

SOME OBSERVATIONS ON THE EMPLOYMENT OPPORTUNITIES CREATED BY THE EXPORT ORIENTATED INDUSTRIES IN MALTA

by JOSEPH V. MUSCAT

HIGHER TECHNICAL EDUCATION, PLANS AND PERFORMANCE

The Malta College of Arts, Science and Technology was set up way back in 1962 as part of a programme of expanding Technical Education, in anticipation of the demand for large numbers of technologists expected to be created by the projected industrialisation of our Island. It now comprises five major departments. Since the training of engineers and technicians is one of the pillars upon which the industrialisation of any country rests, it would be instructive to examine the extent to which the progress at this College is related to what is happening in the industrial field. In this respect, the Department of Mechanical Engineering is perhaps by far the more important, hence in this paper I am going to confine my observations to it.

At this stage it would be useful to contrast the progress achieved in the establishment of this Department, against that of the other departments, using the number of qualified students absorbed by the economy as the criterion by which each department's contribution to the Island's prosperity is measured. The bulk of the students leaving the Catering Department have been readily absorbed by the booming tourist industry. Those from the Business Studies Department found employment in banking, insurance, accountancy, Government service etc. Many Civil Engineering students had to go abroad to find suitable jobs and those from the Electrical Engineering Department were wanted by the rapidly expanding servicing industries, such as in the power station. A small number found employment in manufacturing. That leaves the students from the Mechanical Engineering Department.

According to the original estimates, the combined Engineering Departments were meant to provide every year some 30 graduates at Degree and Diploma level, 60 students at the Higher Technician

Diploma level, and a further 100 Technicians. First of all, it must be stated that the actual student numbers do not in any way approach the original estimates, though it must be granted that the latter were probably meant to be a maximum to be reached after a specific number of years, by which time the industrialisation programme would have created a peak demand for technologists. At present, the total student population in the Mechanical Engineering Department alone stands at around 18 full time (Degree/Diploma three year course), 56 sandwich (Higher Technician Diploma, four year course) and 97 day release students Technician grade. The average number of students completing their respective courses each year, over the last few years, has been around 5 for the Degree/Diploma course, 7 for the Higher Technician and 24 for the Technician courses. Other specialist courses involve even less students per class.

Judged on the basis of an increasing student intake and the output of qualified people, it can be argued that the Department is now established as an essential element in the rapidly changing economy of our Island. There has been a gradual build-up in the variety of the courses being offered, and the number of students applying to join them. The examination success rate has been most encouraging for all the courses and to all concerned, so one has to look outside the College for the reason for this failure to expand sufficiently the student population of this Department. It is reasonable to expect that the engineering graduates and technicians be readily absorbed by the manufacturing industries as these are the very people most suited for production work in all its aspects.

The obvious reason for the small number of students per class is the fact that industry is not providing employment for all of them. While the need for such courses is not disputed, the rate of qualified student output in relation to the national effort devoted towards it, becomes a cause for concern. The Island's capital and manpower resources are thus not being used efficiently. Once enough sufficiently attractive employment opportunities are created by industry, there should be no shortage of qualified students to fill the courses which are already running. We have the human resources to expand Higher Technical Education to the scale originally envisaged. There is a very large pool of qualified second-

dary school leavers, most of them seeking to join courses such as teacher training and those leading to University Degrees etc. It is logical to assume that with the proper inducements, a fair portion of these school leavers, over 4000 per year, could be orientated towards the more productive fields of the economy. In the process they would relieve the Island of the burden of having to provide for the surplus in the traditional white collar jobs, particularly in Government service. This point is of crucial importance in following up the main observations outlined in this paper.

In analysing the causes for the very slow increase in the student population of the Department, one is bound to question whether we are offering the right courses at the different levels. Our Degree/Diploma course in Mechanical Engineering is run on the same lines as any which one would find in most Colleges of Technology and Universities in the U.K. It is of the same duration and covers approximately the same range of subjects. Its academic standard is equivalent to, or even higher than, that of courses leading to the examinations of the Council of Engineering Institutions.

The other two major courses lead to the internationally recognised examinations of the 'City and Guilds of London Institutes'. We run a four year Higher Technician Diploma Course in Mechanical Engineering in which the main subjects are Applied Mechanics, Plant Maintenance and Workshop Technology. It aims particularly at meeting more directly the needs of small manufacturing industries. The emphasis is on a fairly broad span of Applied Technology. We also run Mechanical Engineering and Shipbuilding Technician courses together with other courses on 'Heating and Ventilation' and 'Refrigeration'.

We are following precisely the pattern of courses offered in British Colleges of Technology. It would be fair to say that these courses have evolved through decades of experience in an industrialised country, and are serving their economy well. To copy them is for us the most sensible course of action in the circumstances. There cannot be much wrong with the quality, standard or choice of the courses themselves. This is confirmed by the fact that students from all the courses mentioned have found suitable well paid employment, soon after leaving the College. In support of this one can quote cases where Degree/Diploma students, after two years in industry earn a salary higher than that of the more

qualified and experienced lecturers who instructed them. The courses and qualifications have been generally acceptable to the employers. The problem arises solely from the pitifully small number actually wanted by industry and hence the extremely serious implication that the College's contribution to this sector of the economy is correspondingly very small.

