 FOREWORD

In recent years, the Vocational Rehabilitation Branch of the ILO, in close co-operation with the ILO Turin International Centre for Advanced Technical and Vocational Training and thanks to the generous financial support of the Danish International Development Agency (DANIDA), has organised a series of five regional training courses for managers of vocational rehabilitation, production and sheltered workshops for disabled persons.

The first course was held in Addis Ababa, Ethiopia, in 1975 for a group of managers from English-speaking countries of Africa. This was followed by similar courses for managers of workshops for the disabled from Near- and Middle-East countries (Athens, Greece, 1981), Latin American countries (Bogota, Colombia, 1981), Francophone African countries (Yaoundé, Cameroun, 1982) and Asian and Pacific countries (Solo, Indonesia, 1983).

The reasons for giving such high priority to management training were three-fold. Firstly, it was recognised that the development and expansion of workshop services for the disabled were being seriously hampered by the lack of skilled managerial staff. Secondly, managers of many of the existing workshops had little or no experience or training in workshop management expertise. Thirdly, the whole concept of providing sheltered workshop employment for the disabled is undergoing radical change, i.e. sheltered workshops were originally conceived as heavily subsidised employment outlets for severely disabled persons who could not cope with the demands of the open labour market. As developing countries have very little capital available for recurrent subsidies to make good the losses that such workshops invariably incur, the need for a fresh approach to developing viable workshops for the disabled on small-scale industry lines is now being more widely recognised.

The problem of disablement in developing countries worsens year by year. Wars, natural disasters, malnutrition, industrial and traffic accidents leave millions of disabled in their wake, adding to the large numbers crippled by poliomyelitis, leprosy or those severely handicapped by visual impairments, and as opportunities decrease, the need to create workshops, co-operatives and self-employment for the disabled has never been more urgent.

It is with the above considerations in mind that the training courses were conceived and developed. Their main objectives were to help participants:

- study in a realistic setting the organisation, administration and operation of vocational rehabilitation training and sheltered workshop facilities for the disabled;

- undertake practical studies and exercises in rehabilitation workshop management techniques, with particular emphasis on the equipping and layout of workshops, planning and implementation of training and work schedules, selection of products, production scheduling and control of manufacturing operations, vocational rehabilitation techniques, sales outlets for finished products;

- exchange information on vocational rehabilitation and production workshop services in the region concerned and discuss management problems encountered or foreseen;
- examine, through an active lecture, group and plenary discussion programme, the basic techniques of sound and effective management of workshops for the disabled and how best they could be applied to the participating countries.

This handbook contains the main and essential elements of workshop management techniques which emerged from the lecture and discussion programmes, as well as from the many visits made to various workshops for the disabled in the regions where the training courses were held. It is hoped that its contents will help to inform and inspire all who wish to ensure that the highest possible level of management of workshops for the disabled is attained.

Norman Cooper
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ILO Vocational Rehabilitation Branch
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INTRODUCTION

The discussions and the concrete steps generated by the 1981 International Year of the Disabled Persons aroused world-wide interest and showed orientations that should be followed in an attempt to improve the living and working conditions of disabled people. In this connection, the Report of the Director-General of the International Labour Office, presented to the International Labour Conference in June 1981, placed major emphasis on vocational rehabilitation of the disabled to ensure their full participation in equality of treatment and employment opportunities. The ILO, in fact, has been concerned with this subject since it was founded in 1919, and has a special Branch devoted to the problem.

In recent years, significant support has been obtained from bodies responsible for financing technical co-operation actions on both the international and bilateral level. The programme of aid for disabled workers, with a view to their vocational rehabilitation, was further expanded following the impetus created by the International Year of Disabled Persons (1981).

Experience gained in improving the planning and organisation of vocational rehabilitation systems and in providing for the training of specialist trainers under the best conditions and for the more efficient investigation of the job prospects of the disabled in the industrialised countries represents a store of knowledge that must be shared with experts from other countries who are now deciding which policy they should adopt to help their disabled, and the mechanism by which this policy should be implemented.

The Turin International Centre for Advanced Technical and Vocational Training has actively supported ILO technical co-operation programmes for the disabled. It has, on many occasions, organised or taken part in the organisation of training for those trainers specialised in the vocational rehabilitation of the disabled. The author has contributed to the further discussion of the subject that has taken place on the international level over the last eight years in the course of seminars and workshops in Asia, Africa, Europe and Latin America and in 1983 continued these efforts in the Pacific Region.

