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Meeting of Experts/Decision Makers for Promotion
and Development of Machine Tool Industries in
Developing Countries of Asia and the Far East

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PREREQUISITES FOR MACHINE TOOL PRODUCTION
IN A DEVELOPING COUNTRY ^{1/}

by

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Introduction

Self-analysis is the criteria of any initial approach on a very involved subject, and therefore, perhaps it is better to start with the breakdown of what is a developing country and why machine tools.

A developing country, to my mind, is one that has not fully developed its inherent potential and perhaps this really applies to all of us, and therefore, it would be correct to say that we are looking at the less industrially developed nations.

On the question of machine tools, two questions should always be asked by any authority in any country, and these are, "Why?" and "How?". On the assumption that the answers to the question "Why?" are in the affirmative, and that we have an economically viable product, one is then left with the major question of how to establish a machine tool industry from the ground-floor upwards.

It should be realised that no one really wants a machine tool - what they do want is the product it produces and it just so happens that a machine tool is very often the most economical and viable method of producing it. Therefore, when evaluating a market potential, it is important that the local product requirements are fully researched.

Surely the whole secret of success must be based on first class market research, basic utilisation of indigenous wealth, a co-ordinated development programme and a sound educational scheme.

Market Considerations

Over the past few years, the major machine tool producing countries and major users of machine tools have been obliged, due to the ever-increasing costs in raw material, labour, development costs plus high-technical requirements, to move away from the more simpler and traditional machine tools, to those of a sophisticated nature. There is still however, a huge demand in even highly industrially developed countries for basic simple machine tools and I would

venture to suggest that under your Market Considerations, this type of machine tool should feature as a prime object inasmuch as it has both a local and export potential.

Market research must be the basis on which the decision to commence a machine tool industry must be founded, and will, of course, determine the type or types of machines to be manufactured and also in what quantities. It therefore goes without saying that the expertise employed in market research, must be of the highest order.

One of the companies in my own group, who have been manufacturing machine tools for some 75 years, has just completed a market research to determine the specification of a production milling machine which will have an appeal, not only to users in the U.K., but in international markets, and be a product which would be acceptable after a period five years ahead.

I think it is perhaps correct to use this exercise as an indication of the detail to which a company has to delve, not just to set up an embryo machine tool industry, but merely to ensure that it has a correct future manufacturing programme, even for a type of machine tool which it has produced for some 75 years.

The only premise on which we could work was that a production knee type milling machine would continue to prove to be a profitable investment. We were not however, exactly sure as to how this machine would look or what capacity it should have. Therefore, we enlisted the assistance of some 20 experts and drew up a form of questionnaire which would be complete and yet be able to be answered in the minimum amount of time. This was eventually accomplished and the questionnaire was then taken by some 25 field engineers to some 150 varying engineering establishments and the questions were answered by Opersters, Planning Engineers and Production Engineers, and all this information was subsequently fed into our Research Department. (Appendix)

Here a lengthy report was drawn up and presented to the management for their consideration and approval. This exercise took some months to complete and engaged a considerable wealth of expertise.

I think however, this highlights the necessity of expert Market Research and if we bear in mind that this was done for an established machine tool company, then most certainly it must be intensified for any organisation contemplating the very commencement of this type of product.

We have dealt basically with the technical considerations of the market research but obviously in establishing a new industry, one must look at the possibility of exploiting available raw materials, electric power, man power in all its facets from research and development engineering through to shop floor workers, the indigenous market potential and lastly and most certainly not the least, the vital aspect of foreign exchange earnings by export potential.

Dependent, of course, on the country, it may be found that a relatively small unit restricting itself to one or two types of machines could satisfy initial local demand leaving room within the complex to expand over the years to cater for industrial progress.

On the other hand, it may well be that the country cannot, at inception, or in the middle future, find sufficient indigenous outlets for its initial or projected production, here a close look should be taken at a rationalisation programme with adjoining countries in the form of what might be termed "a machine tool Common Market". Such an arrangement, as I know, has been made by Latin American countries of the 'Andean' Pact and in fact their "Decision 57" appears to amicably cover for such an arrangement.

The Basic Choice

If my premise that it is the more simple type of machine tool that is to be manufactured, then we are left with one or more of the basic three types of machine tools with which to commence production. These are generally known as :

- a) Drilling Machines
- b) Lathes
- c) Milling Machines

The lathe perhaps is the most fundamental of all our machine tools for it was from its basic concept that most of our modern machine tools were created. The simple lathe was used for decades in the North West Frontier of India as a machine for manufacturing rifles and other turned products, and a very successful secondary industry was developed by its consistent use. The lathe was nothing more than a revolving headstock operated with a bow and string and yet this primitive machine tool managed to achieve a precision acceptable in today's modern industrial world.

