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ESTABLISHING MECHANIZED SHOE PRODUCTION UNITS 1/

by

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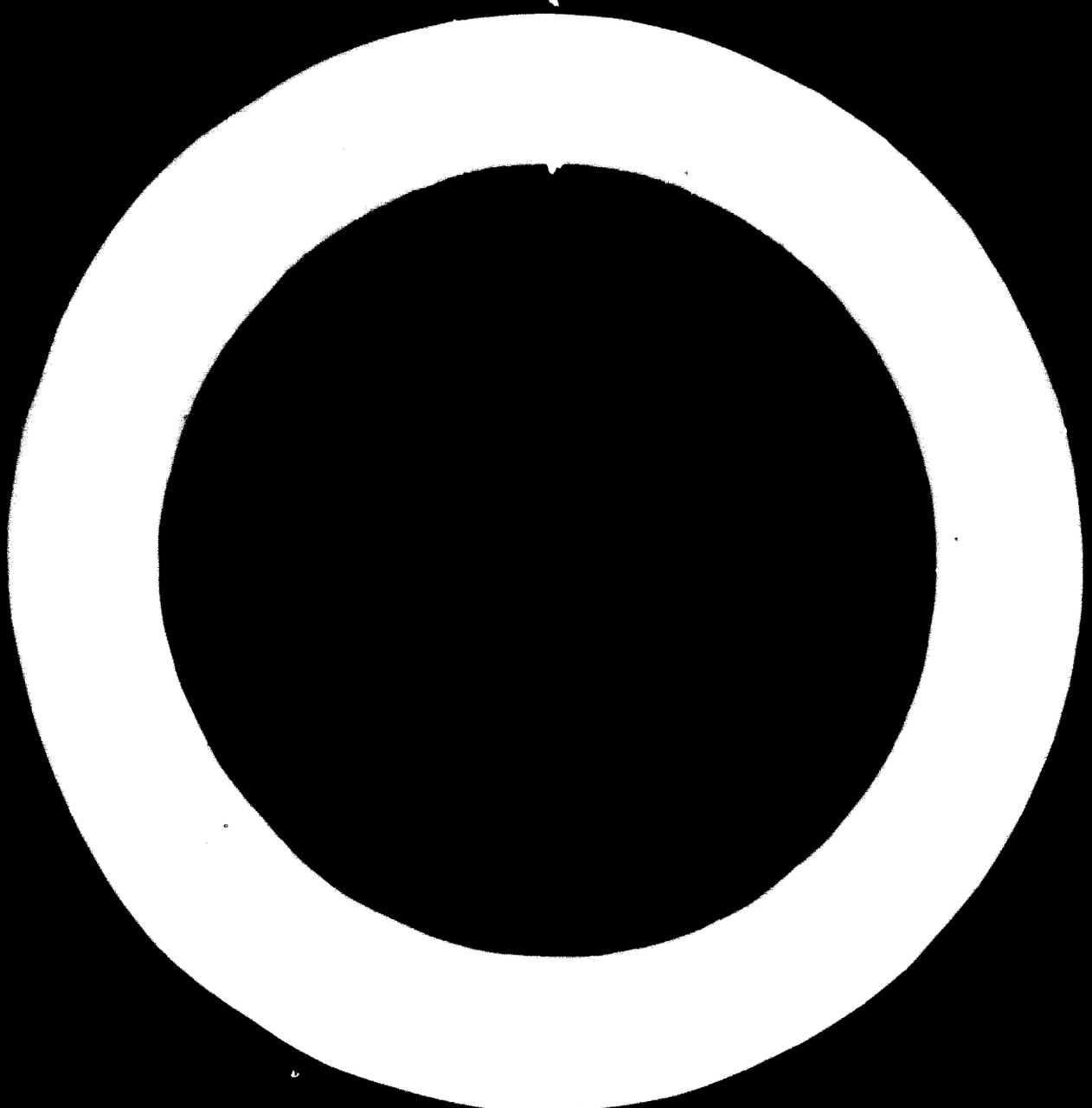