The need to make provisions for employment opportunities available to handicapped persons was recognised by the International Labour Organisation in 1921. Today, many international and national actions, directed towards preparing and providing for employment of the disabled, depend upon the ILO's Vocational Rehabilitation (Disabled) Recommendation 99 of 1955, recently supplemented by a new Convention No. 159 and a Recommendation No. 168 concerning Vocational Rehabilitation and Employment (Disabled Persons). People are considered to be handicapped if they have restraints to normal living such as blindness, deafness, physical or mental infirmities and other related conditions. These may be the result of heredity, serious accident, crippling illness or similar causes. For disabled adults it is not always possible, in many cases only with great difficulty, to fit them into gainful employment.

For a disabled person there are many ways in which employment can be provided within a sheltered workshop, within a small enterprise mainly employing disabled personnel, in a workers' co-operative, by individual enterprises, or by integration into regular employment in a local industry, or agriculture, or government service.

This handbook has been prepared to help those who have the responsibility for setting up and managing enterprises which mainly employ disabled persons in gainful activities.
THE EMPLOYMENT PROBLEMS AND JOB PROSPECTS
OF DISABLED WORKERS

Many handicapped children around the world, particularly those that have some severe form of physical, mental or sensory impairment, attend special "protected environment" schools. At the age of 16, or even 18, their sheltered existence ends. From living for many years in a protected environment, they suddenly find themselves cast out into the world at large. This induced psychological trauma has a severe effect on their lives, particularly as they are often without means of support and also not in employment.

Many countries, by legislation, require industrial enterprises to employ disabled persons as a regulated proportion of their total work force. Unfortunately, with one in ten of the world population suffering from some disability or impairment, the number of employment opportunities, legally provided, falls far short of the number of handicapped persons who need to be employed.

During this century, through the introduction of scientific management techniques into industry, much has been done to improve productivity in those enterprises employing at least 95% of persons who, for want of a better phrase, have normal working capabilities. Very little research has been carried out into the way in which enterprises can wholly or mainly employ disabled persons. It can therefore be said that "not enough applied research is being carried out into employment opportunities for the handicapped".
In the developed world, although extensive welfare services are usually available, the need to create employment in the present depressed labour market situation is becoming almost as acute as in the developing world. In the low-income countries welfare schemes do not exist and there is a great need for capital, buildings, machines and equipment to be put at the disposal of the disabled population.

Also regional differences exist. For example, in Africa persons presently being trained in rehabilitation centres or sheltered workshops consist mainly of those who are physically disabled as a result of disease or malnutrition. In addition, many young persons who migrated from rural to urban areas in search of better job opportunities but did not find the job they were looking for, tend to swell the ranks of the beggars or petty criminals.

Because of undernourishment or illness, gradually they have swelled the growing number in Africa, who are medically disabled and this has aggravated the social and employment situation of those who were originally disabled by atrophy of the extremities through leprosy, or by insect borne diseases causing blindness.

In Latin America there are wide contrasts. Several countries have developed comprehensive rehabilitation services through the medium of social security schemes. Some countries have three stage provision for the disabled. Other countries in the region are not so advanced, but are attempting to develop managerial expertise so as to improve the services given by existing facilities.
The three-stage approach in Latin America consists of:

1) Rehabilitation therapy and work skills training within hospitals or medical institutions. These services adapt newly disabled persons, as far as possible, for a return to normal living and working.

2) Sheltered and training workshops operating nationally for the initial preparation and training of disabled persons in skills which match employment opportunities.

3) Public and private enterprises setting up production areas within normal manufacturing processes so as to integrate disabled persons into the working environment and to give them dignity through job satisfaction.