Turn this lathe from its normal horizontal position into the vertical plane and immediately a different concept of machine is available and from this it is possible to see the development of the Milling Machine and although perhaps the basic difference is that in the lathe the work-piece moves and the cutting tool remains stationary, the reverse situation is the creation of the Milling Machine.

What type of machine tool to manufacture ? Again this can only be decided after a long market research, but care should be taken that whatever type or types of machines are finally decided upon, they should fit in more closely with the country's overall industrial development programme.

Far too often, simple type lathes are manufactured and used as a basis of training for production engineers, only to find that in the next phase of their industrial career, the operators are confronted with machines of high speeds and feeds far in excess of those encountered in their initial practical training.

This perhaps leads us to study the possibility of looking at a semi-automatic machine such as the Turret Lathe, which very often can be considered to be the happy medium of the manual and fully automatic machine tool .

Again perhaps one should look at the export market potential for most certainly, where there are literally hundreds of manufacturers of the straight-forward centre lathe, the turret lathe does still not fall into the category of a saturated market. But please, I use this as only one of many examples. .

Technical Collaboration

Technical collaboration with reputed manufacturers is an essential part of the establishment of a machine tool industry but pitfalls should be avoided so that agreements are not signed for old fashioned machines, and that there is a truly progressive partnership.

Royalty or other technical collaboration agreements for the manufacture of machine tools should be coupled very closely to an updating, for otherwise, one finds that by the time full production is achieved on a particular machine tool, its obsolete design does not make it a viable export commodity.

The partner should also supply expertise to establish a local research and development unit so that new designs of machine tools can be created to more fully meet the country's individual long term requirement.

Although there are individual opinions as to the best form of collaboration to quickly establish a machine tool industry, the supply of machine tools in completely knocked down condition (CKD) must surely be rated as one of the best, for not only does this act as a visual aid, but also enables the true feel of machine tool fitting to be communicated to the new recruits. I think it is important to realise that perhaps one of the characteristics of machine tool manufacture which is not often required in other engineering industry, is this whole question of producing components and units that will slide or rotate freely and yet maintain their accuracy even in adverse conditions. Swarf and coolant, a necessity in our industry, are not always the best environment for precision products.

A Planned Industrial Development Programme

I would like to venture in making rather a bold statement and that is that I do not think that sole machine tool manufacturing in any country is a viable proposition. I feel that it must be closely linked with an overall industrial development programme and that this should cover a minimum period of at least five years.

Close co-ordination is required by both private industry and government departments. To achieve this, a successful planned long term programme will go a long way to achieving economical and less costly production. The similarity between machines and other engineered products, lends itself to the planned creation of sub-manufacturing units and I do not know of any machine tool producers in the world who do not buy out many of their associated components.

Quantities used alone in machine tools, make it completely uneconomical to set up self-sufficient production in their own factories. It is safe to say that the advanced state of the modern machine tool industry is based on the research and development work achieved by a whole host of other industries. These vary from metallurgical progress achieved in steel production right through to light weight, highly reciprocal components used in the aircraft industry. Therefore again, I emphasize, that a closely linked long term development programme is an absolute necessity.

It should not be forgotten, and in fact emphasized, that a machine tool is often considered to be the product which makes all other products, and there should be no design short-cuts, neither should the question of quality be ignored for no matter how simple the machine tool might be, it is essential that it is fully operative during its working life and reliability is the essence of success.

It is often emphasized that foreign exchange saving is a vital aspect in the question of imports of raw and semi-finished materials, but never should there be a substitute of indigenous material which would be detrimental to the final quality of the product.

Any developing machine tool industry wants protection and this is achieved by either a ban on imports of similar products or protective tariffs, but whichever is the choice, caution must be exercised so that a manufacturer of machine tools is not lulled into a state of over-protection thereby creating uneconomical production methods, for selling in any export market is not only dependant upon quality, but most certainly, price.

On looking through the list of participants here today from many countries throughout the world, I see many friends and many success stories

and most certainly in looking at these, I am more convinced than ever that the basic ingredient of any successful industrial development is based on a solid and well founded machine tool industry.

Many countries which not so long ago were considered to be a developing country, (and I use the word with caution in the world of machine tool production), are now obtaining their positions in the world league table of machine tool suppliers.

Geographical Location

This is a very important aspect and there are many vital considerations to be investigated under this heading. It is essential to try and find a location in an area which does not have high salinity or humidity as the erosion factor here has a very important bearing on quality control.

Equally, if this has to be, additional expenditure is immediately incurred in the creation of pressurised or air-conditioned buildings. Dust and sandy areas are also contributing abrasive factors that we can well do without.

