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Seminar on the Establishment and Development of the Automotive Industry in Developing Countries

Karlovy Vary, CSSR, 24 February - 14 March 1969

DRAFT REPORT

2nd Part

[illegible]

[illegible]

[illegible]

(a) [illegible]

(b) [illegible]

(c) [illegible]

[illegible]

[illegible]

[illegible] the development of the motor industry in [illegible] the main problem has been one of achieving [illegible] which bear comparison with [illegible] countries [illegible] It is also generally accepted that [illegible] difficulty [illegible] full utilization of [illegible] equipment [illegible] record is one of [illegible] areas. [illegible] developing countries have shown that motor vehicles can be built in [illegible] environment and [illegible] degrees of manufacturing integration [illegible].

Without detracting from the achievements of local nationals, which is [illegible] worthy of the highest praise, the manufacturing know-how in laying down plants, providing and installing equipment, machines and tools, has come from developed countries and under the supervision of their personnel. It is reasonable to question to what extent the problems of poor product quality and high manufacturing cost could be anticipated by the corporations responsible for the training, [illegible].

Two reasons are generally put forward in explanation of the disparity between the performance of developed countries and the performance in developing countries. One assumes that the reason is inherent in the technological "gap". The other assumes that the reason is inherent in the economics of scale and that production costs at low volumes are unavoidably high. Some truth may reside in both reasons but it is doubtful that these reasons can be regarded as more than a superficial explanation. The developing countries are not called upon to develop the technologies of motor car or for that matter to engineer a motor car in competition with the developed countries. In the matter of production cost, Ford in England, in the years before the war, marketed an excellent car at exactly £ 100 and this was long before the advent of highly automated machinery and was at relatively low volume.

In seeking to find fuller explanation, an analysis of technology in its widest sense may be constructively helpful.

[illegible] Research

Pure science, the pursuit of knowledge for its own sake, is perhaps more international in character than any other human activity. There is a fellowship between scientists and communication that freely overleaps national boundaries. The publications of pure science are freely available. The presence of scientific research institutions in a country is a matter of national pride. Nonetheless there is a greater awareness of scientific development where communication by social propinquity is most commonplace. It is difficult to see how a paucity of resource in these respects is contributory to poor quality and high cost.

Applied Research

Much the same comments can be made of the work of applied research. Perhaps propinquity plays a more important part in communication and hastens the work of production development; its effect on current production, however, is negligible.

Production Research

Even where applied research has been able to show opportunities for production application of new materials, new processes and techniques, usually much work remains to be done (and sometimes very expensive experimentation, before production problems have been overcome. Most of the principal firms in the motor industry are very active in this regard. Again, very few developing countries are concerned with this kind of development work. Their concern is the development of their industry on the basis of well tried and proven methods. Where the production development work is the concern of the machine tool trade or the manufacturers of production equipment, the products of success become available on the world markets. Not all of this work is concerned exclusively with high volume production. Many machines are now available which have been designed for greater versatility and batch production methods. It is probable that

there is scope for production research aimed at quality production and high quality at low volumes. It is conceivable that there is in this a potential competitive advantage for developing countries with relatively low labour costs over developed countries where there are high labour costs and sometimes a shortage of manpower.

Product Engineering

The sophistication of modern product engineering in the motor industry, as reflected as it is in the total management organizational structure, is reasonably complex. At the same time it is completely under corporate management control. (Mr. Hooven's paper on systems engineering is an insight into the planning and control of creative effort.) This aspect of product engineering is concerned with future development. Two techniques are used which are concerned with product quality and the cost of current production. One is known as "Value Engineering" and the other as "Method Engineering". They are neither sophisticated nor technically difficult. Fundamentally, they are the application of common sense to a known problem. Both are within the capability of reasonably well trained technicians in a developing country.

Manufacturing Engineering, Plant Engineering, Quality Control, Production Planning and Control, Production Part Purchasing, Time Phasing, Cost Accounting

This is where the broad back of middle management lies. These are the men who plan and install the facilities of manufacture and who have the responsibility for providing facilities which production supervision and labour can use in the production of a quality product at the right price. It is manufacturing engineers who identify the manufacturing process, design the tools, specify machines and facilities, measure minimum cost of production and material usage, specify and determine material handling arrangements, identify manufacturing capacities. It is quality engineers who interpret product specifications in terms of quality, identify quality in the manufacturing process and control quality at the end of the line. It is production planning and control personnel who quantify the production schedule in terms of material and production parts, control inventories, minimise

[illegible] It is [illegible] engineers who ensure good maintenance of [illegible] production equipment. It is [illegible] personnel who develop [illegible] and now install [illegible] quality development and effective control over [illegible] overall programme. Cost accountants who measure costs and report cost [illegible] continuing basis.

It is undoubtedly in this region of technology that the greatest [illegible] developing country is to be found. But this is not the technology of steam-hammers but the down-right business of making how things are made on the shop floor, of doing things in the right way and sequence, of working as a team. This is the direct line of industry. In the language of management technique, it is "procedures of working", "systems of reporting", "the delegation of authority and identification of personal responsibility", "commitments to performance" and "the appraisal of performance against commitment". Traditionally the background of those men has been the apprenticeship and technical college. Only recently has there been an influx of men from universities.

The Skilled Trades

The skilled trades of industry, particularly in tool making and pattern making and those trades which develop maintenance engineers in every field of activity, have their roots in a long tradition of craftsmanship which goes back to the middle ages. The idea that craftsmanship has been lost in an age of machines is erroneous. The craftsmen of the past is today in the skilled grades of industry and in the ranks of junior and middle management. The machinery of industry by which production schedules of more than 1,000 vehicles a day are maintained year in and year out are the triumph of craftsmanship and middle management.

Production Skills and Production Skills

Some forms of production work require special skills for which appropriate training and examination tests are necessary. Body painting, some machine operations, torch soldering of bodies and metal finishing, panel beating, are examples. The majority of production operations can be learned

...readily and no great difficulty has been experienced by developing ... in these respects. Natural leaders can always be found who, ... some training, fulfil the responsibilities of shop floor supervision.

... know-how

It has been said that we live in an epoch of managerial revolution. ... control of industrial enterprises requiring capital investments in ... excess of one milliard dollars and which in Ford and General Motors are ... of enormous magnitude can only be effected through a management organi... in which there is a continuity of control from policy decision to ... floor supervision. An organization which is sensitive to every level ... variations in product cost, product quality and product acceptance in ... market, as they happen, before they happen and in the effect of corrective ... effort as it is applied. This has become as much a discipline and a technology as any other part of the productive effort.

Organization

With this understanding, the "technological gap" between the developed countries and the developing countries, can be seen to be in "business know-how", "middle management expertise", "the skilled trades".

This is perhaps a different understanding to that of "technology" as a great mystery to which only the developed countries have the key. It is not the business of a developing country to design and develop new products involving new techniques and new materials in competition with Ford and General Motors, which, by their excellence, will achieve a half percent penetration into their market.

This section begins with asking for a fuller explanation for the reasons behind high cost and poor quality in the vehicle products of developing countries. Perhaps we begin to understand, but further analysis into cost implications and the economics of scale is necessary.

Suggested subjects for Seminar Discussion

(a) The work of the International Labour Office in apprentice training, technical schooling, management training

(b) Reprocessing of production operations to suit available equipment and volume levels.

(c) Technical assistance and education in know-how for small businesses

(d) The control of product quality in developing countries

(e) The deployment of experts from developed countries and the overseas training of developing country nationals.

5. [illegible]

[illegible] problems of developing country in the [illegible] particularly at low volumes of production, [illegible] which arise in short runs:

(a) [illegible] cost to [illegible] is an acceptable objective for cost performance in developing countries;

(b) prevailing high cost in developing countries is unavoidable in consequence of basic cost parameters peculiar to a developing economy; (does not these parameters vary)

(c) prevailing high cost is the consequence of transition and development in manufacturing economy; (and in what way the transition can be expedited)

(d) there is an inter-relationship between cost, quality and capacity utilization.