Taking examples from the Asian region and Singapore in particular:

the President for the Society for the Aid of the Paralysed wrote in a recent survey report:

"One thing that stands out as the result of the survey is that the handicapped must be given employment. The main problem that stands in their way is mobility. Mobility stands in the way not only of employment but also leisure activities and education. It may well be that incentives have to be offered to employers to employ handicapped persons by giving them tax exemption so that the additional expenses that may be incurred in providing mobility and work aids will not be looked upon as impediments to employing the handicapped."
In Asia, as in other parts of the world, employment is as important to the disabled as any other aspect in helping them to lead a normal life. This is especially so for disabled persons who have experienced working life before disablement, or who have the appropriate qualifications to be employed if given the opportunity. Those concerned with rehabilitation of the disabled in Asia and the Pacific often report that prejudices and superstitions still abound in rural areas, which comprise a major proportion of the region. Rural people still believe that disability or handicap of a person is a "Sanction from God" upon the village where the handicapped person lives and that nothing can be done to improve the situation.

In these circumstances, it is very difficult to persuade the handicapped to be seriously interested firstly in education and later in training so that they will be able to accept a good level of employment opportunity. Luckily, with the deeper penetration of education into rural areas and a better understanding of social issues in local communities, these beliefs and superstitions are gradually being forgotten.

In the scattered Pacific islands, the difficulties of bringing rehabilitation services to the handicapped are tremendous because of the distances involved and the present lack of an organised infrastructure. Despite the range of services available, little is being done to serve the disabled in rural areas.

As an example of a national situation, Greece has a high proportion of handicapped persons of an advanced age and taking care of the older handicapped makes a great demand on available funds. This reduces the resources available for training younger disabled persons for employment. Although young persons are being helped in their transition from training to employment, job opportunities for the handicapped are very difficult to obtain in most countries of the Middle East.

Following the impetus created by the International Year of Disabled Persons, government officials and rehabilitation workers in all countries are becoming increasingly aware of their responsibilities towards the disabled. They are, more than ever before, taking into account the productive potential of persons previously not considered for normal industrial employment. They are also considering new approaches to effective employment promotion for the disabled, so as to provide improved living conditions for some of the least favoured members of their nations. This strategy has not been helped by the productive situations of most countries which are mainly in economic contraction.
The question officials concerned with the handicapped are trying to answer is: how to make these less fortunate persons more useful and dignified members of society and, at the same time, more productive within the national economy. Rehabilitation specialists generally may learn from the new approaches being applied and try out the same, or similar, techniques in the rehabilitation of others socially unfortunate within their societies.

If the number of job opportunities available to handicapped persons are not sufficient within the manufacturing sector, then other possibilities have to be considered. When governments have accepted handicapped persons for employment within the public sector and have advertised their willingness to do so, as in Sri Lanka, this has encouraged other employers to follow this lead. The growth in size of the service sector has opened up many more opportunities than previously for the gainful employment of disabled persons in tourist offices, tourism services, hotel and catering activities, and in publicity and packaging.

The formation of horticultural, agricultural and industrial co-operatives and a wider development of a spirit of entrepreneurship has led to many handicapped persons being self-employed and self-supporting in home industries. This
progress has been considerably helped by the development of rural community programmes for the handicapped. A successful scheme is presently operating and expanding in Indonesia.

Unfortunately, quota schemes obliging employers to employ a specified number of disabled persons are difficult to enforce during times of economic recession. As was stated recently by an employer responsible for a large work force, "With disabling illnesses and other factors affecting our work force, we generate our own handicapped population. The dimension of this generation process means that we are employing more handicapped persons than the legal requirement. Therefore, we can accept no more from the open labour market".

To alleviate the plight of the socially disadvantaged, whether they are disabled or not, it must be within the ingenuity of mankind to design systems so as to integrate this ever increasing, though marginal, population into contemporary society, with possibilities for generating income and a more fruitful life. Neither training nor legislation alone will make this possible, but there is an evident need to design and provide work opportunities for the handicapped, so that they can have a better standard of living and regain their lost dignity.
Some preliminary concepts

The technical management of small enterprises mainly employing disabled personnel is concerned with the planning, allocation and utilisation of resources to achieve a desired objective. Or stated alternatively, it is the job of management to take resources and mould them into goods or services which are of value to the community and, through this action, provide employment opportunities for the handicapped.

The main resources are firstly people, whether or not they have some degree of disablement, secondly materials to be converted into products or services, thirdly equipment aids or machines and, lastly, money for the purchase of resources and the payment of accounts.