Transportation is always costly and the feeding of local machine tool users, together with shipping or port facilities, must be carefully studied. The harnessing and use of available ancillary industries should also be taken into consideration as we already know it is not always economical to set up individual manufacturing units for machine tools alone. Very often, a pump or engine manufacturing plant can amply cater for gears utilised in machine tool production, as well as perhaps giving a better workload on their installed capacity.

The availability of iron and steel and other raw materials again, should be closely linked with plant location, for a good foundry is essential.

Education

This is a subject which even in the machine tool industry would cover a symposium in its own right and therefore I feel it wise to really limit myself to types of personnel to be trained.

- a) the Craftsman
- b) the Middle Management, i.e. the Foreman
- c) the Top Management & Technical Direction.

To train machine tool craftsmen engineers normally requires a period of at least five years, but it has been proven that by concentrating on one particular craft or one particular application, a worker can become quite proficient in a period of under two years. This has been achieved in the shipbuilding industry where a young nation has produced giant tankers, using men without any previous shipbuilding experience. Imagine tankers of over 200,000 tons being built from a "green field site" in virtually a two year period.

We are obviously on this question of worker education, talking of an operation where we are creating a new machine tool industry and therefore, are unable to call on the normal products of an apprentice training school. These however, must be created and developed along with any normal machine tool manufacturing unit.

Middle Management, or the Foreman category, is the key to education for he is the craftsman and the tutor and is in direct contact with the workers for a great deal of time. Overseas training for the Middle Management with the foreign collaborator is, I feel, an essential part of the overall educational system.

On the Senior Management or Technical Direction side, here we are again talking of a long term programme and whereas a university background does quite often meet certain requirements, personal experience in the key operations of a machine tool factory over a minimum period of 5 years, is an important prerequisite.

Summary

My paper perhaps does not have such an academic approach as is normally appropriate for this type of symposia, but again, the subject does not easily lend itself to an academic approach. The only approach is surely that of a practical nature. Should any of the subjects that I have covered generally, be of particular interest to any of the participants here today, I would be delighted to discuss this more fully during my stay.

To summarise, I would like to say that the first prerequisite for machine tool production in any country, is unambiguous market research, a sound technical education programme, a firm decision of the type or types of machine

tools to be initially produced and a closely co-ordinated plan for industrial expansion and development. A long-term tie-up with a genuinely interested machine tool partner, the creation of a sound local Research & Development Institute, and the sure knowledge that a fairly hefty capital expenditure which a machine tool factory will entail, will produce for you a viable and profitable product which can hold its own in any international competition throughout the world.

(APPENDIX)

THE QUESTIONNAIRE

The questionnaire is in three sections :

- a) Questions 1 - 6 ask merely for details of the customer concerned.
- b) Questions 7 - 25 are designed to be answered by the representative from observation in the shop.
- c) Questions 26 - 30 are questions which should be put to the customer for his opinion. The representative should not try to answer this section himself.

PARKINSON MILLING MACHINE SURVEY.

- NOTE: (a) Please use one questionnaire form for each machine studied.
- (b) Tick relevant blank boxes, and delete as appropriate in YES/NO boxes.

CUSTOMER INTERVIEWED.

1. Name of firm :
2. Address :
3. Product :
4. Number of employees :
5. Person interviewed :
- Position :
6. APTM representative :
- Date :

MACHINE OBSERVED.

7. Make and Model Number :

8. Type of Miller :

- (a) Plain
- or (b) Universal
- or (c) Vertical

9. At what height was table being worked :inches (To nearest inch)

10. Attachments being used :

- (a) Vertical Head
- (b) Universal Head
- (c) Dividing Head

Yes	No
Yes	No
Yes	No

11. Spindle Speed being used: R.P.M.

12. Feed being used : inches/minute

13. Maximum depth of cut : inch

14. Length of cutter in contact with work : inches

15. Type of Cutter : (a) Face
 or (b) Side and Face
 or (c) Slab
 or (d) End Mill

16. Cutter made of : (a) High Speed Steel
 or (b) Carbide

17. Cutter Size : Diameter.....inches
 Width.....inches

18. Machine cycle being used: (a) Manual
 or (b) Autocycle
 or (c) Pendulum Milling

19. Diameter of arbor :inches

20. Work being held by : (a) Vice
 or (b) Fixture

If fixture, was clamping : (a) Manual
 or (b) Toggle or Cam
 or (c) Automatic
 or (d) Air Hydraulic

21. What component was being machined? :

22. Component size : (a) Length.....inches
 (b) Width.....inches
 (c) Weight.....inches
 (d) Approx. weight.....lbs.
 (Including fixture if any)

23. Component Material : (n) Steel over 65 ton tensile

or (b) Steel under 65 ton tensile

or (c) Non-ferrous

or (d) Cast Iron

24. Batch quantity required :

25. Coolant being used? : Yes No

QUESTIONS TO CUSTOMER.