It will also be helpful to examine some specific examples of total cost performance to discover the relationship between manufacturing cost and other costs.

In Europe in particular a transition period in the latter part of the 19th century into the industrialized years of industrial recovery up to the present day. During this period there has been an almost continuous improvement and development of process design, manufacturing methods and product machinery. During this period also, there has been constantly rising schedules of production. In consequence there was a total change in organization and cost control systems.

In the 1930s, and in the years immediately following the war, production processes involved a large amount of hand work and production volumes were relatively low. Production figures of 30 per day for specific vehicle types were by no means uncommon.

The following description of the manufacturing processes for motor vehicles at high and low volumes of production, illustrates this difference.

[illegible]

(1) Cut blank to shape and rough pierce window opening - one tool for each operation - single action press

(2) Draw panel contours (one tool) - double action press

(3) Pierce window opening - single action press

(4) Finish outer door panel - manual operation and hand bend now

(5) Finish inner door panel, drill tool holes - manual operation on hammer form

(6) Hand finish door panel at assembly - manual dressing operation.

Speed of press operations - approx. 200 per hour.

Door panel design has changed very little in principle since that time. The metal cutting operation, however, has changed completely, eliminating all manual operations. The sequence is as follows:

[illegible]

(1) Blank and rough pierce window opening from coil stock - blanking press coupled to sheet uncoiler and levelling rolls

(2) Form panel contours - double action press

(3) Trim panel and finish pierce window opening, pierce handle holes - single action press

(4) Finish form door flange - single action press.

Inherent capacity of automated press line - 900 pieces per hour.

The presses and tooling of the former method were simple and relatively inexpensive. Frequently the presses were of considerable age and "written off" as assets.

The modern requirement is for presses of much higher tonnage and press cycle time. The presses are more accurately built and more elaborate in their control mechanisms. They are very much more costly.

The complete line of presses and the uncoiling machine are linked together with interlocking and automatic handling devices. Tooling is more robust and designed to facilitate the mechanical transfer of panels from

[illegible] to another. In some instances the inner and outer door panels are run simultaneously down adjacent lines of presses and come together at the start of an automated assembly line at the end of which the door panels are [illegible] clinched and welded together.

The total cost in presses, automated equipment, press tooling, is extremely high, but the labour content is very low. Apart from labour saving and conservation of manufacturing space, there is a marked improvement in panel quality and a consequent saving in the labour of body metal finishing.

Whereas idle machine time in the older method made relatively small additions to manufacturing cost, idle machine time in modern equipment is ruinous. Total press shop utilization figures in the order of 80 per cent are essential if planned vehicle cost is to be achieved. The assurance of meeting these objectives (which are commitments on the part of the management personnel concerned) is, adequacy in the skilled trades, tool designers, process engineers, material handling engineers, production planning and control personnel, maintenance engineers, plant engineers, and an assurance of good quality raw material in sheet steel.

Manufacturing cost justification for high capital cost is implicit in:

(1) Labour saving
(2) Conservation of manufacturing space
(3) Savings in material handling cost
(4) Material savings in the use of cooled steel
(5) Inventory savings and savings in storage space
(6) Cost savings inherent in good quality.

This list of saving looks impressive but it must be remembered that capital cost is very high and economy is dependent on a high level of capacity utilization. At the lower level of labour cost which prevails in developing countries, the margin of profitability could well disappear in favour of simpler forms of productive effort.

One cannot over-emphasize the production difficulties associated with this kind of production equipment. It is, however, in this respect where the larger and more efficient corporations, as much as anywhere, gain a cost advantage in a highly competitive industry.

The substance of this review of high and low volume production methods in sheet metal body panels, applies also to most other production processes in the industry. Engine block manufacture by high volume production methods requires an investment in the order of 10 million dollars. The production capacity inherent in this equipment is in the order of 150 blocks per hour. Actual production count on an all-day basis rarely exceeded 80 per hour until recently. Using the same basic equipment but providing important changes in layout which break up the sequence of automation and allow small banks of blocks to accumulate between important sections of machining operations, all-day production achievements have been recorded of over 130 per hour. This is an example illustrating the difficulties of achieving planned capacities (on which profitability depends) which is associated with this kind of equipment.

The automated block machine line is as the term implies, a series of machine operations linked together with transfer mechanisms. The machining and the transfer of the block from one operation to another being entirely automatic in action. The control mechanism for transfer, stopping and starting of tool feeds and speeds, cutting coolant supply, gauging operations, tool wear correction, is a complication in which the failure of, for example, a limit switch can stop the complete line of operations. This was the basic reason limiting production capacity achievements to 80 blocks per hour. Simpler block machine tooling relies on an operator controlling the machining processes and the manual handling of blocks between operations. Small banks of stock are held between operations and a high level of capacity utilization is more readily achieved.

The problem of achieving a high level of capacity utilization with simple manufacturing equipment is certainly no more difficult than with highly automated equipment. Increased manufacturing capacity is a matter

[illegible] increments of increase. The next increment of increase in block machining capacity after maximising existing capacity is another block line and a further investment of 30 million dollars. Low volume equipment provisions can be more flexible and utilitarian and increases of capacity achieved at relatively lower cost.

Capacity utilization is also a matter of shift working patterns, scheduled maintenance and tool change-over planning. The success of the larger and more efficient corporations in developed countries is not merely a matter of manufacturing efficiency. Success in the rapid launching of new vehicles of greater customer appeal robs their competitors of production volume. The effect is to increase their own capacity utilization through increased overtime and shift working patterns with the opposite effect on their competitors. Low capacity utilization whatever the cause is a contribution toward high cost. Supplier shortages of production part or raw material, government delays in the approval of import licences, release of money, not only affect capacity utilization by direct stoppage but also by a dislocation of productive effort in which there is an inertia more easily slowed down than speeded up.

Quality Problems

Inherent in the design and specification of high volume production equipment is a high level of quality performance potential. Machines which have been designed for fast, continuous production must be fundamentally robust and consistent in their performance. In the nature of things, however, a quality fault developing during the course of production soon proliferates. Quality control equipment which permits of quick and readily made quality assessments are essential. This equipment is expensive and adds significantly to total cost.

In new model development and launching, changes in product design and specification are inevitable. There is considerable cost increase in changes to tools and machines well advanced in construction which are made even more costly in consequence of changes necessary also to the automation equipment and associated machinery.

The problem of quality performance in the [illegible] facilities made were in the [illegible] of the country and in direct contribution [illegible] provement in supervision and production operations. [illegible] quality in any circumstance is the result of good, [illegible] process, efficient, good tools, good trained men, effective management control of the production operation.

Cost Comparison Studies

"Automotive Industries in Developing Countries", a document issued by the International Bank for Reconstruction and Development, [illegible] Development Association, reviews and analyses [illegible] developing countries in section 7 "Cost Comparisons" (see pages 25 to 31).

At the beginning of this section, four questions were posed in search of a better understanding of the difficulties in the way of lower cost performance in developing countries. The first question asks to what extent the production costs in the developed countries are an acceptable objective for developing countries.

Production cost in developed countries is not at an irreducible minimum. There is a constant drive by management toward lower production costs which can be seen in the employment of cost clinics, mainly cost meetings, specific cost reviews, material [illegible] weight reduction [illegible] pieces; value engineering and methods engineering; material substitution cost analyses in powdered metal techniques, plastic moulding and die castings. The production part supplier is under constant pressure to reduce costs. There are employee participation schemes with suggestion bonuses paid to employees for successful cost reduction proposals. Cost consciousness is an essential attribute of management at all levels. New model design and planning has as its primary objective, a better vehicle at lower cost.

Certainly cost performance as exemplified by developed countries is a keen objective [illegible] developing countries. But there is no direct evidence which shows that the same effort made with same skill in a developing country would not have comparable effect. From a standpoint of the

[illegible] cost, lower production volume demand and an acceptance (not [illegible] desirable, but currently prevailing) of lower standards of working conditions and fringe benefits, there is certainly the [illegible] cost should not in fact be lower than cost in developed countries.

