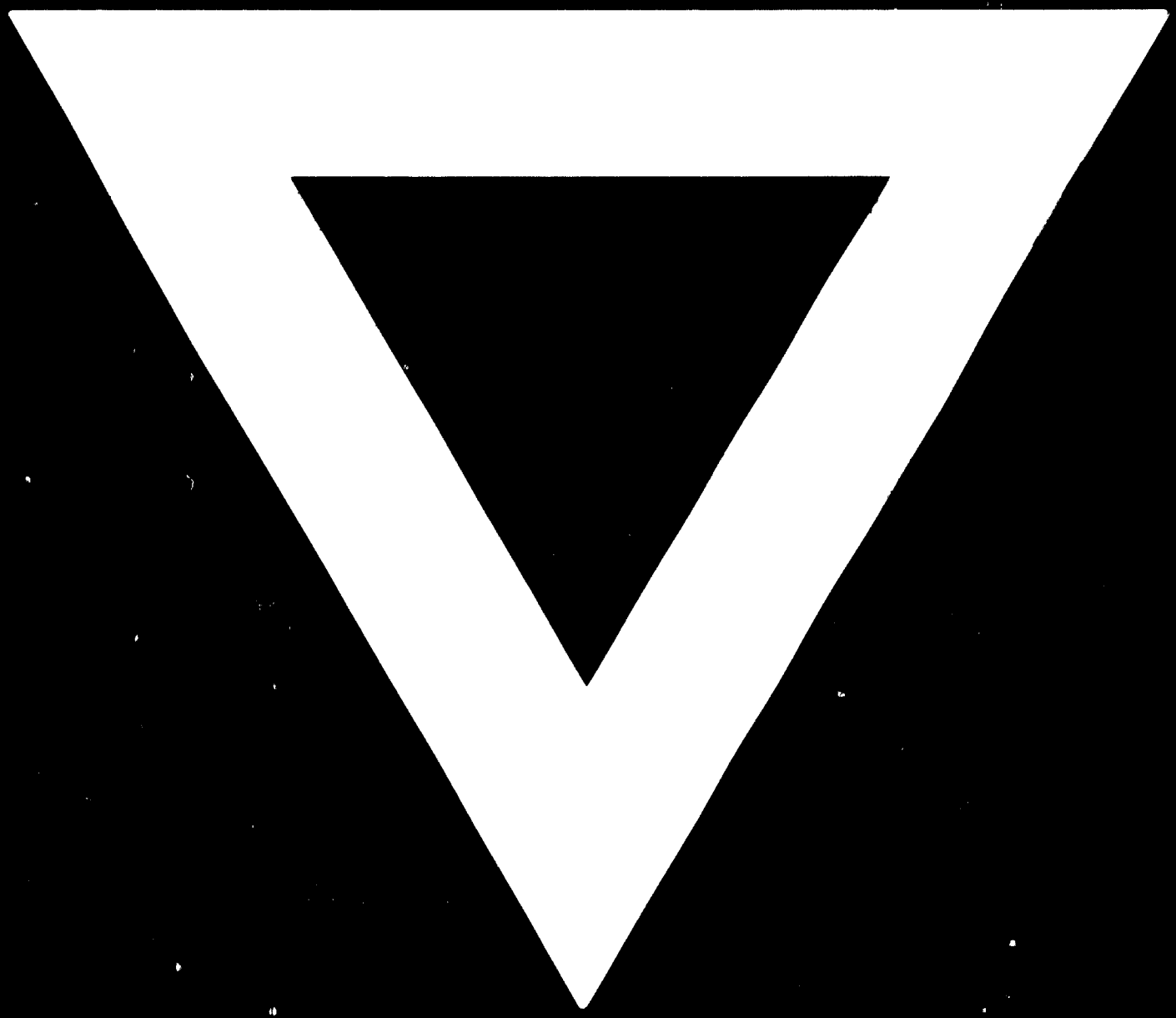

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