The following example is a fair guide to the employment pattern for a single year. Of an average yearly output of five students from the Degree/Diploma course, one goes into teaching, one to the Drydocks and another to the Electricity Board. This is logical because these students were already in employment with these bodies before undertaking the course, and their services are required in these very same places of employment. One finds work with a firm of engineering contractors and only one out of the five on an average goes to an export orientated manufacturing firm. Up to now all the students who have completed the Degree course have found employment of one kind or another but one can be absolutely certain that as matters stand, had there been a higher output of this class of student, suitable employment would have been very hard to come by for all of them. Many students had to take up work which is not quite in line with what they were trained for. In many cases, students seeking employment, faced an extremely difficult task persuading their prospective employers that an engineering graduate could be of service to their firm. Training schemes are practically unheard of except at the Malta Drydocks. Although all the students have found employment, the numbers involved are far too small for this fact to offer any comfort. The number of students employed by industry is up to now so insignificant, that it cannot help us to assess the full potential contribution, which the provision of this type of higher technical education is making towards industrialisation.

The prospects open to the holders of the Higher Technician Diploma and the Technicians' Certificate are on the whole very poor indeed. There have been a few cases where students have found employment suited to their grade, and it is through cases like these that we know the potential of these students as a group. This implies that industry is not offering jobs with a salary and working conditions better than what these people enjoy in their present grade as fitters etc.

The absence of job opportunities means that to some extent the national effort devoted to providing a higher technical education to these students has been wasted. As I see it, worse than that, it implies that the factories which indeed require the services of these technicians are remaining without them, and in consequence, in the long run the economy of these Islands stands to suffer. One must not forget the demoralising effect which this situation has on students intending to take Engineering as a career. Many sandwich type course students did not even find employment of a category higher than that of apprentice to keep them occupied for the six months of the year when they are not at the College. The student numbers involved in these courses are appreciable, hence the scale of the problem. Only a minute fraction of the total who complete the course go into the really productive exporting industries. This is indeed odd as these courses have been organised specifically to provide the technologists to service them; the very names of these courses are an indication of the intended occupation, 'Plant Engineering', 'Production Engineering', 'Jig and Tool Design' etc.

In summary it may be said that the scale of job opportunities offered by industry is most disappointing, otherwise once the student finds the right job, the salary is realistic, the prospects are good and in return the student's work output satisfies the employer. This does not mean that there are no other problems facing the student just leaving College. Certainly there are, but these are not different from those which one would encounter to varying extents in all industrialised countries. I am referring in particular to the initial lack of suitable industrial experience and background. This is no way the fault of the College, the student or the system, though something can certainly be done to integrate academic training with a planned programme of industrial experience. This is not practicable in the absence of cooperation from industry. Given a fair chance, our students generally acquire the necessary experience, as they gradually take on more responsibilities while in employment.

In the last three years there has been a significant slow down in the rate of industrial expansion. In consequence the number of new jobs created during the same period is correspondingly small, and hence the openings for technologists and technicians are re-

duced. While this factor is recognised as having a bearing on what has been said already, for reasons which I am going to explain, I want it to be regarded as outside the scope of this paper. Government aided industries have created a total of around 10,000 new jobs, the bulk being engaged in production solely for export. The number of qualified engineering students within this figure from the Polytechnic is perhaps not much greater than 10 to 20 at the most. Therefore leaving aside the issue of the total number of new jobs, the ratio of new jobs created to the intake of qualified students by industry, becomes a very significant figure. This, in my opinion, is at the root of all our economic problems as it is a symptom of the inherent weakness of some parts of the industrial sector. It is appropriate to mention at this point, that as many as 46% of the industrial enterprises which have been subsidised by the Government in one way or another, are now facing difficulties. This is indeed a serious blow to the programme of industrialisation. The issue being considered here is a fundamental one, and as such it is not appreciably affected by the temporary fluctuations in the rate of industrial development, in the Government aided stage. The total number of new jobs created per year by industrialisation depends to a large extent on local political decisions and on the economic situation governing the rest of the world. The ratio of the number of technologists to the total labour force depends entirely on the nature of the industrial undertaking and the way it is run.

UNSATISFACTORY BALANCE IN THE NEW JOBS CREATED: CAUSE FOR GRAVE CONCERN

The industrialisation of this country, up to now, has created an unsatisfactory employment structure in that there is a relatively large number of low paid manual workers and there is only a sprinkling of well paid technologists and managers, with few opportunities for the intermediate technician grades. This is certainly not in line with a young nation's dream of creating prosperity through an integrated programme of industrialisation and higher technical education. In the industrial sector, we are creating a society where the very large majority is earning wages at the bottom end of the scale, while thousands of graduates and secondary school leavers have the openings which befit their intelligence

denied to them. This imbalance in the employment structure is indeed very sad as it does not correspond with that existing in the industrialised countries of Western Europe, which we want to imitate. At very great cost to the Island's economy, we have created vast secondary schools and invested heavily in creating adequate opportunities for higher education as befits a prosperous developing country. Our children are willing and able and therefore have the right to expect from society the kind of employment which corresponds to the extent of their labour and intelligence. Yet in spite of Government's intentions in this respect, the increased opportunities in education are, to a large extent, merely reinforcing the numbers in courses leading to the more traditional occupations for which the supply by far exceeds the demand. Regrettably this creates rather than solves, problems for our economy in that it produces qualified people for whom not enough jobs are available, and worse than that, it creates a real shortage or underemployment in those sectors upon which the future prosperity of our Island depends. From what I know this kind of problem is not confined only to Malta. It is common to most newly developing countries.