While there are good grounds for believing that the current high level of cost in developing countries could be substantially reduced, the problems are very real and the difficulty lies in every aspect of motor car life. The degree of effort which must be made is that which could be expected of a developed country. It is therefore reasonable to identify high manufacturing cost with the transitional development of know-how in developing countries.

It has also been shown and it is an understanding of experience that cost, quality and capacity utilisation achievement are interrelated. No problem of cost, quality or capacity utilisation is solved in principle by additional expense in new machines. New machines will bring other problems of cost, quality and capacity utilisation. There may be other justification for new machines, unsuitability of the production process, for example, but the cost-quality comparison study must be made on the basis of optimum performance of the existing equipment and method.

The early stages of motor industry development are deceptively easy. There is no great difficulty in facilitating and launching a small assembly plant but further integration of manufacture in circumstances in which the developing country has to discover for itself the necessary know-how, is the starting point of high cost. Assurance of low cost begins with technical schooling, apprenticeship training, management training, and planning which makes the best use of know-how available in developed countries.

4. Areas suitable for Regional Discussion

(a) The relationship between manufacturing cost and other cost

(b) The effect of scale of volume on production cost

(c) The relationship between cost, quality and capacity utilization

(d) Cost accounting for developing countries.

Section 6. Training Requirements

All historical evidence points to the progress of the development of a motor industry in a developing country as being invariably one of continually increasing production cost. There are many indications that the major cause lies in an inadequacy in manufacturing and business know-how. Low labour production facilities are inevitably associated with a high labour content. Generally speaking, this is not an objectionable feature in itself. High manufacturing cost, however, is never acceptable. There may be national reasons for economy which set a limit on what can be invested in support of vehicle manufacture. It may be necessary to ration vehicle distribution. The term "high cost" implies high in relation to what cost. For the national planner the implication must be, high in relation to planned cost. The development of a motor industry unavoidably involves the training of people in a wide variety of industrial practices. It involves education, training in skills, and learning the disciplines of industry.

A programme of development which has as its objective, a high level of manufacturing integration must include also, training and educational arrangements for industrial personnel. But it must also be remembered that while training and education are essential, know-how is the attribute of practical experience. Considered in this larger sense, training and know-how arise from three sources:

(a) Technical schools, training establishments, universities

(b) The example and influence of foreign nationals from overseas affiliates

(c) Practical experience (on-the-job training).

The problem of wastage is very difficult to assess. Of 100 men taken into technical schools and training establishments specifically for the motor industry, as few as 10 may remain after 2 years. The wastage being due to many different reasons. On the other hand, there will be a supplement of men trained for other industries. The yield in men able to accept the responsibility of junior management, technical authority, and in

designers and skilled tradesmen of first class ability, is lower still.

The direct contribution that can be made by foreign nationals from overseas affiliates both in physical progress and in personnel development is of the utmost importance. The contribution can be made not only to the vehicle manufacturer, but also to the parts and material industry. The relationship which is established between the overseas affiliate and the developing country has a significant effect on what contribution is made by overseas personnel. In paragraphs 42 to 44 of the paper "Automotive Industries in Developing Countries" issued by the International Bank for Reconstruction and Development entitled "Ownership and Control of Overseas Affiliates", this aspect of co-operation is discussed.

On-the-job training can be a training in bad habits and unprofitable methods perhaps more easily than it can be training in good practice. Where men are without training, guidance or example, they often employ great ingenuity in overcoming their immediate difficulties, but not always wisely in the light of problems that follow. A circumstance may develop in which men take up a "position" and a defensive attitude. Even where men have had good training, the same circumstance will arise. It cannot be expected that these problems will solve themselves and the written or spoken word is often ineffective. What is needed is example and a new approach.

Experience has shown that protracted overseas training for developing country nationals is often unsettling and that on return a man finds difficulty in accepting his circumstance. But short periods of overseas training, with specific objectives which relate to actual problems discovered in exercising their responsibilities will tend to keep progress fluid and avoid the inertia of the defensive attitude. Forward planning should provide for both the time and cost of an exchange of personnel on a long term basis.

The paper submitted by the International Labour Office gives a comprehensive review of its activities. From the standpoint of the report of this Seminar being a Manual of Instruction to National planners, more factual information would be helpful. The demand for the motor industry is for

apprenticeship training centres, properly facilitised. There is a need for training in manufacturing engineering, plantengineering, quality control, production planning and control, and cost accounting. The location of training must be within the country and as diversified in location as the centres of industry demand. A developing country planner needs to know what cost is involved and what substance in cost is available. What buildings are required, the periods of training, the numbers of students in training and the annual quotas of trained men by specific examples. Perhaps above all, he needs to know what trained help in teaching staff is available.

Finally, there should be a specific recommendation for all trades, the technicians of all manufacturing staff personnel and all levels of junior management.

The Place in Industry for University Students

The following news item appeared in the London "Daily Telegraph", 15 January 1969.

> "The Ford Motor Company plans to recruit 260 university graduates this year. 160 more than in 1968, and expects to interview more than 2,000 students during the next three months."

One may be sure that in Germany also where there is a comparable Ford plant, there will be similar recruiting programmes. In U.S.A. it has been the practice for many years for major corporations to take in each year large numbers of university graduates. They will invade every aspect of manufacturing life.

"Automotive Industries in Developing Countries", issued by the International Bank for Reconstruction and Development, comments as follows: page 23, paragraph 53,

> "Volkswagen was especially outspoken on the shortage of such people ('Fachleute'), complaining that engineers from developing countries often lacked the necessary practical experience to take over plant responsibilities and are often unwilling to soil their hands in factory operations. Typically, there was an inadequate supply of the 20 to 30 middle-range managers, technical supervisors, and master mechanics necessary to set up initial procedures and improvise or make adjustments when things went wrong, especially during the first years of plant run-in."

The laboratory of industry is the shop floor and the office of manufacturing management and technical authority. In the developed countries the key that has opened the door of industry to university talents is the system of delegated authority and personal responsibility, the discipline of procedures or working and systems of reporting, approvals which are given on the basis of commitments made and appraisal of performance with regard to commitment. This in developed countries has become also the discipline of cost control and cost reduction. It is a truism that one never knows what a man's capabilities are until he has been challenged.

Pilot Plant Facilities

During the 1920s and 30s in the developed countries, the motor industry tended toward a large degree of autarky among vehicle manufacturers. Ford in particular aspired to almost complete self-sufficiency. The reason behind this policy was an inadequacy in the part supply industry and in the supply of some raw materials; a circumstance which is paralleled today in developing countries. The 1950s saw a reversal of this policy. The increases in volume demand created a need for additional floor space and additional investment in facilities. At this same time, considerable progress was being made in the development of automated machinery and otherwise improved process equipment. Better understanding of the problems of material handling, the profitability in good plant layout, reduction in inventory holdings and reduced obsolescence, coupled with new impetus in the development of the supply industry, brought about a dispersal of many of the manufacturing processes which had previously been considered "captive" to vehicle manufacture. The tooling, equipment, manufacturing standards, inspection equipment and quality control specifications were handed over to supply industry firms. The cost effect of these trans was favourable to the vehicle manufacturer. Additional manufacturing space gained in this way could be offset against the cost of new buildings and the opening of new plants. In any case, fixed overheads of vehicle manufacture tend to be higher than those of small firms manufacturing relatively simple parts and assemblies in buildings with less head room

and simpler construction. At that time, labour rates tended to be lower in the supply industry than in vehicle manufacture. In consequence of all factors, the negotiated agreement often achieved lower than "captive" cost to the vehicle maker.

Where new and changed product designs were contemplated, pilot facilities were frequently set up by vehicle manufacturers. Having established manufacturing feasibility and cost implications, these facilities also were passed over to supplier firms after the appropriate negotiations were completed.