Before entering on to the subject of how to make shoes, the potential for growth in shoe making in the world should be considered together with arguments in favour of mechanisation, even in low labour-cost areas. A relationship has been deduced between consumption of leather shoes per head and gross national product per head which indicates a sharp rise in shoe consumption at the lower end of the GNP scale, levelling off to three pairs per head a year in Western Europe and the USA. Although this is a generalisation, it is fair to say that one can expect a substantial growth in demand for footwear in the developing countries. But of course one does not have to wait for this increased local demand - exports offer a tremendous opportunity for manufacturers who can make a good, consistent product at a competitive price

One of the cardinal questions is that of mechanisation. There are many good reasons for adopting a mechanisation policy, and the most important are the following. Firstly, economy of labour resources. There is plenty of evidence that shoe making has been carried out in Africa for thousands of years. The actual level of productivity of the early Egyptians is unknown but it is likely that their output per head was no worse than that of hand shoe makers today , which is very wasteful of labour when mechanisation can increase productivity by up to seven times.

Secondly, mechanisation permits the manufacture of better products at lower cost. Better because the shoes are better fitting and are consistent in dimension and quality. A close study of the two extremes of hand made and mechanised footwear shows the difficulty of selling entirely hand-made shoes in competitive world markets.

Thirdly, a mechanised shoe factory is able to reduce its labour cost substantially in return for a comparatively small investment in machinery. The cost breakdown of an average British factory made shoe shows that the cost of plant is only about 3% of the total cost of the shoe, thus the greater the cost of labour, the greater the potential saving.

Fourthly, with mechanised shoe making it is easier and quicker to train the labour because the machinery takes a lot of the skill and craftsmanship out of shoe making, and this is particularly important when starting up factories in developing countries.

Fifthly, being able to obtain export business helps in building up production to economic levels and taking advantage of economics of size.

Last, but not least, mechanised manufacture of footwear with leather uppers can compete in quality and, at present at least, in price with footwear with porpmeric uppers; as more and more synthetics are used in the shoe industry competition in quality and price will obviously grow and can best be met by machine made shoes.

The problem of setting up a mechanised factory can be best answered by 4 Ms: machinery, materials, manpower and management.

There is a tremendous variety of shoe machines of different types because there are may different methods of shoe construction but for practical purposes consideration need only be paid to the two main methods of making shoes - by the cemented process and the direct moulded process. Looking at British footwear production by constructions, it can be seen quite clearly that the cemented process accounts for the vast majority of the output, while the PVC injection moulded process is a clear second, which has been increasing steadily over recent years.

The method of making cemented soled shoes is different to the process involved with direct moulded shoes, and can be summarised as follows: patterns for the upper have first to be designed and graded to cover the required range of sizes. The upper material and lining material can then be cut, either by hand direct from these patterns if quantities are small, or by making press knives to the shape of the patterns and then employing a powered cutting press. The two maintypes of cutting press are: a swing beam press used for cutting single thicknesses, and a travelling head press which is more economical when cutting multiple thicknesses of material from wide rolls. There is also the possibility of shoe components being cut in the future by means of laser beams.

The next step is the processing and stitching together of the cut upper and lining pieces to make the closed upper. One of the most important processes is skiving, or reducing the edges ready for folding. A machine, the Thermo Cementing & Folding Machine Model C, has been recently developed and cements and folds the skived edges of leather or synthetics using photo-electric cells to control automatically the flow of cement and the action of snipping and pleating. The equipment is a perfect example of a modern machine reducing the skill required by the operator.

After these and other preparatory operations the upper pieces can be stitched together to produce the closed upper with the last, insole, toe puff and counter being assembled next to make the lasted shoe.