The lure of the white collar jobs is too great to be put aside by the students and their parents who guide them and who rightly look at the status, salary and prospects of employment which in theory should follow upon the completion of their studies. While personal background, national tradition, the seeking of job security and the reluctance to embark on something new account for preference in the choice of career and hence the course of studies, there is no solid reason to suppose that students who for example take an arts subject could not take up an engineering subject with equal prospects of success in their studies.

The expansion of higher technical education is complementary to a programme of industrialisation. The technologists are the skeleton around which a factory is created and grows and in time prospers. These key personnel should in turn create employment opportunities for thousands of others who are not themselves technologists. In industrially advanced countries, the ratio of technicians to operatives is around one to ten. Admittedly this is only a rough estimate and it varies from one industry to another. We want to raise the standard of living of the population as a whole by

having a greater proportion of the working force contribute towards greater productivity by their intellectual ability rather than through manual labour. One need not overemphasise the point that on a personal as well as a national level, more wealth is created by the exploitation of one's intelligence, than is created by manual effort. In short we want to increase the number of professionally trained employees, and reduce the number of 'machine operators'.

If the present situation demands that we go through a major industrial and economic revolution, it seems that Higher Technical Education is playing only a minor role in this development. This is certainly not what the planners had in mind when the Malta College of Arts, Science and Technology was set up 12 years ago. Since only people who are trained and qualified can, through their intellectual contribution, lead to success a programme of industrialisation, the failings pointed out earlier on are indeed a matter of very grave concern for the future. We are now realising that while this type of education is certainly very useful to the Island, the extent of its use is being determined by the industries themselves and not by the Government's efforts in this respect. To build up a nation of manual workers on minimum wages, to raise the family income, to entice agricultural workers into industry, to be at the mercy of the whims of foreign investors and external market and political situations, amounts to merely replacing one form of dependence by another. In analysing the detailed answers to the questions raised by this problem, one can appreciate the underlying factors which account for the present situation, and assess the likely consequences on the future. Once aware of the inherent weakness of the present industrial set-up, the agency responsible for the guidance of industrial development, can take appropriate measures to rectify this lack of balance in the numbers of job opportunities created for technologists and operatives.

If the College itself is not supplying the technologists on any significant scale, then one is bound to ask the question as to how the manufacturing industries have been meeting their demands for them in the various grades. Before the Polytechnic was set up, the number of people having any qualifications in engineering, was very small indeed. Such people gained their knowledge through employment with the armed services. So it is reasonable to conclude that there did not exist in the Island a pool of trained and

qualified engineers and technicians, which industry could draw upon. There were hundreds of highly skilled craftsmen, who were indeed very competent at doing specific jobs. These people filled the vacancies created by industry, and I have no doubt that many of them worked very efficiently under the guidance of expatriate technologists, and industry was satisfied. Therefore, the very sad fact emerges that the needs of local industry as it is constituted at present are indeed very limited. Industry's intake of technologists is low because the system as a whole is inherently weak, and not because there is no real need for them in significant numbers. I regard the difficulties which industry is facing in Malta, to be in part a direct consequence of its failure to utilise to the full the output from higher technical education.

The failure of the export orientated industries to create employment opportunities on a sufficiently large scale to absorb all the engineering students from the Polytechnic, should not be used as an excuse for drastic measures, such as reduction in the number of courses now running. The fault lies at somebody else's door. Besides ex-students from this College, are giving very useful service in other sectors of the economy, sectors which themselves service and support the industrialisation programme, and which I have not touched upon in this paper. It should be remembered that the object of higher technical education is the creation of a large pool of qualified manpower for industry to draw upon, when it needs it and in the quantity it needs it. While it is true that many students who have completed their course, have not as yet found suitable employment, this should be taken as a warning signal and not a major cause for alarm. It is the scale of the problem which makes this warning signal a cause for concern, and a stimulus to take remedial action.

It is totally unrealistic to expect that the timing of the needs of industry should always coincide with the period when students complete their courses. One must allow for a period of anything between five and ten years during which one year's output is gradually absorbed by industry and used effectively. This has in fact already been happening, and I have no doubt that this process would continue. It is the scale of this process which has so far been so disappointing. It takes from one to two years to set up a factory, but it takes between five and ten years to produce a tech-

nologist – with useful experience.

TYPICAL INDUSTRIAL ESTATE FACTORY: INGREDIENTS OF PROFITABILITY

Having established that Malta is capable of providing the right kind of technologists to service industry, and having found that the failings are outside our control, it is appropriate to have a closer look at the industries which failed to create the employment opportunities which were expected of them. We begin by asking a very fundamental question as to why foreign industrialists set-up shop in Malta to manufacture for export. The brief answer is, the profit motive, profit on a scale which is not attainable by investing the same capital in their own countries. The next question to ask is then: 'What are the main ingredients of a profitable industrial undertaking?' Very briefly I would say the right combination of men, machines and managerial skills. Let us now examine these points in some detail, to see the manner in which each contributes to the overall profitability of a firm, naturally treating the matter purely on principle and excluding all the other factors which do not have a bearing on the technical aspect of this paper.