It is management's objective to make products or give services in which time/cost ratios are optimised and, in the case of enterprises mainly employing disabled persons, to ensure as far as possible, that employees are able to develop their full potential.
The successful enterprise

For an enterprise to be successful five factors are important:

- An opportunity is present which supports the manufacture of a product or the development of a service.

- A strategy exists so that the identified opportunity can be fully developed.

- Sufficient financial resources or credit facilities exist.

- The enterprise has technical and commercial expertise within it or available to it.

- The manager is both knowledgeable and skilful as well as being imbued with an entrepreneurial drive.

Enterprise failure

The factors which lead to enterprise failure are:

- Rapid fall in demand for products or services.

- High cost of sustaining fixed assets.

- High overhead costs.

- Lack of attention to accounts receivable or long-standing debts.

- Overstocking of tools, materials, or finished components.

- Low level of internal control of processes, finances, management information and records.

- Lack of competent technical or managerial staff.

- Excessive staff costs.

Factors for success

But the main factor for success in the early development of an enterprise is the drive and determination of all those concerned to make the venture succeed. The main measure of their success is that goods or services are delivered at the due date, at a price acceptable to the consumer and at a cost which develops financial reserves so as to ensure the future progress of the enterprise. One of the first functions in which technical management will be involved is planning.
Planning

Planning is that function of management which sets the objectives and targets for the workshop, or enterprise. In the plan, the various resources previously mentioned are allocated, work methods established, the organisational structure needed to reach the target is prescribed and a system of control is set up, so as to ensure that the objectives are being reached.

The plan should contain the following elements:

(a) A definition of the work programme's aims and goals and its duration.
(b) Procedures for procuring and allocating resources.
(c) Alternative processes, or methods, for the optimal utilisation of resources.
(d) Periodic up-dating of the plan to account for unexpected events and allow for beneficial changes to take place.

To transfer the plan into practical action requires authorisation at various levels.
Many fine plans have been produced that never get past the design stage for various reasons, such as:

1. The plan was attempting to achieve too much in too short a period of time.
2. Insufficient consultation with political or other ministerial authorities when researching the criteria for the plan.
3. Changes in the local economic situation reducing expected financial resources.
4. The plan was too idealistic and had little chance of being converted into practical action.

When the plan has been finalised, based on sound analysis and forecasting, then authorisation to put the proposal into action has to be obtained from the appropriate sponsor, whether this is national, local or financial.

Once the plan has been authorised, then decision-making factors come into play.
Decision making

Decision making infers the setting up of an effective communication system. In this sense, communication can be defined as any process in which operational information is transmitted from one member, within the enterprise, to another. Without effective communication channels the enterprise cannot function.

Decision making involves three steps:
(1) Listing alternative strategies and solutions.
(2) Determining the consequences of implementing a favoured decision chosen from the alternatives.
(3) Comparative evaluation of the consequences of other alternatives.

Analysis of most decisions taken within a small enterprise operating with a participative management policy would reveal that decisions are the response to a complex structure of influences.

These influences may arise from factors external to the enterprise, e.g.: ministerial decree, local financial regulations, market forces, raw material supplies, consultant advice, etc., or from internal factors, e.g.: quality of product, effectiveness of financial accounting, management style, absence of personnel, lack of production skills, etc.

Often, facts relevant to a decision are of a rapidly changing nature, ascertainable only at the moment of decision and often applied by the decision maker without a full appraisal of factors (1), (2) or (3) above being possible. This, then, is the concept of calculated risk taking.

Often, in the limit, the success of a manager depends on his capability to take "balanced" risks and, to ensure that risks are monitored, a control system is essential for organisational management.

To enable decision making to take place, second level authorisations have to be given to those officials expected to put the plan into operation by defining their individual roles and responsibilities. Once these roles have been prescribed, the management task is to describe the organisational structure necessary for the achievement of the prescribed target.
Organisational structure

Signifies setting up a structure within which officials operate so as to attain a common goal. Organisations are formed mainly for one of two reasons: either the tasks involved become too great to be handled by an individual, or to obtain or utilise resources which require the actions of more than one specialist.

In a small enterprise mainly employing disabled personnel it is often found that a single manager handles all the business functions such as purchasing, marketing, accounting, etc., but, as the enterprise expands, some or all of these functions have to be delegated.