In the development of opportunity which is in the concept of pilot plant facilities, there is the means of developing a supply industry in which cost and quality standards remain under control. It is to be expected that progress in management competence and the development of manufacturing know-how will move faster in the organisation of the vehicle manufacturer than elsewhere. In the use of pilot facilities, the vehicle manufacturers' organisation can act, as it were, as a catalyst of change for the development of the supply industry.

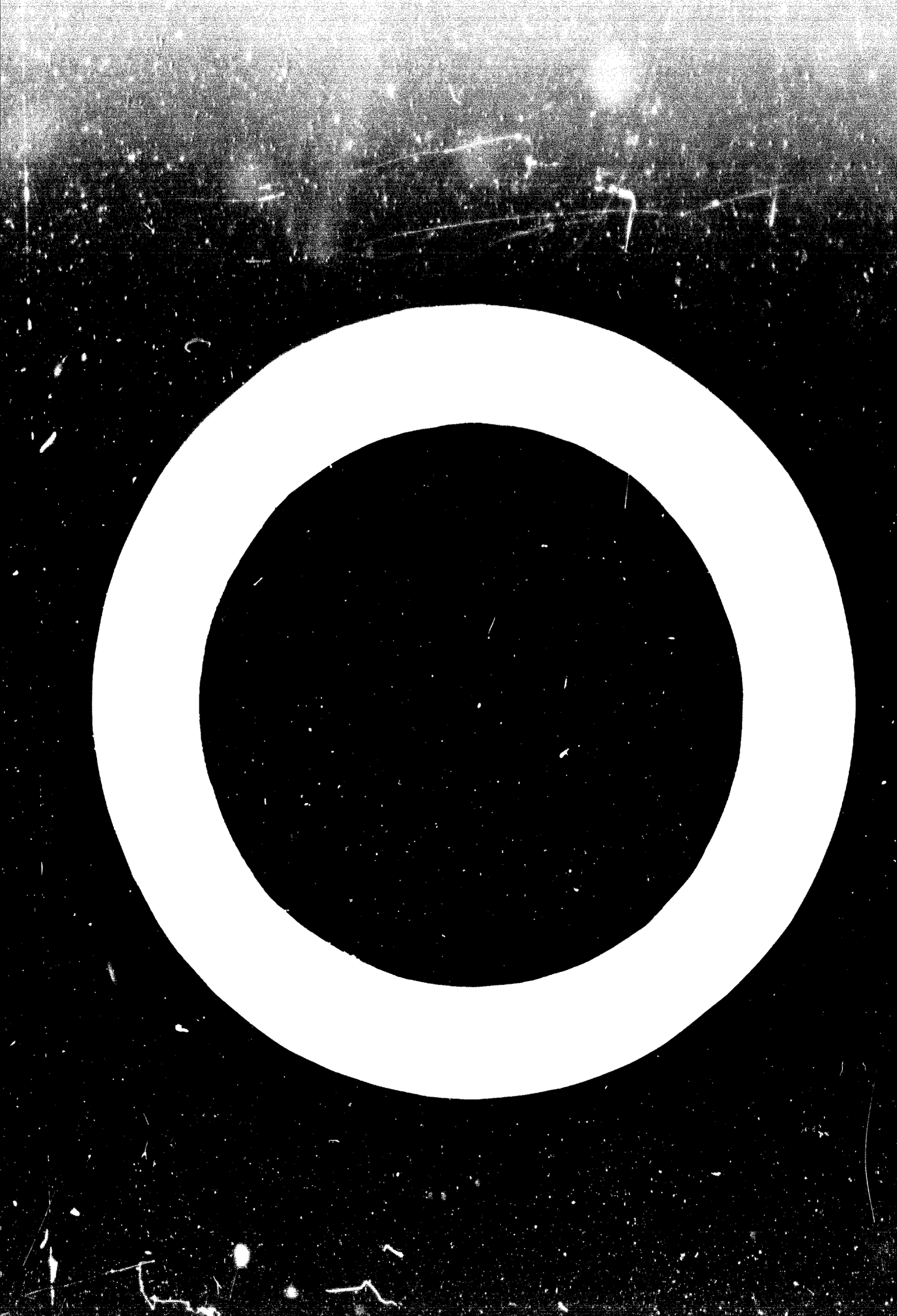
Suggested Subjects for Seminar Discussion

(a) Training facilities in developing countries, apprenticeship training, shorter-term training in craft skills, technical schools, on-the-job training

(b) The university student in the motor industry

(c) The contribution of the international firm

(d) "Pilot facilities" as a means of developing the supplier industry.



Section 7. [illegible]

It must be recognised that the launching of a manufacturing [illegible] is not a speculative [illegible] activity which [illegible] happen. Nothing can happen within the plant [illegible] until [illegible] within the plant which have not [illegible] before [illegible], and however [illegible] Certainly, the [illegible] and experience [illegible]. [illegible] the more fundamentally [illegible] the planning of a new venture, the more difficult the task.

Planning is not an exercise which is done once and then finished with. It should be continuously [illegible] and [illegible] effort. Planning mistakes will inevitably occur. If there is to be [illegible] for every miscalculation, no one will be found willing to make a commitment of resources. Most there can be [illegible] for a failure to [illegible] circumstances where they are not known, and to [illegible] is indefensible.

In [illegible] a manufacturing operation [illegible] country, including method changes made in favour of lower production [illegible] complete information in manufacturing [illegible] should be available. These standards include [illegible] returns, [illegible], maintenance [illegible], capacity assessments, and so on. In many instances, launching planning will be included in the "pre-[illegible]". Some of the difficulties of launching are enumerated as follows:

(1) Tooling, machine and facility tryout

(2) The learning curve of production and manufacturing staff personnel

(3) Material supply problems of quality and delivery

(4) Quality control of in-process manufacturing operations and final appraisals

(5) Cost control

The provision of pre-production training facilities, pre-production tryout of tools, facilities and machines, other educative exercises will minimise production problems occurring subsequent to the start of production.

cost of these anticipatory exercises is substantially less than the cost of pre-production launching problems met with for the first time in full production circumstances. Good anticipation implies a clear understanding of the achievable objectives in cost, capacity and elapsed time.

The launching achievements of the major manufacturers is truly remarkable. Commonly there is a six weeks period of tooling, machine and plant changeover. All that can be done in pre-production tryout and training is done. Full production at near standard cost is achieved in three weeks. Where new plant is involved, the elapsed time is a little longer but is usually measured in weeks rather than months. It will be said that the problems of developing country are of a very different order, as indeed they are. It could be said that the problems of launching a new model involving new product designs and production processes, for suppliers as well as vehicle manufacturer, at production volumes approaching 10,000 per day, is infinitely greater than that of launching a current model at perhaps 30 per day. The example is a challenge and a proof of what can be done with thoughtful planning. Planning of this description is costly in initial expense. The pay-off is in lower production cost.

The capacity of a manufacturing plant is the capacity of the least productive unit of production. Maximum capacity is the production count achieved with the shift-pattern using the greatest number of hours available after scheduled maintenance and plant clean-up have been provided for. But each shift requires its quota of supervision, manufacturing, engineering service, plant service. For each additional shift there must be planned training and development. It is a cost penalty, to be confined to single shift working.

Where there is unbalanced capacity in manufacturing facilities, partial shift working and overtime working can be employed to balance capacity until further rises in production schedules demand additional facilities.

Suggested Subjects for Seminar Discussion

(a) Preproduction training facilities

(b) Production part supply prove out

(c) Material prove out and specification checking.

(d) Preproduction exercises in plant control, reporting systems, cost control, store keeping, in-process storage requirements, materials handling

(e) Tool, machine and plant facility prove out

(f) Trial runs of plant services in fire-fighting and protection, hospital services, canteens

(g) Reviews of machine guarding, operator safety, working conditions, heating and lighting.

Section 8. Personnel Relations

It is intended that this section should be concerned with that aspect of industrial development which is in the relationship between management and employee. It is as vital as any other aspect of industrial development. Little information is available in the papers submitted. Much work must already have been done by the International Labour Office. The reports of the Metal Trades Committee and the resolutions which it has adopted are an indication of the scope of this work. Some discussion with the International Labour Organization authorities seems to be a necessary preliminary to the preparation of recommendations to a national planner in a developing country in regard to this aspect of motor industry planning.