Managerial skills under local conditions usually embrace a variety of functions performed by one or a very small group of men, more likely than not, expatriates. Most export orientated manufacturing concerns are small, or at least they start with a very small number of employees. So the owner or his representative in Malta reserves solely for himself the functions of general, production, personnel, technical and sales manager; that is he does an all round managerial job. He himself is usually a highly skilled technologist, a specialist in fact, who is very competent in the field covered by his enterprise, and it would be fair to add, that it is not likely to find anybody on the Island who can do his job with the same degree of overall efficiency, because none has the relevant experience in that highly specialised line of product. It must be realised that because of the small size of the firm, to have this type of management is perfectly normal, especially in the initial period of the firm's existence. The industrialist who sets up shop in Malta in fact relies on making economies of this type to make legitimate fat profit, by drastically cutting down on the overhead expenses, on a scale as big as he can get away with.

He brings with him the kind of skill which he rightfully turns to

his advantage, skills which we ourselves do not as yet have, and which technical education alone cannot provide. He is an exploiter in the very legitimate sense of the word, in that for example he is exploiting his intimate knowledge of market conditions for a particular product, together usually with widespread contacts which would serve his purposes by ensuring sales in the quantity and at the price which would guarantee him a profit. He may be exploiting a new manufacturing process, or a new product, probably one of his own design. As the originator, he has faith in its sale potentialities and is thus just creating a new market for himself out of his own ideas.

He probably comes from employment through which he built up vast experience of a process; which he thinks he can use to his own advantage. All this is perfectly acceptable practice. This kind of thing is going on all over the world. The emphasis is on profit arising from the use of specialist knowledge, personal initiative and/or original ideas, which the local people seem to lack. This kind of knowledge is never taught in Colleges and it takes a 'people' generations before they become bold enough to establish industries based on the exploitation of their own original ideas.

We reach the sad conclusion that the management of such industries regards itself as self contained, and it does not need technologists and technicians to assist him in his task. He would require them only if the firm prospers and expands to the extent that he himself would not be able to exercise control of the various functions alone. Even in that event, it is more likely that he would promote somebody from within the firm, rather than employ an inexperienced outsider. He would employ a number of people other than machine operators, but these trained by him and working under his instructions or general direction, need not have the broad based general technical education which the College provides. Nor are the services of such people genuinely required, or so the manager thinks. The manager believes that he knows everything and directs everything from matters relating to production planning to details about a minor maintenance job. There is no room for making use of the employee's intelligence and initiative, for making use of College acquired knowledge, for testing new ideas and so on.

There is room for process controllers or machine operators by

the *scope*; for a small number of supervisors, clerical staff perhaps, and a small number of maintenance fitters, but there is no room for the technologist and technician. The product line and the process are fixed and operation proceeds as dictated by the management. All that is wanted is machine operation as fast and with as great an economy as possible.

By machines I mean to include all the material requirements for production. The Government provides the factory building at a low rent, together with financial incentives in the form of grants, loans, subsidies and tax exemption. Local banks provide up to one third of the working capital, hence it is fair to say that the industrialist himself provides approximately one third of the total investment in the form of machines, plant items and workshop tooling. It is therefore appropriate to concentrate one's attention on the machines themselves. In many industries, the product and its manufacturing process are such that no major items of very expensive plant are required, and workshop facilities are on a very small scale.

The industrialist who *invests* his money in Malta envisages the maximum return on his capital through the exploitation of the abundance of the relatively cheap labour and not on the exploitation of the massive productivity of very expensive plant and machinery as is usually the case in the technologically advanced countries. With this order of priorities in mind, he invests the absolute minimum on capital outlay consistent with the needs for maximum economic productivity of the labour force which he employs. Consequently we see the growth of these industries where the average investment on machinery per employee is very low indeed, compared with that of the more advanced countries. One can see examples of this in factories making electronic equipment, rubber seals, leather goods, plastic components and clothing. There are expensive machines in these places, but the general case is that each machine feeds on work to an appreciable number of production line employees, themselves equipped with the very simplest of tools and additional machinery. An injection moulding machine can be taken as a good example of this. These major items of basic plant, production machinery and supporting machine tools are generally standard equipment and as such are relatively inexpensive though they may appear to be very impressive to the non-

technical visitor to the firm. The operation of this class of machinery relies on the use of labour which has to be trained to acquire the specialised skill in performing the job, and it is practically independent of College education. The machines, processes and products are so specialised that key personnel have to be sent to factories abroad to gain the necessary knowledge, training and experience. This practice is supplemented by the services of expatriate technical staff engaged in management, supervision, and training the local employees to take over from them. All this is technical training and experience outside the scope of Government sponsored technical education. It is perfectly normal practice anywhere in the world, for a manufacturing firm to train its employees in performing the specialist tasks assigned to them. Even in advanced countries, the technologists themselves have to be trained by and gain experience with the firm which employs them. Colleges do not train machine operators. These are skills acquired in a matter of weeks if not days or even hours.

The emphasis here is on the exploitation of abundant, cheap, disciplined, easily trained labour to operate the machines, labour which probably costs less than one third of the corresponding grade found in the rest of Western Europe. The fraction is perhaps even less when overall labour costs are considered. While this category of labour may be available in the quantities required in the industrialised countries, the minimum wages which it demands are determined by the general level of prosperity of the rest of the community. In other words, the standard of living of the country and not the qualifications or the productivity determine the employee's remuneration. The industrialist who sets up shop in Malta wants to exploit precisely this point, as the local wage levels which he pays are determined by the general level of prosperity of the underdeveloped country and not by productivity levels. As he concentrates on labour intensive processes, his total savings are substantial, and contribute towards a big profit in the shortest possible time, without risking huge capital investments.