The breaking down of discrete functions into elements, and the arrangement of these elements so that each item is within the competence of an individual or a group of individuals, is one of the principles of organisation. With this division of functions within an organisational structure, a need arises for co-ordination and control.
Control

The purpose of control is to ensure that resources are progressively and effectively utilised. As the health of the enterprise relies to a large extent on financial stability, one important function of control is to provide up-to-date financial records to management. Control in this sense should not be confused with other functions such as authority, responsibility, supervision, etc.

Once a plan of action has been established and the main features communicated to responsible officials, then control activities have to be instituted.

Control activities cover four main areas:

- Measuring
- Comparing
- Reporting
- Correcting
Measuring

The plan should have established measures or benchmarks to be controlled from time to time. The frequency with which measurements of the operation need to be taken will vary from one enterprise to another dependent on differences in local factors.

Measurement should not be carried out at too frequent intervals so as to become a high cost administrative burden, nor at too infrequent intervals so that the results of measurement are out of date before corrective action can be applied.

Comparing

After measurements have been taken, these have to be compared with the interim results expected as laid down in the action plan. In this comparison phase, significant divergences are noted and management action taken in respect of exceptions from expected results.

Reporting

As the controller, usually, is not the manager who will have to take action as exceptions from the plan arise, then the results of observations or measurements and their significances will have to be reported. Reports should be as brief as possible, with exceptions highlighted. Where facts are hidden inside extensive data, there is a danger that significant changes may not be identified by the official receiving the data.
Correcting

When significant changes from the plan are reported, then one of two courses of action have to be taken:

(a) Corrections to bring exceptions back to the forecasted norm,

or

(b) The action plan is modified to allow for the new exceptions.

The controller reports on exceptions, but it is up to the manager to decide whether (a) or (b) should be put into operation. This concept of "different roles" must be clearly understood, otherwise the manager begins to usurp the advisory functions of the controller and the controller begins to take over the supervisory function of the manager.

The control function in a small enterprise may be delegated to a single official but, as the enterprise expands, it may be necessary to have separate controllers for:

- Production
- Product quality
- Budget
- Cost

The manager analyses the control reports from each of these functions, then compares, balances and acts accordingly. Whilst it is difficult to give a specific indication on how large the control action should be, it can be related to production operations as a function of the number of personnel in employment. In most enterprises the number of persons employed in some form of control (remembering that controllers are not managers) should not exceed 12.5% of the total productive work force.

To summarise, managing the small enterprise means getting results through people. Inanimate objects such as materials, machines and money, have no value unless men and women make them work for the benefit of the community. If a manager has more work than he can handle alone, he manages others, in order that they can work effectively.
For a number of reasons, including lack of experience, those to whom the manager delegates responsibility may not work effectively and the job of improving the subordinates level of effectiveness rests squarely on the shoulders of the manager who cannot delegate this duty. If the manager effectively improves the performance of his subordinates, he will improve also the productivity of the enterprise.
Productivity is defined as "A measure of production efficiency" and takes into account the value of output when compared with that of the input. This simple statement hides the fact that to measure productivity is a complex task. Firstly, the results obtained depend on WHO is responsible for making the measurements.

An economist will get a different result to that of a marketing manager and a production manager is likely to arrive at a different conclusion to that of a financial controller.

In an enterprise mainly employing disabled people, what should the basic data be for considerations of input and output? Should we only consider production volume, or costs, or the efficiency of the work force? Or should we try and measure the social consequences of providing employment to those previously unemployed and, possibly, having to be supported by welfare schemes at a fairly high cost?

As Rudyard Kipling said:

"I keep six honest serving men
They taught me all I knew;
Their names are what and why
and when
and how and where and who."

To answer some of the questions posed above, the manager has to continually question himself, his strategies and those benchmarks against which he is measuring the successful operation of his enterprise. Once this type of questioning stops, the enterprise is likely to go into decline.

As financial control is of major importance in ensuring that the enterprise is operating economically and effectively, the next chapter will deal with financial management factors.
Financial management needs

Workshop management has to provide goods or services so as to satisfy the demand of customers and the transactions involved have to be recorded in financial terms. Managing finance depends on accurate presentation of accounts showing gains or losses so that the manager can take steps to keep production in control. This requires a process of book-keeping or recording which provides a detailed history of the financing of operating activities and a summary of accounts at defined periods.