Section 4. Regional Co-operation

An article by Jack Baranson in "Finance and Development" Issue No. 4, 1968, begins by stating some of the difficulties which have stood in the way of effective regional co-operation in Latin America.

> "Even against the potential advantages of common market arrangements, the obstacles to the integration of particular industries are often underestimated. Arguments for integration frequently stress that an enlarged internal market will promote a further expansion of industrial investments. This was the basic intent of the Latin American Free Trade Association (LAFTA), but in the automotive industry, at least, industrialization programs, operating under systems of national protection, already have expanded the production facilities of the LAFTA region to more than ten-fold what would be economically justifiable. And each year new countries enter the industry, adding to an already overdeveloped regional capability. The unhappy reality in the automotive field is that, far from creating market opportunities, the LAFTA agreement confronts member countries with the problem of disposing of excess plant facilities. This fact alone provides a major reason why so little progress has been made thus far in reducing internal trade barriers in the LAFTA region."

This opening paragraph relates the "potential advantages of common market arrangements" with circumstances in which production facilities have already expanded to "more than ten-fold what would be economically justifiable". It should not be assumed however, that the potential advantage lies exclusively in a higher level of volume demand. Paragraph 4 of this report, Technological Problems, and paragraph 5, Cost Implications, suggest that it cannot be demonstrated that excessively high cost is the unavoidable consequence of low volume production. It is also suggested that if comparable effort in cost control were made in developing countries (where lower labour rates prevail and where the high cost of new model levels, writ is avoided), to the effort made in developed countries in controlling cost, the advantage could well be with the developing country.

"Automotive Industries in Developing Countries", issued by the International Bank for Reconstruction and Development, comments as follows:

Introduction, paragraph 5

> "One of the significant insights that emerges from the study is that industrial progress is as much the result of sound economic and commercial policy as it is success in overcoming critical shortages or deficiencies in financial resources, production factors, managerial and engineering skills, and in supplier capabilities. A corollary to this conclusion is that the pattern generally followed by developing economies in establishing their automotive industries bears critical scrutiny."

It also follows as a corollary that the potential advantages of common market arrangements will not be realised if the pattern generally followed by developing economies in establishing their automotive industries is the pattern also in co-operation.

Sound economic and commercial policy is as dependent on the excellence of analysis and fact submission by middle management and technically authoritative personnel as it is on skill in policy making.

With this understanding, the potential advantages that lie in common market arrangements can be said to be:

(a) An opportunity for economy in a concentration of management effort in policy making, middle management administration and technological competence.

(b) An opportunity for better utilization of manufacturing facilities by reductions in the number of manufacturing centres.

(c) Better utilization of available skills in design, manufacturing processing and other manufacturing engineering and plant engineering activities, quality control, etc.

To reap these advantages, there must be a reduction also in the number of differing vehicles of similar specification. A rationalization of models by inherent profitability may be desirable.

The importance of national pride in the location of vehicle manufacture cannot be ignored. Fortuitously, vehicle assembly is not especially sensitive to volume demand. In considering regional co-operation between

perhaps three countries, the provision of three assembly plants is not irrational nor overly destructive of economy potential. Capital investment is highest and the concentration of management effort needed is greatest in: engines, axles, gear boxes, sheet metal and is still high in the other components, suspensions, electrics, brakes, steering, etc. A regional co-operation planning proposal based on shared component manufacture at fixed transfer prices could prove more practicable than common market arrangements where protective tariffs have distorted values and make no provision for the rationalisation of productive capacity and resource in skills.

There is another aspect to diseconomy of scale of a motor industry in a developing country; it is the point of view of an international firm. "Automotive Industries in Developing Countries" comments as follows:

Investment Risks and "Adequate" Earnings. Page 16, paragraph 29

> "International firms become involved in overseas ventures in different forms and with varying degrees of resource commitment. These forms range from licensing arrangements to full ownership and control of an overseas manufacturing affiliate. Resource commitment may range from a few technical experts on a reimbursable fee basis to substantial commitments of financial and other corporate resources. Where resource commitment is involved, the international firm must take into account: (a) the long run prospect for earning a return; (b) the availability of financial and other resources; (c) the relative risk and uncertainty in a particular venture; and (d) alternative opportunities to earn profits. Added risk and uncertainty are weighed against the chance of a quick return and the prospect of being shut out of future market opportunities."

An international firm's potential in the long term prospect for earning a return should be substantially enhanced by a joint venture in which two or more countries are involved. There will be greater justification for a substantial commitment on the part of the international firm which can include not only vehicle and major component manufacture, but also, technical assistance in the development of the parts industry.

International firms respond most readily to planning based on comprehensive sound analysis and appraisal. Here again the combined resources of the planning personnel of two or three countries welded into a single team has the greater potential for good performance.

Suggested Subjects for Seminar Discussion

(a) The general problems of communication and co-operation in regional planning;

(b) The general problem of tariff barriers and other financial difficulties

(c) An international firm's problems in negotiating with different countries in a combined venture.

Section 10. Completion of Motor Industry Planning

The following steps would support the sequence of reviews, proposals and recommendations which would constitute a comprehensive plan for a motor industry in a developing country.

(1) A review of the current status of national plans allied to the motor industry including: existing service, maintenance and repair facilities, road planning, current transport adequacies and inadequacies, major factors influencing forward requirement, special considerations.

(2) Quantification and rationalisation of requirement: currently, during the last five years, and somewhat more speculatively, for the following five years. The quantification would assume a continuance of current trends and known factors.

(3) An analysis of the requirement indicating significant volumes and principle cost items.

(4) A review of the national vehicle park including its age structure with observations on: (a) the effect of current service, maintenance and repair performance on vehicle life; (b) actual achievements in vehicle performance in ton/miles and passenger/miles, making comparisons with standards achieved elsewhere.

(5) A financial review of current circumstance in the motor industry with forward estimates made on the basis of implementation of approved plans. Profit/loss accounting against assumed standards. Actual cost comparisons with approved project commitments.

(6) A review of selling prices having regard to import duties and tax charges.

(7) A review of the national tariff and tax structure and its effect on the development of the motor industry.

(8) A review of current manufacturing and importation agreements with international firms including conflicting interests and avoidable duplications.

(9) A review of inherent motor industry manufacturing capacity and production achievements with estimates of forward trend.

(10) An analysis of current manufacturing cost with particular reference to high cost. A review of cost trends and the factors by which they are conditioned.

These reviews will serve as a background to the presentation of new plant which may include regional co-operation.

(11) A general review of new proposals including expenditure estimates, supplier industry proposals, and plans for regional co-operation.

(12) Details of proposed forward plans for regional co-operation. Statements of specific expenditure and cost implications. Statements of principle advantages and disadvantages. Review of negotiations in hand and anticipations for progress.

(13) Review of the special problems of the co-operating regions. Statements of quantification of vehicle demand for each co-operating region.

(14) A revision of items 3 to 10 inclusive as dictated by the demands of regional co-operation.

(15) An outline of proposed objectives for negotiation with international firms.

(16) Statements and reasons for preferred international firms and products.

(17) A full financial review of forward plans with proposals for international firm financial participation arrangements.

Finally, request approval for:

(a) Regional co-operation proposals.

(b) Tariff and tax revisions in principle.

(c) Proposals for international firm participation.

(d) Selected international firms with alternatives.

(e) Proposed expenditures and financial commitments.

(f) Proposed assignments of responsibility for negotiating with co-operating regions and international firms.

Section 2. [illegible]

The [illegible] are specifically concerned with the [illegible] of civil, the ordinary planning for a motor industry:

(a) "The Use of Old and Re-cultivated Road Transport by the Motor Age, Fort Chester, New York.

(b) "[illegible] Heavy [illegible] Commercial Automotive Equipment" by [illegible] Paton, Vice-President - Fleet Engineering, The Yale and Dixon Lorry, Canada.