Lasting consists of wrapping the closed upper over the wooden or plastic last and fastening it to the insole, either by adhesives or tacks, or a combination of both. The ideal would be to do this in a single operation but it can be appreciated that with the properties that leather has in respect to stretch and the tremendous variety of last shapes and sizes, this cannot yet be done entirely successfully. Therefore, it is usual to last the shoe in three steps - the front portion or forepart, the centre or waist and the back or seat. There are various alternatives and combinations of lasting machines and systems that can be employed.

The modern process is to mould first the back part of the shoe, containing a thermoplastic stiffening material using one of the machines available. The upper, with the back part pre-moulded, is then put over the last and a combined pulling over and forepart lasting machine is used to stretch it in position and attach it to the insole with thermoplastic adhesive.

The waist, or centre of the shoe, can be lasted with tacks or with adhesive using a machine which stretches and lays down the leather, injecting thermoplastic cement at the same time. The final lasting operation is to secure the seat, with tacks, for instance to give a strong fastening which is particularly important with men's and heavier footwear.

Following lasting, the next operation is to roughen the bottom preparatory to applying cement or attaching the sole. The roughing can be done either with a simple wire brush or with a modern automatic machine suitable for higher outputs.

It then remains to attach a steel shank to strengthen the waist, a filler to level the forepart, and to attach a sole and heel. The sole, which is roughened and cemented with the same adhesive as used on the upper, is attached by means of a hydraulic press and using modern adhesive the bond can be set up in 10 seconds, or even less. The heel is attached either with nails or a nailing machine or, for certain styles of heel, with staples and a stapling machine.

The result is the finished shoe, but of course there are many operations that

have not been mentioned which are concerned with preparing the components before they are processed.

The other major shoe construction is that of direct moulding, of which PVC injection moulding is by far the most used. For this construction the shoe is lasted and roughed in the same way as for the cemented process but the lasted upper is then placed on a metal foot form and put into a mould cavity so that PVC can be injected to form the sole and heel and at the same time stuck to the roughened and cemented lasted margin. Various types of machines are available for this process; either a high production multi-station machine such as a ten station rotary injection machine, or a smaller, lower output but more versatitle twin station machine. The latter machine is fitted with a refrigeration unit so that cooling time is reduced to a minimum and productivity is as high as with the big machines when one operator uses three twin station machines.

A more recent development is the injection moulding of blown polyurethane. This is still in its early stages of development but the polyurethane material has many ideal properties for shoe soling. Despite the advantages offered to the customer or wearer of the shoe, there are certain advantages and disadvantages to the shoe manufacturer. At present, the main disadvantage is the high cost of the polyurethane compound but it is hoped that in a few years the price will be reduced to bring the material within the reach of more than just the top quality shoe manufacturers. The machine required is even bigger than that for PVC moulding and involves a capital investment in the region of $100,000.

These modern machines and processes cannot be used efficiently unless they are laid out correctly with proper means for transporting the shoes from one operation to the next. In the closing room, where uppers are made, the most widely used type of work transporter is the Eatough transporter which was developed by Satra, the Shoe Trade Research Association in England. A signal on the control panel lights up when any operator is down to one box of work so that the supervisor can despatch a further box to that operator, and in this way the arrangement of machines is equally suitable for any sequence of operations as the work no longer travels on an operator to operator basis.

In the lasting room the sequence of operations is more standardised and is not greatly affected by differences in style. Transporters, such as this No. 2 Duo-Rail Transporter, are therefore widely used. Single pair carriages

are conveyed from one operator to the next and wait there until the shoes have been processed and started on their way to the following operation.

In a typical machinery layout plan, the closing room benches are arranged along the transporter. The cutting presses and preparatory operations are located above it, while at the top there is a duo-rail transporter with the lasting and sole attaching machines arranged around it. It should be emphasised that, when a new factory is being designed, the plant should be selected first so that the best layout plan can be drawn, and only then should the offices, warehouses and other areas be added and an architect engaged to design the building itself. There are repeated instances of the unfortunate consequences of designing a shoe-factory building first and then trying to put the machinery into a space that is neither the best shape nor size.