It can therefore be appreciated why the technologist has no place in this scheme of fast profit making. This is certainly not a healthy pattern of jobs distribution, and while it makes for big profits within a few years, it is only sound if treated as a matter of short term policy. Because of their small size, these factories

usually consist of just one department, the production department. In an industry devoted to the manufacture of just one product, working conditions for the major part of the labour force approximate the worst of the 'factory system', the men just become a part of the production line. Naturally, the bulk of the profits evaporate out of the country.

This is indeed a retrograde step for our economy in that instead of raising our standard of living through following in the steps of the more industrialised countries, we are unwittingly absorbing the problems which these very same countries are so eager to shed themselves. In fact they are passing on solely the undesirable part of their technology, that is the part which relies on cheap labour. These countries are investing in their higher education even more heavily than we are doing. Their declared aim is to create a society where every citizen has the means and the opportunity to make the maximum contribution to his own prosperity and to that of his fellow human beings. The resulting structure of society is such that the number of qualified and trained people per 1000 of the population is rising rapidly, while that of people with the barest minimum of education, that is the kind which supply the factories with the 'machine operator', is rapidly decreasing. It is precisely because of the shortage of this type of manpower that industrialists from Western Europe set up factories in underdeveloped countries.

It would be most appropriate to point out that when we speak of the 'industrialisation of our Island', we are in fact referring primarily to the setting up of light industries. Whereas the latter constitutes one aspect of the 'industrialisation process' of a country, it falls by far short from making that country industrialised, in the sense that we apply the term to most of the countries of Western Europe. A country becomes industrialised when it sets up a complex vast network of inter-related and interdependent productive and servicing units which make it economically self-supporting. The average capital investment per head of population is usually very high; productivity and wages follow suit. The industry supporting services alone such as rail transport, power supplies, university based research etc., constitute major enterprises on their own right, and the individual industries themselves, cover more than mere production lines. The setting up of light industries im-

plies the direct route to the 'production line' without the expense and benefits of supporting technology and services.

Enough has been said about the employment structure to leave very little to add about the 'men' who contribute to the profitability of a firm. Since the work is usually of a repetitive nature the cheapest grade of labour for the specific job is employed. The bulk of the working force is made up of unskilled labour, with a high proportion of young females. The need for craft skill in manufacture is eliminated through the use of production machinery and the sub-division of the manufacturing process. Jobs such as those involving maintenance and toolroom work, require the employment of skilled and semi-skilled people, usually working under the direction of the manager and his expatriate assistants. As an example, the scale on which the maintenance work for a small firm is carried out, is too small to justify the employment of a technician to take charge of it. The same can be said for other activities, normally requiring the service of technologists. There is not enough specialist work to keep such people occupied on a full-time basis, and hence such duties are performed by the manager himself or his subordinates, some of whom are totally unqualified for such tasks. Usually the employment opportunities improve as the firm expands and consolidates its market at the same time usually becoming aware of its deficiencies. A number of Government aided firms have in fact already reached this stage, others have failed to expand, and some are in grave financial difficulties.

A VERY IMPORTANT OBSERVATION: CAPACITY FOR FLEXIBILITY

We have seen how the above employment structure has, through the incentive of big profits for the investors, created employment for thousands. The industrialist's profit has been allowed to leave the Island untaxed in the belief that the employment thus created constituted an end in itself, from which our population stands to benefit. We now realise that things are not in fact working this way at all, in that we see the security of continued employment created by a large section of the export orientated industries threatened by the fact that many of them are running into difficulties. One cannot blame the industrialists for not employing the technologists and technicians whose services they thought that they could do without. But one must certainly blame them for creating an employment structure which completely disregards one of

the most basic principles of good factory organisation. I am referring to the in-built capacity to cope with variations in market demands insofar as they affect the product itself, its quality and the manufacturing costs. These are matters which only the technologist and the technician can deal with adequately. This is why I am maintaining all along that the employment structure as originally constituted was inherently weak.

It is generally recognised the world over, that many manufacturing enterprises of the 'industrial estate' type, are extremely vulnerable to fluctuating market conditions. These risks owe their origins to events thousands of miles away, and the investor and the host government have no control over them whatever. While Government assistance is essential in the initial stages of setting up a factory, it is reasonable to expect that after a few years such industries should be able to stand on their feet and be capable of facing competition in world markets. Let us have a brief look at examples of factors which determine market conditions to appreciate the difficulties which such firms have to face.

Many engage in the production of consumer goods for which there is already a surplus of productive capacity in the rest of the world. Under these conditions a firm can hope to remain in business if at least its manufacturing costs are highly competitive. Here it is useful to point out that the technology of low cost quantity production is not synonymous with the skill of machine operation, or craftsmanship. The two are worlds apart. This calls for specialist knowledge and ingenuity in the application of production techniques which only the intelligent trained man can provide. If the production process does not keep abreast of the developments taking place in competing countries, there is a danger that such a firm's product would be squeezed out of the market, as competitors exploit to the full the benefits of their technical innovations. Production techniques and machinery are being improved all the time, the extent of this process usually being determined by the size of the market for the product, the capital available for investment in research and development, and the unpredictable genius of man himself. The majority of these improvements, while usually never very spectacular and never understood or appreciated by the general public, do have a significant influence on the production costs.