Both papers are essentially practical in their approach and exhaustively cover their subject. By reason of their practical value to their inherent circulation, it is recommended that they should be included in the final report as written.

Suggested Subjects for Further Discussion

(a) The inclusion of the papers in the final report as written

(b) Service station distribution in a developing country

(c) Proprietary interests of motor owning licensees in service stations, service parts, accessories

(d) The purchase of second-hand vehicles

Section 11. Review of Development Plans of Participating Countries in Connexion with the Second Development Decade

The items listed in Section 10 will serve also as a check list for this section of Seminar discussion. In reverse, discussion with participants from developing countries may add to or modify the items listed. Further discussion with the participants on the work of the Seminar up to this point should begin to indicate the form which the final report should take and to what extent it will be helpful in achieving the purpose for which the Seminar is being held.

MATERIALS USED IN A MOTOR VEHICLE

Aluminium	Engine parts, transmission parts, spark plugs, castings, trim mouldings
Asbestos	Brake linings, gaskets, sound deadeners
Bauxite	Ore for metal aluminium
Beeswax	Wire insulation, adhesives, lubricant
Bismuth	Hardens lead, tin, steel
Borax	For smelting and special steels
Cadmium	Alloy to harden copper, electroplating, paints
Carbon	Rubber making, paints, electrodes, graphite seals electrical brushes
Cattle	Glue, glycerines, hides, hair for air cleaners
Chemicals	Nylon, synthetic rubber, plastics
Chromite	Ore produced chromium used for plating, alloys
Clay	Sand-binder in foundry, rubber filler, moulding
Coal	Iron and steel making, nylon, solvents, tars, fuel
Cobalt	Steel making
Coconut oil	Paints, lacquers
Copper	Electrical system, radiator, plated parts, alloys
Columbian	Stainless steel
Cork	Gaskets, insulation
Cotton	Wadding, padding, felt, tyres, insulation, thread
Diamonds	Cutting, grinding, drilling metals
Flax seed	Linseed oil for paint
Fluorspar	Flux in iron and steel making
Glass	Windscreen, windows, headlights, spun insulation
Gold	Ornament plating

Hides	Upholstery, belts
Iron ore	Steel, castings for engines and chassis parts
Jute	Fabric, floor coverings
Lead	Batteries, petrol, solder, plating
Lime	Flux in steel making, lubricant in wire making
Limestone	Iron making
Magnesite	Mineral ore of magnesium
Magnesium	Light alloys for engine parts
Manganese	Steel making
Mercury	Mirrors, amalgams with other metals, switches
Mica	Electrical insulators
Mohair	Upholstery, carpets
Molybdenum	Steel alloys, fine wires, grease, paint
Nickel	Alloyed with steel, copper, other metals, plating
Paint	Body and interior finish
Paper	Insulation, gaskets, soundproofing, filters
Petroleum	Petrol, oil, lubricants, synthetics, solvents
Plastics	Body and engine parts, trim, upholstery
Platinum	Alloy for special wire, electric contact points transistors
Rubber	May be natural or synthetic. Tyres, weather-proofing, vibration damping, belts, insulation, hoses, windscreen wipers
Silver	Electrical system, plating, brazing
Sisal	Seat padding
Soya beans	Alkyd paints

[illegible]	Frame, body, wheels, engine parts, gears, springs, hardware
[illegible] cane	Alcohol, cellulose for safety glass, solvent in varnishes
Sulphur	Vulcanising rubber, lubricant additives, steel
Textiles	Upholstery, lining, tyres
Tin	Plating, alloys, solder
Tungsten	Special steel, lamp filaments
Turpentine	Paints
Vanadium	Special steel
Wheat straw	Straw boards, panels
Wood	Cellulose for safety glass, packing cases, paper, fibre board, truck body parts
Wool	Upholstery, carpeting, felt
Zinc	Batteries, alloy for die cast parts, plating
Zirconium	Alloy in steel and copper making, aluminium castings


26. 1. 72

[redacted]

[redacted]

[redacted]

(a) [redacted]

(b) [redacted]

[redacted]

(a) [redacted]

(b) [redacted]

[redacted]

Contrary to the usual vehicle fleet, [illegible] will be conveyable, [illegible] for which there is little risk. The [illegible] manufacturing units [illegible] where [illegible] of investment is highest.

Manufacturing [illegible] can be sold as [illegible] of three categories as listed below. The section of the country to [illegible] category [illegible] there, and, in the case of [illegible] already established [illegible] integration [illegible].

(a) Small [illegible] of limited resources and relatively backward in [illegible], particularly in the industrial field.

(b) Medium to large [illegible] with some established industry

(c) Countries already well advanced in [illegible] development.

[illegible]

(1) The development of good service, maintenance and repair facilities; the education of people in vehicle care and good driving practice

(2) The development of manufacturing facilities for easily made replacement parts

(3) Vehicle assembly plant [illegible]

(4) Manufacture of [illegible] kinds of easily made vehicle parts

(5) Manufacture of vehicle components (engines, axles, gear [illegible], suspension units, etc.)

(6) Full manufacturing integration.

[illegible]

In no other aspect of the motor industry is there greater opportunity for improvement, profitability and quick returns. The benefits of [illegible] in this respect are firstly, conservation of the vehicle fleet and reduction in [illegible] in new vehicles. Secondly, improved performance in transport services and vehicle utilisation. Thirdly, reduction in imports of vehicle parts for replacement in servicing and repair. Fourthly, a widely distributed

...on in the discipline of industry. In the training of men in the ... of sheet metal, body painting, soft trim repairs, lighting, instrument and electrical services, engine and drive line replacements, etc., ... in an introduction to vehicle assembly.

Training programmes for service and maintenance engineers which follow ... pattern of procedure and control set out in Section 2 of this report, ... used by all the principle vehicle manufacturers in their dealer and ... networks. Rationalization in this respect is as important as in ... other.

...

In the development of a replacement parts industry, tyres and batteries ... the list. But each is something of a unique industry and makes little ... contribution directly to vehicle manufacture. A development of manufacture ... in such items as door rubbers and other rubber components is a direct contribution to vehicle manufacture. The glass industry also stands ... and could manufacture door glasses, windshields and lamp glasses. ..., filters, wiring harnesses, ignition cables, are readily manufactured. The next group may include relatively simple machined components ... as water pumps, brake drums, bushings, various springs. More technical and financial help may be required for the third category of parts ... for higher skills, more sophisticated materials and more elaborate ..., including forging and foundry installations to produce valves ... valve train components, pistons and piston rings, steering components, complete brakes, spark plugs, distributors, carburetors, starting motors and generators. This classification furnishes a key to the progress by which a developing country satisfies the demand for automotive components, and a key to the stage through which a developing country advances toward autarky.

Annex

While Stage 1 can be associated with high profitability and reduction in import charges, Stage 2 may reduce import charges, but by [illegible] reduction will result in increased cost as compared with import cost. It may also be the starting point of protective tariffs and [illegible] cancellation. Stage 3 will make no contribution to vehicle cost reduction nor to reduction in foreign currency expenditure, the C.K.D. cost being little different to the finished vehicle cost. It cannot be recommended that Stage 3 is developed other than as a necessary preliminary to further manufacturing integration. However, with the guidance and the co-operation of the licensor or manufacturing affiliate, no particular practical difficulty has been experienced by developing countries in accomplishing this stage of development. The principle manufacturers of Europe and North America have considerable experience in this aspect of manufacture in developing countries.

The selection of vehicle type for manufacturing development is firstly in the broad division between passenger vehicles and commercial vehicles. The choice is too complex to allow of specific recommendation. Volume of demand must be an important moderator of choice. True justification for beginning the development of a motor industry at Stage 3 must be founded on an assurance of potential as is evidenced in other industries. Consideration must be given to available resources in school universities, technical and apprentice training institutions. Stage 3 must be thought of as being a point of no return in the development of a motor industry. For the industry to develop smoothly and at least cost, production schedules must be kept steady between planned increments of increase. Stop-start production in consequence of delay in the release of money and licence approval for imports, is disasterous in its effect on production efficiency and manufacturing cost. Uncertainties in tariff arrangements, the problems of over and under protection, can be equally damaging to industrial development. The negotiated agreement with an overseas affiliate, more than anything, will set the pattern of future development.