The developments in machinery, transporters and planning techniques, together with technical advances such as heat setting, prefinishing and injection moulding, have enabled a very great improvement in productivity to be achieved in European shoe factories in the last twenty years, as can be appreciated when reading the figures to show the increases in productivity and the reductions in floor space, last inventories and work in progress that have been achieved in the average British factory.

The most suitable building for a shoe factory is undoubtedly a single storey building with good, natural lighting and adequate supplementary artificial lighting. The question of the best output for each production line is a complex one, but opinion generally points to 1200 pairs or 2000 pairs being the best daily output per shift to give good machine utilisation and good control and organisation.

The second of the four Ms is materials, and intelligibly enough mechanised shoe making requires several special raw materials and components if it is to be used successfully. Of course, the upper leather itself must be as consistent as possible, both in its quality and its substance, for with injection moulding techniques consistent upper substance is critical if good mouldings without spue are to be achieved. To fit in with modern pull tow lasting machines, special thermoplastic toe puffs are virtually essential if the adhesion is not to be spoiled. To take advantage of the backpart moulding technique, thermoplastic counter material is required, or if this is not used properly prepared and moulded fibreboard counters are needed. Another item required in

precision mechanized shoe making is good quality and accurately made press knives and dies. Steel shanks, either loose for insertion with staples or tacks or combined with the plastic heel, will be required to fit exactly the contour of the waist of each style of shoe. Even the various tacks, nails and staples used must be precision-made so that they can be fed automatically by the machines without interruption.

Modern processes also depend upon specialized hot melt adhesives, some of them in rod form for better control, upon special plastic compounds and other finishes and chemicals. Therefore, it is most important when setting up a modern mechanized factory to ensure that all these materials and components are either available locally or can be imported from overseas to enable the factory to achieve the efficiency and productivity of its counterparts in Europe.

Before leaving the question of materials brief reference should be made to the growing use of PVC upper material for lower quality footwear. This is taking place not only because of the cheap price of this material, but because of the possibilities opened up for high frequency welding and cutting carried out on such machines as this two station high frequency press. This enables supported PVC sheeting to be cut, welded and moulded into intricate shapes which would be costly to produce in leather, and by a recent process to reproduce in a single operation complex vamps with very good imitations of stitching, punching, graining, etc. It seems inevitable that these welding techniques will be used to an ever-increasing extent in the manufacture of the medium and lower grade shoes and that factories which are going to continue to use leather uppers exclusively will need to concentrate upon the quality and comfort aspects.

The third M is manpower. This really should include also women power because quite a large number of women workers are now employed in European shoe factories. In the past, they have traditionally worked in the stitching or closing room because of the lightness and cleanliness of the jobs done there, but now that modern semi-automatic machinery is being increasingly used there is no real reason why they should not carry out many more jobs in other departments of a factory.

As mentioned above, the mechanization of shoe making leads to easier and quicker training of factory workers. In the old days of hand shoe making a young man might be apprenticed for many years before he was allowed to carry out some of the more important operations. Now, an inexperienced worker can be taught in

a matter of weeks, or even days, how to operate a machine and achieve the required quality standards. Nevertheless, proper training of operators is still most important and in addition, as machines become more complex and more nearly automatic, skilled and trained maintenance engineers become of increasing importance.

For a new factory being set up in a country where there is no tradition of mechanised shoe making and no existing pool of trained workers, training is a difficult problem. It is difficult to find training facilities abroad for machine operators, but the best answer seems to be one or more of the following.

Firstly, a technical agreement could be concluded with an established factory and workers sent there for training and practical experience, or some of their skilled supervisors could be seconded to carry out training in the new factory. Secondly, it may be possible to engage skilled instructors from abroad for the first year or two of operation and use them for training operators. Thirdly, it may be possible for assistance in labour training to be arranged with the help of the government, or possibly of UNIDO.