Another hazard which such industries have to face, is the setting up shop by competitors in employment starved communities in other under-developed countries. There is enough capital in the world to enable many countries to do just this. The main point here is that the industrialist shifts his sphere of operations to exploit the cheaper labour available in these countries. As has already been explained, there is as much suitable labour in these backward countries as there is in Malta. These are the type of industries which rely for making a profit on the balance of substantial overhead expenses, and on the exploitation of cheap labour.

Some industries, because of the very nature of the manufacturing process, operate on an extremely small margin of profit. Not so much because the process itself is unprofitable, but because of fluctuations in the scale of the demand for the product. That is, the overall profit is extremely sensitive to market conditions. The profit may be very large once the factory is in full production, but once the output rate falls, overheads of one kind and another swallow up the profit accumulated during periods of peak production. This fact emerges from an analysis of the unit-cost build-up of the finished product in the form that it reaches the world markets. The benefit of industrialisation can only be transmitted to the economy through the country's own contribution towards the manufacturing process.

To start with let us consider those elements of the selling price from which we do not stand to gain at all. Most of the profit itself goes abroad to the investor, untaxed and unchecked. The raw materials themselves are imported. These, together with the finished products are transported in foreign owned facilities. The electric power consumed is generated at an uneconomic rate. The factory buildings are built by the government and let at a heavily subsidised rate. Fees for manufacturing licences go abroad, together with most of the earnings of the industrialists in their capacity as managers, directors, technical experts, etc. A great deal of money leaves the firm to pay for advertising, market research, sales organisations and other specialist services performed abroad. The production plant and machinery, which is probably the biggest item in the unit cost build up, is all imported. From this it can be seen that the employees' contribution to the overall sales value of a product can, on average, be very small indeed, but this depends on the product.

That brings us to that extremely important consideration in all manufacturing activity, the production process layout. Some products are converted from material in the form in which it is supplied into the finished product, in just one or two machine operations. As an example of this one can take the extrusion of plastic piping. The 'value added' in this type of process, expressed as a fraction of the total manufacturing cost, is so small that one must wonder whether it is at all worth while investing in this type of industry, unless appreciable sales in the home market are guaranteed. Again considering the implications of the unit-cost build-up, it must be appreciated that the real money making, wealth creating elements of the manufacturing process are retained in the hands of the foreign investor, safe within the borders of the country of origin of the capital. This type of investment has invisible strings attached to it. The money making elements of manufacture, that is, those operations performed through the service of highly paid technologists and managers, are never transferred to Malta, and consequently a kind of permanent dependence is established through the provision of expert services, the sale of spare parts, retention of the sales organisation, and most important of all, control of the selling price, in the form of overheads.

Let me give an example of this. A British firm arrives at the conclusion that it is no longer economic to produce rubber seals in its own country, and sets up a subsidiary factory in Malta. In seal manufacture, the ratio of technologists to machine operators is of the order of about 1 to 500. The parent firm retains for itself, the marketing, research and development, together with the manufacture of the very expensive machinery which is used in seal manufacture. These activities require a ratio of technologists or equivalent grades, to operator grade labour, of about 1 to 10. It can therefore, be appreciated that the contribution of manual labour in increasing a nation's wealth is pitifully small indeed. Human labour is inherently relatively cheap and unproductive in an age when machines are taking over from man most of the monotonous repetitive tasks in manufacture. In very sharp contrast, the application of the human intellect to productivity is most rewarding to the man himself and to humanity as a whole. No machine can ever replace this function of man, but man himself must be trained and given maximum opportunity to make the best use of his intellectual powers.

Returning to the implications of the process layout. Some finished products consist of an assembly of parts, each part requiring a number of operations, such that the total value added within the factory becomes substantial. This type of manufacture, quite apart from its benefits of a high proportion of labour content, gives much greater scope to the local technologist and technician to make his contribution towards the economics and flexibility of production, particularly in the fields of production management with all that this implies. This in itself is a vast subject which we need not go into. This is the field where our students should fit in, in much greater numbers than at present. The valuable work of those ex-students employed with the export orientated industries, is indeed a great encouragement to us and acts as a pointer to the potential contribution which the College can make to the industrialisation of this country.

This consideration of the process layout leads to the most important observation of this study, mainly the flexibility of the product and its manufacturing process. In the preparation of this paper I attempted to obtain statistical data to support my observations by concrete facts. The published statistics did not give the information in a form which could be useful for my purpose. I intended to draw up a list of export orientated manufacturing firms, and for each determine

(1) the number of employees which can be classified as technologists and technicians engaged in maintenance, production, drawing office, toolroom or similar factory servicing facilities.

(2) the number of shop floor unskilled or semi-skilled employees mainly in the category of machine operators, that is the bulk of the labour force.

(3) from these two figures derive the ratio of operatives to technologists, the ratio being considered as highly significant, because it is regarded as an index of the flexibility of the firm.

(4) to obtain details about the progress and prosperity of each firm, and stating this in the form; firm shut down; facing financial difficulties; managing, but with difficulty; limited but satisfactory and normal progress; very successful. Any other form of information relating to the financial standing of the firm would not be feasible to obtain.