[redacted]

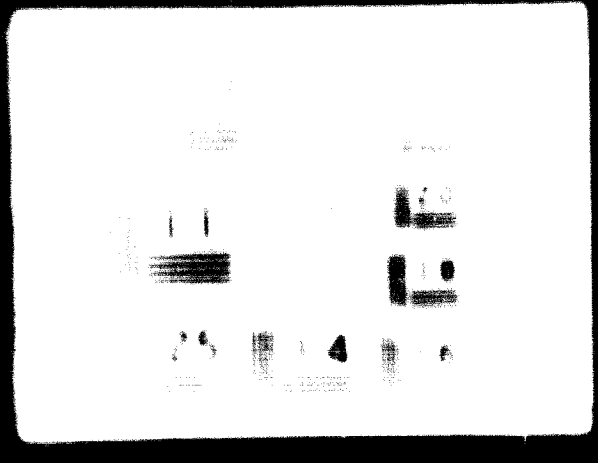
[redacted] that a developing country's readiness in technical management "knowhow" becomes a subject. In the development of [redacted], this readiness is dimensioned by the ability, [redacted] of planning in the earliest [redacted] given. Inherent in the plant [redacted], overall engineering supervision, tooling and facility specification, [redacted] the many other [redacted] and manufacturing control [redacted] which in many [redacted] have meant a major limitation to the [redacted] highly industrialized environment.

[redacted] the responsibility for the manufacture of the first car [redacted] for integration, the developing country's national [redacted] this [redacted] capability for this, some to allow responsibility for generating technical [redacted] and controls which will ensure the production of a quality part [redacted] acceptable prices. At the relatively low volume production schedule [redacted], it will probably be necessary to make simple but important changes [redacted] the product design and to develop entirely new manufacturing processes [redacted] tooling from those used in high production mass [redacted]. It may be [redacted] poor material, unsuitable equipment, poor tool making and [redacted] other difficulties. In this challenge is the opportunity for industrial development and expansion, but the dice are heavily stacked in favour [redacted] poor quality and high cost.

Proliferation over a wide field of manufacturing processes in the manufacture of motor vehicle parts, the accumulation of problems which interact [redacted] one another, can result in great disappointment, substantial losses [redacted] real setback in industrial development.

[redacted]

A study of the observations on "corporate attitudes toward overseas [redacted]", contained in paragraphs 34-44 of the paper "Automotive Industries in Developing Countries" issued by the International Bank for Reconstruction and Development, suggests that the national planner of a developing country would be well advised to be extremely sceptical



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Seminar on the Establishment and Development of the Petrochemical Industry in Developing Countries

Karlovy Vary, CSSR, 24 February - 14 March 1969

DRAFT REPORT

[illegible] recommendations are entirely to be of practical value. Discussion with interested bodies and field work must be the basis of calculation. With this regard we may list some of the underlying factors of specification:

(a) Current circumstances and foreseen trends in basic industries, iron and steel, chemicals and plastics, agriculture, power supply, gas, water, oil, natural resources.

(b) General industry planning - heavy industry, electrical industry, light industry, textiles.

(c) Town planning, urban motorway plans, road planning, development plans for other forms of transport (rail, water, pipe lines).

(d) Miscellaneous transport requirements, postal services, schools, local transport's transport, water sports, military requirements.

Special Vehicles. Buses and trucks are alike in truck vehicles in that engine characteristics, facilities can be provided which will produce a range of engines suitable also to car and tractor motivation. The same engines serve also a wide range of commercial equipment, building equipment, mining equipment, farm machinery, earth moving equipment, road making equipment.

Cars buses, coach, ambulance chassis and many other items of truck vehicle specification are common with the chassis specifications. Bus bodies and truck bodies can be standardised with common facilities. These factors must be considered in establishing rationalisation and will form part of future manufacturing integration planning.

Snow clearing equipment, refrigerator trucks vehicles may be included under special vehicles. It should be noted that trunk vehicles entirely suitable to hard surface roads may be quite unsuitable to dirt surfaces particularly in wet weather.

[redacted]

(a) [redacted] commercial vehicle fleet

(b) Quantification of forward requirement for commercial vehicles

(c) Commercial vehicle priorities


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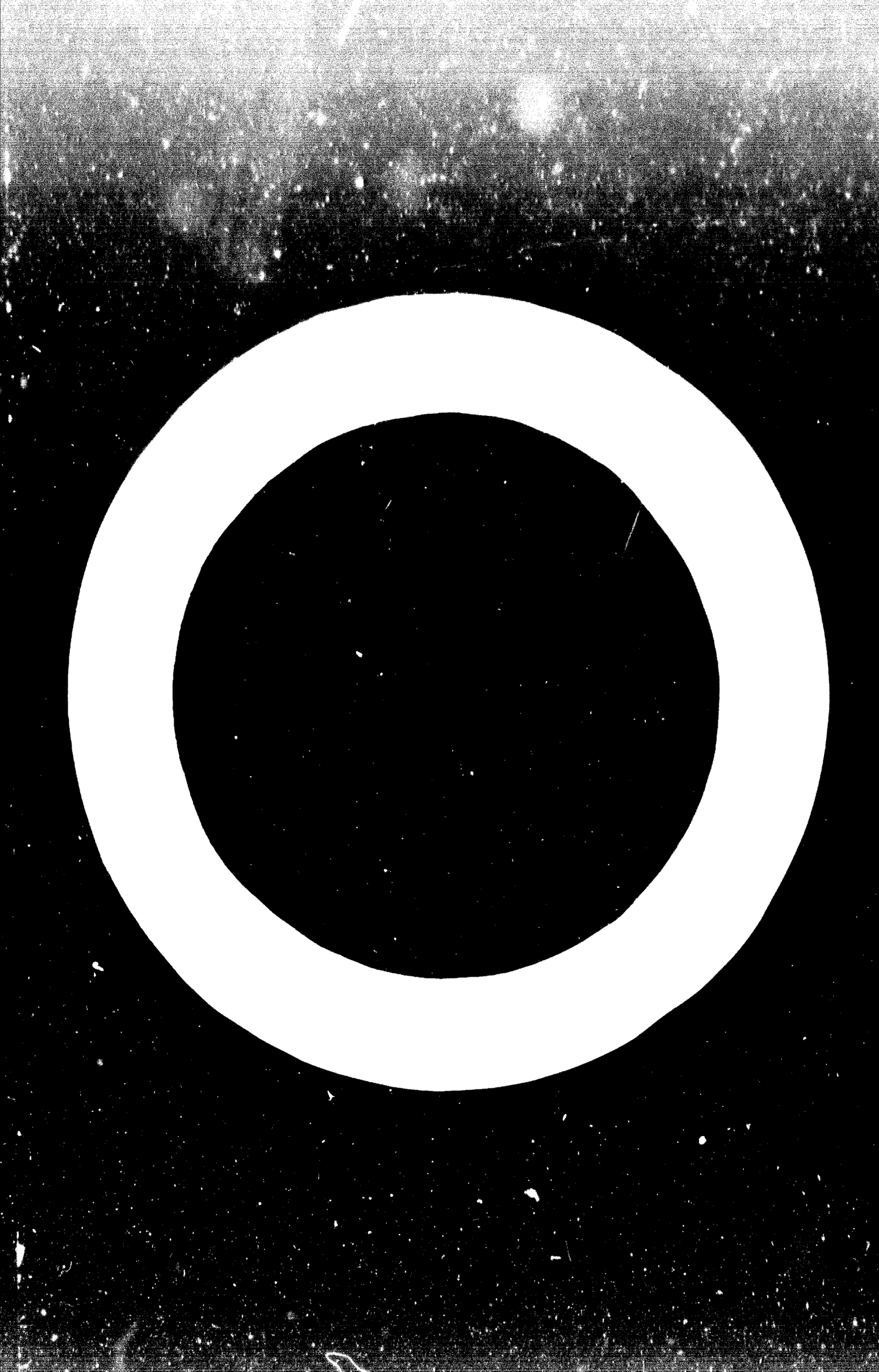

Every science has a natural course of development. At first it is [illegible] with erroneous pre-scientific beliefs and gross observations [illegible] progress is slow. A slow gathering of carefully observed facts [illegible] preliminary to the formation of generalizations. Then insight is obtained, first in one connection, then in another, progress [illegible] more rapid. The various fields begin to contribute one stimulus to another." *

The terms developed and developing countries, are no more than relative to each other. All countries are developing and some more rapidly than the so-called developed countries. In this sphere of change in which we live, we are making a leap in evolution out of an uncertain past into a future we cannot foresee. Changes follow one upon another with breathless haste. With this regard we must avoid what is all too easy to do, pointing to examples at one stage of progress as objectives for an earlier stage of development. Even so, example is often the best "teacher". There are examples which encourage confidence and point to better performance.