When it comes to the training of maintenance engineers this can usually be done with the help of the machinery suppliers. The author's company, British United Shoe Machinery Co. Ltd., for example, is part of a large group of companies situated in many countries in the world, including Australasia and Japan. Unfortunately, the volume of business does not warrant the setting up of further subsidiary companies or branches in the African continent at present.

Technical knowledge and training facilities of the principal companies in the group are, however, equally available to shoe manufacturers in any country. A full range of conventional shoe making machinery is manufactured and a large staff of technicians in Leicester is available to install machines overseas or assist with training in our own Service Training School.

It is, perhaps, stating the obvious that having found and trained labour it is very important to retain them and so cut out wasted training time, and here welfare facilities play an important part. Such things as canteen services, medical and dental clinics, good working conditions, sports and recreational activities after working hours all contribute to a happy working force with minimum time lost and minimum labour turnover.

This leads onto the fourth M - management. This subject alone could, of course, provide the basis for a series of papers but many of the requirements of good management of a shoe factory are those which apply to any production unit.

However, because of the complex nature of shoe manufacturing it is essential for a manager to have a thorough understanding of the shoe-making processes so as to enable him to apply his management skills to the full.

Training for shoe factory management is fairly well catered for in a number of Technical Colleges in Europe. In Britain there are four or five colleges of technology who run both part-time and full-time training courses, of which details are available on enquiry.

These training facilities in Britain are about to be rationalized and within a few years shoe industry training will be concentrated in two, or at the most three, colleges and a new three-year training course is going to be introduced, which will combine technical and specialised shoe industry training with general management training. This, therefore, should provide the ideal background for potential managers at any time after they have completed their school education.

Another way to acquire management skills is again through liaison with an established factory which can loan managers, provide advice, assistance, patterns, designs and many other services which are difficult for a newly established organization to acquire.