26. What type of controls do you prefer? (a) Handles

or (b) Pushbutton

or (c) Joystick

27. Are Rear Controls necessary? Yes No

If YES, should they be (a) Standard

or (b) Optional

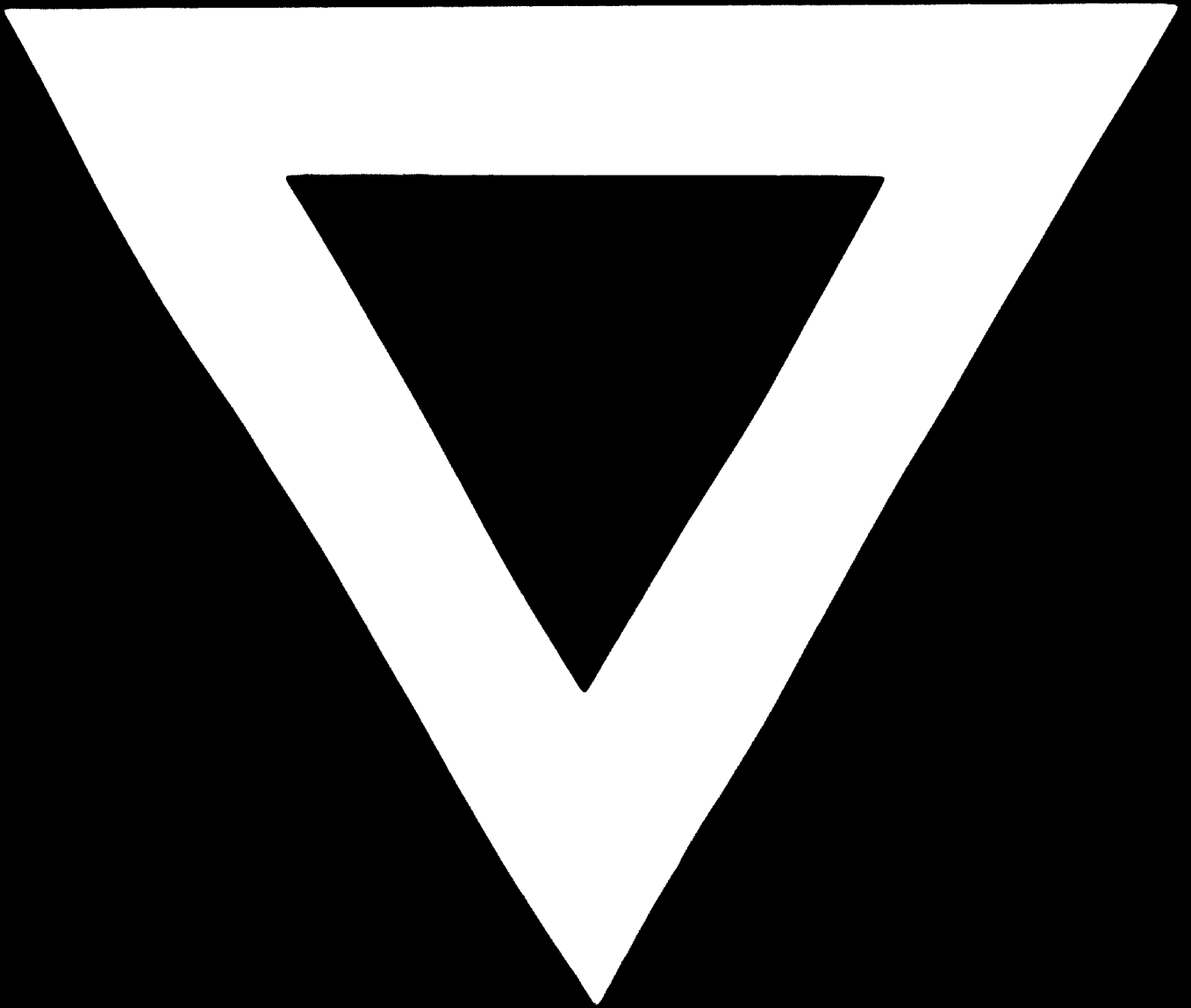
28. Do you consider machine working height is : (a) Acceptable

or (b) Too high

or (c) Too low

29. Are the feed selection controls in a convenient position? Yes No

30. Are the speed selection controls in a convenient position? Yes No



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