Neither is our own past an example for others to follow. There have been many mistakes made in those several hundred years of progress and, as a race, we cannot afford that much time. We must look back with hindsight and profit by what we learn. With this regard the motor industry has been a very attractive contributor to industrial development. No industry more than the motor industry covers a wider field of effort. A small car averages 2,500 major parts and assemblies, or 20,000 parts if every nut and bolt is counted separately. Almost every form of manufacturing process is used in building a motor car. There are some 50 different materials incorporated in its construction.

While this wide variety of manufacturing effort offers continually expanding opportunities for industrial development through manufacturing integration, 2,500 major parts and assemblies are 2,500 instances where

* From "The Biological Time Bomb" by G. Rattray Taylor

[illegible] can be kept cost in mind at all times. There are the same number of opportunities for quality problems, many of which can jeopardize the [illegible]. There are some 30 different materials, any one of which can also [illegible] problems of cost, quality or supply.

[illegible] is a field of choice to find ideas and some logic to attack a problem, one hardly changes the real nature of the problem and its "[illegible] to exist" and the "technological gap" are probably [illegible] examples. Rules have been taken to discover the real nature and [illegible] which give rise to the problems which only these tools. Thus, [illegible] cannot be solved down to proportion to the scale of values, [illegible] processes can be found to suit different levels of volume, [illegible] is most pervasive of uncontrollable quality problems. [illegible] a wide gap between the resources of developed and developing [illegible], but much of the business of making more use of shop-floor [illegible] where the technology is that of metal cutting, engineering and plant [illegible], hand design and tool making. There is no basic reason, for [illegible], why skill in tool making in a developing country should not equate [illegible] skill in tool making in a developed country. From this point of view, [illegible] can be done to narrow the gap, while, from other points of view, the [illegible] grows wider and wider.

In the [illegible]'s industry in Europe and North America, it is only [illegible] now that the university students in large numbers, have begun [illegible] a place in industry. Their intrusion was made possible by the [illegible] of the disciplines of industry in management administration and [illegible] authority, and in the development of systems of delegated authority. [illegible] can be found in developing countries, of using the trained minds of [illegible] students in bringing disciplines to industry at an earlier stage [illegible] development. But what industry in developing countries lacks, before [illegible] else, is discipline, and we need to use scientific concept.

The [illegible] needs to be [illegible] in sequence is the [illegible] development [illegible] of [illegible] industry planning. In some instances, there are direct

experience to the Seminar papers which were not available. In others, although less obviously, each paper has made a contribution to the report. It is hoped that the work of the Seminar will help to expand the ideas already developed and perhaps develop others of even greater significance, which, in the final report, will come together in what will be an effective Manual of Instruction for the national planner in developing countries.

Section 1. The Elements of Preliminary Planning

This section is concerned with the infra-structure of a country's development and those elements of it which determine the quantification of new and total vehicle requirement. It cannot be assumed that the present levels and specification of vehicle provision are ideally suited to current circumstance. The examination must therefore begin with current usage, specification and quantity. Consideration can then be given to the forward years. The probability of technological, economic and social change which cannot be foreseen or predicted over a longer period than 10 years, suggests that little useful planning can be done which goes beyond this period of time. Of these 10 years, the first five can be predicted with reasonable confidence. The second five years must be regarded as quantifications of anticipated trend rather than firm estimates on which commitments can be made. Nevertheless, predictions of trend which cover the second five years can be very important, indicating, as they do, ultimate plant size and site requirements, and geographical location preferences. There will be indications of trends in population growth and population distribution; road and other transport facility development; the probable development of the ancillary and supporting industries to the motor industry itself.

There will inevitably be a division between that which is practicable and that which is desirable in the development of a motor industry and in the provision of motor vehicles. The basic tool of the forecaster is the curve of historical record and his forecast, a projection of that curve, taking into account those known factors which will modify the projection. The potential demand is always greater than the figures shown in the historical record and its projection. This potential is only valid, however, for one point in time. For, if the restrictions current at that time had been removed, the potential which existed in the forward years might well have disappeared. The planner's task, therefore, is one of measuring change in consequence of planned intervention and in which potential is only valid at any given point in time, as an indicator of the scope for change.

Factors Influencing Vehicle Demand

Passenger Cars. The appeal of the passenger car is universal. So desirable is its possession in the conveniences it gives and in the freedom of movement it offers, in its capacity for giving enjoyment and recreation, that almost everyone will make considerable sacrifices to obtain one. Aside from direct restrictions on import, income per capita and vehicle price will have been the principle factors which have determined the size of the current vehicle park. The park however will consist of vehicles which have changed hands many times and are commonly 12 or 14 years old as well as those which are relatively new. The paper issued by the International Bank for Reconstruction and Development (International Development Association) on "Automobile Demand in Developing Countries", is concerned with vehicle park forecasting and comments on the significance of "vehicle life". The paper as a whole is recommended for its contribution to the general problem of forecasting. It must be pointed out that it will be most useful to those countries already in a fairly advanced stage of development. (See paragraphs 37-63)

This section of the International Bank's paper, apart from its intrinsic merit, illustrates also the wide range of variables by which quantification of demand can be qualified. For the manufacturer of passenger cars in developed countries, there is also the problem of assessing degree of market penetration for both the home market and the export market. Market penetration is conditioned by: product appeal, customer loyalty, manufacturing reputation and public image, after sales service and sales organization network and outlets, advertising campaigns, manufacturing capacity and product availability, price in relation to competition in the same market field, changes in the incomes structure by age groups. (In the developing countries purchasing capability is tending to move downward to younger buyers.)

It is worthy of note that in spite of all these variables, the principle manufacturers of developed countries in their new product offerings

launching plans at production rates of in excess of 1,000 per day will [illegible]:

(a) designed, engineered, prototype tested the new vehicle;

(b) established total facility requirements, new and existing tools, machines and production methods, manufacturing capacity for every part and assembly;

(c) developed tooling programmes and established a job 1 date;

(d) established manufacturing cost in terms of standard cost, material and production part cost, variable and non-variable overhead cost, investment and tooling cost;

(e) developed pre-production training programmes and manpower requirements;

(f) filled the dealers' showrooms with vehicles and the service stations with essential spare parts;

(g) estimated total sales and market penetration; developed advertising campaigns; and

(h) estimated total cost, the production volume break-even point of profitability and the return on investment at selected increments of increased production volume.

While little of this is the direct concern of the national planner, an understanding of the depth and breadth of control which can be exercised is of general interest.

Trucks. The range of commercial vehicles from light vans to the heaviest trucks, covers a far wider range of model types than is true of passenger cars. The tendency in developed countries is to proliferate variety in meeting the special needs of differing trades and commercial usages. For developing countries, a rationalisation of vehicle type and a restriction on the variance within each type is inevitable.

The national planner's problem begins with establishing this rationalisation and limitation on the basis of the historical record. Thereafter he may begin to establish projected quantification. Desk studies and