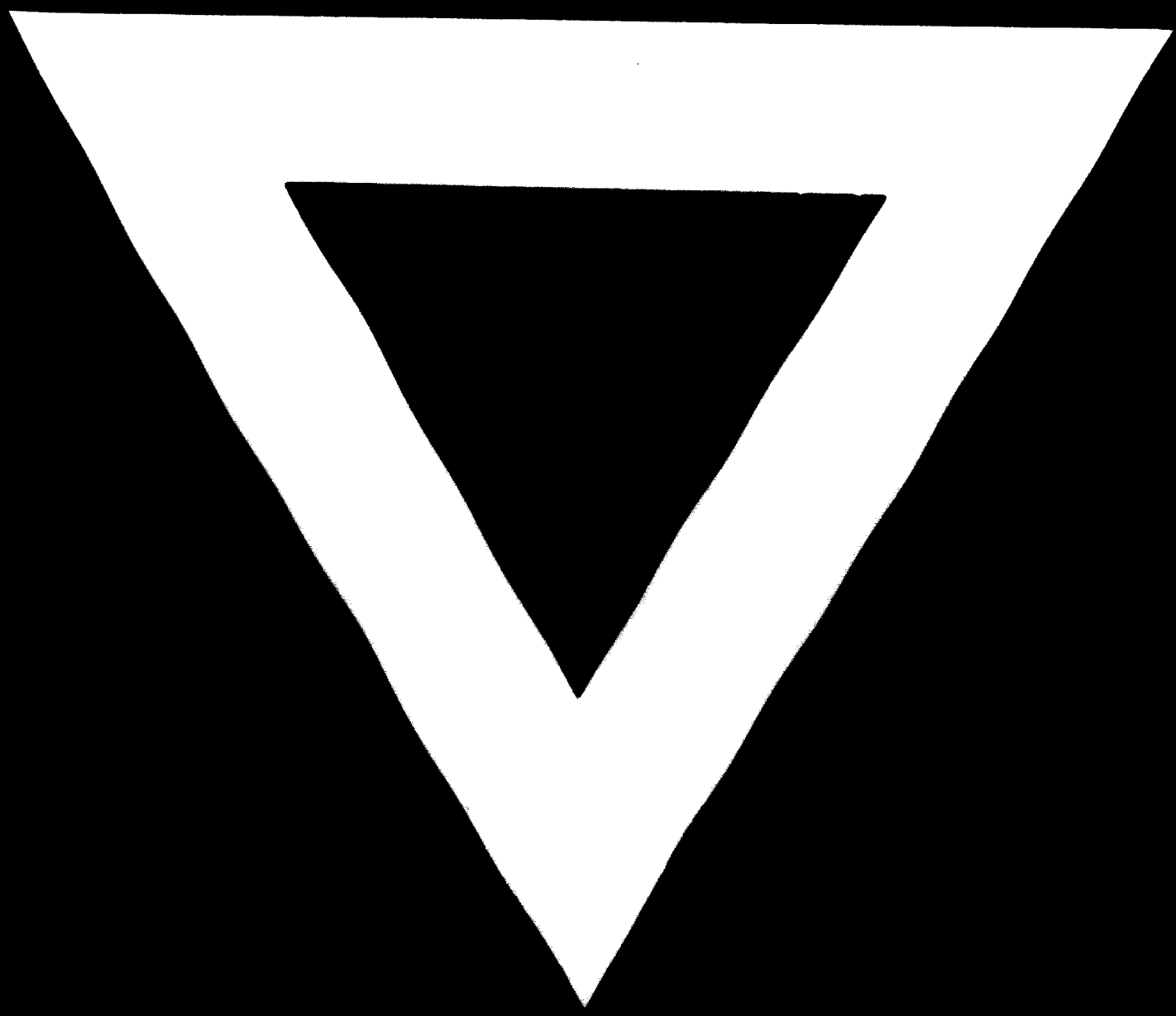
One of the main tools that are required by shoe factory managers are proper work transport systems, as referred to earlier. Not only do they serve to convey shoes and components from one point to another but, when properly used, they enable the management to supervise production and quality control much better.

A proper system of production planning and production control is essential to ensure that labour is not wasted, that floor space is used to the maximum advantage and above all that the amount of work in progress, and therefore the working capital required, is kept to an absolute minimum. Naturally this shorter through-put time is also a big advantage in giving quicker delivery to one's customers. Costing is obviously critical when profit margins are finely calculated, as they generally are in the shoe industry, and special techniques are needed in some cases to cater properly for the very variable materials that may be used. For example, the number of pieces that can be cut from a skin of leather is not dependent entirely upon the areas; flaws, the direction of stretch, varying thickness, varying colour and grain all affect the utilization of the skin if good quality shoes are to be made.

A further tool of management is a good feed-back of information from the market, and therefore good forecasting of demand and sales for the purpose of bulk buying of components and materials and efficient production planning. These are just a few aspects of management problems which may have special significance in the shoe industry.

To summarise, it should not be forgotten that, when setting up a new shoe production unit, especially in a developing country, production should be started on a modest scale; preference should, where possible, be given to specialisation of the product line rather than trying to make a little of everything. Maximum advantage should be taken of the many benefits offered by mechanisation and the latest machinery, materials and management methods should be employed. If possible, a tie-up should be arranged with an established shoe factory to obtain help with manpower training and many technical aspects of shoe design and manufacture.

When designing the plant, or having it designed by the machinery supplier, the building should be designed round the plant rather than vice versa. Finally, every advantage should be taken of all possible means of training, not only initially but on a continuing basis so that knowledge and skills can be continually kept up to date in an industry which is presently going through a period of very rapid development and change. To assist in this it is to be hoped that governments can be persuaded to help the long-term development of their shoe industries by awarding scholarships or in other ways encouraging study at technical colleges abroad.



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