(5) to examine whether facts as recorded in the last point are

related to the above mentioned ratio, in support of the idea, that 'the greater the number of technologists to operatives, the better are the prospects of a firm, in achieving the aims for which it was set up in the first place: profit, continued employment and expansion.

With these ideas in mind, it would be useful to have another look at the inherent flexibility of the firms and their products. One cannot generalise all that easily when dealing with such a large number of enterprises, but it would suit our purpose to group the firms as follows.

In the first group I would place all those factories in which the plant, the process and the product are fixed practically for the entire lifetime of the factory. One can take firms engaged in the manufacture of synthetic fibres, animal feeding stuffs, soap powders, edible oil etc., as good examples of this group. Because of the very heavy investment in plant, such firms usually rely on a steady domestic and export market. The main openings for technologists and engineers are in plant maintenance. For actual process control, skill and training acquired within the firm are usually regarded as more important than academic qualifications. In this type of industry, key jobs go to people with the best knowledge of the process, which usually implies a system of internal promotions to those with the greatest experience. Many factories of this type which run into difficulties, do so either because of fluctuations in market demand for their highly specialised product, or because they have ignored the need to set up proper maintenance facilities. Some of these firms, themselves subsidiaries of old established firms in Europe, took great care of the maintenance aspect, and installed their own foreign technicians. These are gradually being replaced by local personnel, though for such posts experience is regarded as being of greater value than academic training alone, hence up to now openings for our technicians in this field have been very few indeed.

In the second group I would place all the 'machine' based industries, that is those where the product is completed through the operation of a number of machines in series. I have in mind those industries where the number of machines is relatively high in relation to the total number of employees, machines which do not cost less than anything between £M500 and £M1000 each at least. Although a great deal of minor machinery is used in most factories,

most of it cannot be regarded as the basis of machine operation. This type of machinery usually has provision for some measure of flexibility in the product, either through the specific setting of the machine or the use of templates or dies to suit the product design. This introduces another element in the make up of the labour force. In addition to the maintenance services, the firm must provide facilities for the design and production of the tooling (e.g. moulds), assuming that these are made in Malta. Fresh openings are created for technicians in the design and the highly skilled work of manufacturing the moulds. Unlike the first type which cannot alter its product to suit demand, this type of firm does not suffer from this inherent weakness. Through this ability, the firm is in a better position to work on a batch basis, and hence cater for a greater variety of products, still within a specific range, which is usually very wide. This product flexibility is therefore justifiably related to a lower ratio of technologists to operatives. I know that some moulds are obtained from abroad, but there is no reason why they cannot be made locally.

In the third group I would place those industries which contain a combination of some fixed plant, some machines, and a great deal of minor special tooling. The greater part of the last named equipment is usually made within the factory itself to suit specific manufacturing techniques peculiar to the product. This, in my opinion, introduces the third and most important field, in what may be regarded as the supporting services of a factory. This is the element which enables the firm to expand in such a manner as to extend the range of its products and to cut down in its production costs. This is the type of firm with the greatest prospects. Success is dependent on the employment of technologists and technicians, through whose efforts the firm's products remain flexible and competitive. The higher proportion of technologists to operatives, makes up the services which support the production side of the factory, if they are not actually engaged in it.

CONCLUSIONS AND PROPOSALS

Having reached the conclusion that one of the root causes for our failures in industrialisation is the low ratio of technologists to operatives, one can propose measures to put this matter right. As can be seen from the analysis of the export orientated industries,

some of the problems arise from the very nature of the industrialisation process itself. The investor sets up shop in Malta to make a big profit within the shortest possible time and in the process he creates employment for thousands of people. Matters outside this mutually acceptable arrangement are no concern of his. By the time that the long term unpleasant consequences of this policy become apparent, his original investment would have depreciated to the point, of not being economically useful any longer. He would have already made enough profit to enable him to pack up and leave. Whether we like it or not, there is very little that the Government can enforce on the industrialist, to avoid the inherent weakness of such a process, without scaring him and other prospective investors away. But a great deal can perhaps be done to consolidate the programme of Higher Technical Education and ensure that the foundations are laid for a sound industrial economy for the future. The potential gain from the proposed measures is a form of long term investment.

Returning to some very basic concepts about the long term aims of industrialisation. In an effort to create the maximum number of jobs in the shortest possible time, the Government offers incentives without considering the immediate resulting employment structure of such a process. Priority is given to getting industry rooted in Malta, in the hope that given time, the problems mentioned would be solved without Government intervention. One accepts this normal process, provided that the pace of industrialisation, shows satisfactory progress. It is assumed that as firms expand, as they pay greater attention to their production efficiency, as satellite industries emerge, as expatriates are replaced by locally trained people, as more factories are established in Malta, as the manufacturing processes involved become more sophisticated, employment opportunities would be created for as many technologists as the College can provide, and this in turn would increase the number of students seeking places in the courses which are already running. We can already see examples of this very welcome development. Now we must ensure that the scale of this process is maintained at such a level which corresponds with the scale of the investment in Higher Technical Education, and the extent to which we want to see our country industrialised. The following proposals should therefore be regarded by the Government as part of its du-

ties towards its own citizens, and not as an imposition on the industries themselves.

(1) Government must encourage Higher Technical Education, by providing subsidised employment in the manufacturing industries to *all* the students who join engineering courses at the Malta College of Arts, Science and Technology. Assuming that all the students involved in this scheme are following sandwich type courses, it implies that for that part of the year when the students are not at the College, they are in employment in industry. This is done for the specific purpose of giving all the students the opportunity to gain industrial experience. This scheme would ensure that by the time the student has completed a five year course for example, he would have enough practical knowledge of the workings of industry, to supplement his academic qualifications.

The Government should not impose upon the individual firm, the status which the student would enjoy in his employment; whether he is classified as unskilled labour, apprentice, trainee etc. is in itself irrelevant, as this depends on a number of factors, such as the age and ability of the student, the stage reached in his studies, his aptitude towards the particular work, and so on. Let the industrialist exploit this type of employee to his best advantage, and in time, without compulsion, he would come to appreciate the extent of the student's contribution to the firm. The scheme creates the opportunity for employer and prospective employee, to test each other, without engaging on permanent commitments.

There is hardly any implication of any additional financial burden to the Government as this is precisely what it is already doing though in a slightly different context. I am referring to the fact that it is already subsidising the wages of apprentices and other employees in the same category. Because most students are young and inexperienced, these wages cannot be very high, so the overall cost to the Government of such a scheme cannot be very great. The scale of the subsidy to the wages which the employer pays the student, would take into consideration the actual contribution of the student to the firm. The Government subsidy would be terminated on completion of the course. Whether the student then remains with the firm or not, is up to him and his employer to decide.

(2) Complementary to the above, the Government must insist that the aided industries employ not less than a specified ratio of Gov-

eminent nominated students in relation to the other grades of labour at any one time. This should not prove to be difficult, provided that the Government does not insist on the position which such students hold within the firm. One can gain useful experience from all types of manufacturing activity. Naturally such students would be expected to be employed on productive work, and not allowed to idle away their time. It is to be assumed that in all cases involving the placement of students or technicians in industry, the individuals themselves are acceptable to the management of the factory.

(3) A Government organised and supervised industrial training scheme should be set up, such that all students would have gone through a balanced programme of training in industry, through the type of employment mentioned above, by the time each would have completed his course at the College. Preference should naturally be given where practicable, to the type of employment most in line with the studies of the student. Through the opportunities thus created, the student may already have had experience of a number of firms by the time he has completed his course.

(4) The implementation of such a scheme requires that all the engineering courses should run on a sandwich basis, without implying at all that there is any change in the academic content. I would suggest extending this system even to the degree course. This at present takes up five years starting from 'O' levels. I would suggest making this a six year course, which includes the two years up to 'A' levels on a sandwich basis, so that training in industry could begin from the time that the student decides to take up engineering as a career. It is absolutely vital that engineering students should have acquired enough industrial experience by the time that they complete the course. There are other advantages of this scheme which I need not go into.

All these measures aim at increasing the output of effectively qualified people per year without adding to the number of courses and classes which are already running. By increasing the number of students per class, we would be using more efficiently the existing facilities for Higher Technical Education. It would be useful if records are kept for each engineering student, showing the nature of the employment taken up on the completion of the course.

(5) In handling out subsidies to industry, the Government must

insist on the employment by the firms which receive such aid, of a fair proportion of technologists and technicians, at least in a trainee capacity, to ensure that there is a satisfactory employment structure within the firm itself, consistent with its own needs for efficiency. This is primarily intended to ensure that the firm is run on a sound technical basis. The numbers to be thus employed would be determined by the nature of the technical services required and not by the ratios referred to earlier.

(6) Similarly, the Government must insist on the employment of technologists and technicians who have already completed their studies, very specifically for the purpose of gaining industrial experience. Ratios for technologists to operatives should be established for each factory, but it may not be practicable to insist that these people be necessarily employed as technicians as they may not as yet have the experience required for the job. Another reason may be that if these are appointed as technicians, it would mean the redundancy of more experienced but less qualified members of the existing staff. It would be logical to assume, that in general, management would make the maximum use of these people, according to circumstances. But these people should not feel disappointed, if for a time they may be compelled to do work, which they regard as being below their status.

Apart from giving these people the opportunity to gain industrial experience, these qualified people would be available to run the factory in the event of management deciding to close it. Government should encourage this process, by allowing the transfer of technicians from the Drydocks who are at present working as fitters and have no immediate prospects of promotion. As an inducement it should make up for the difference in earnings between their present wages and those obtainable through the new employment. In all these cases, once the employee is accepted by the management as a technician proper, all subsidy should cease.

(7) The Malta Development Corporation must encourage the setting up of industries which employ a fair proportion of technologists to operatives. It should also encourage the building up of a qualified technical staff, in the existing industries.

(8) The same body must assist in the emergence of satellite firms, which engage on specialist work, as a service to the other industries. As an example, one can consider a medium-sized fac-

tory specialising in the design and manufacture of moulds for the plastics industry. Such firms usually employ a fairly high proportion of technologists.

(9) It would be useful to compile statistical information, from which the ratio of technologists to operatives can be established for all the firms at any time.

(10) The government should take steps to set up a technical and managerial consultancy service, such that all the firms can have access to the best expertise available in the Island. Small firms which may not themselves be able to afford the full time services of technologists, would particularly benefit from such a scheme.