The need to maintain a strong financial balance is essential if an enterprise is to avoid going into voluntary liquidation and wind up its activities.

When an enterprise is in a weak financial position, there is an over expenditure of management energy on financial control and a consequent economic restriction on product development. Equipment cannot be renewed, new staff cannot be hired and eventually the organisation shows severe signs of fatigue. Once this is noticed by clients, orders fall away, this is followed by further financial restrictions from banks or other sources of credit. At this point, unless there is a heavy injection of capital from government, or other financial sponsors, the rehabilitation workshop cannot be sustained as a viable enterprise.
This chapter does not intend to provide a detailed guide to financial or accounting techniques and principles, but it is intended to give some points of information which will assist in the management of finances.

An enterprise has to have funds to cover the purchase and maintenance of buildings, machines, raw materials and also for the payment of services and salaries. Thus, consideration has to be given to the need to provide finance for:

(a) premises and equipment;
(b) production resources;
(c) wages, salaries, contract expenses, etc.
To raise funds, if they are not provided nationally, a manager has to discover potential markets for the products of his workshop and then to decide on the size of the production operation required which is directly related to sales volume in the immediate, middle and longer terms.

Working capital

The manager has to constantly concern himself with the size and composition of the working capital and he requires, at regular intervals, level statements of available cash, if he is to maintain a strict financial control. For management purposes, changes in financial trends from one statement period to another are much more significant for financial control and analysis, than having to extract such elements from arithmetically accurate financial data.

The manager must consider how much of the income can be used to provide or maintain fixed assets. That is, those assets that are needed to allow production to proceed but cannot be sold in the foreseeable future. Fixed assets are buildings, installations, furniture, etc. Fixed assets must be kept apart from current assets; current assets provide funds for current use, such as purchasing raw materials, providing services, e.g. gas, electricity, water, etc., paying for work in progress, or paying off debtors.

The amount of capital required to finance fixed assets is usually easily estimated once a manufacturing plan has been established. However, whilst manufacture of products or the provision of services is proceeding and before clients have settled their accounts, the workshop or co-operative must keep going, workers paid, outstanding bills settled and some financial reserves kept in hand to meet unforeseen emergencies. The resources devoted to those actions are called "working capital". Working capital may be described as the difference in value between current (but not fixed) assets and current liabilities. A significant indicator to the health of an enterprise is the monthly statement of the working capital available.
**SIMPLIFIED WORKING CAPITAL STATEMENT \( \times \text{US$ 1000} \)**

<table>
<thead>
<tr>
<th>ASSETS AND LIABILITIES</th>
<th>THIS MONTH</th>
<th>LAST MONTH</th>
<th>SAME MONTH PREVIOUS YEAR</th>
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</thead>
<tbody>
<tr>
<td><strong>CURRENT ASSETS:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash reserve at bank and in hand</td>
<td>75</td>
<td>92</td>
<td>70</td>
</tr>
<tr>
<td>Material stocks</td>
<td>125</td>
<td>95</td>
<td>85</td>
</tr>
<tr>
<td>Finished goods</td>
<td>40</td>
<td>55</td>
<td>60</td>
</tr>
<tr>
<td>Work in progress</td>
<td>90</td>
<td>84</td>
<td>85</td>
</tr>
<tr>
<td>Debtors</td>
<td>115</td>
<td>160</td>
<td>90</td>
</tr>
<tr>
<td>Advance payments to suppliers</td>
<td>15</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL ASSETS (A)</strong></td>
<td>460</td>
<td>521</td>
<td>410</td>
</tr>
<tr>
<td><strong>CURRENT LIABILITIES:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creditors</td>
<td>280</td>
<td>306</td>
<td>245</td>
</tr>
<tr>
<td>Expenses payable</td>
<td>75</td>
<td>140</td>
<td>75</td>
</tr>
<tr>
<td><strong>TOTAL LIABILITIES (B)</strong></td>
<td>355</td>
<td>446</td>
<td>320</td>
</tr>
<tr>
<td><strong>WORKING CAPITAL AVAILABLE (C)</strong></td>
<td>105</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>( C = A - B )</td>
<td></td>
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</table>
In analysing this simplified statement, an auditor would consider that the enterprise from which these figures had been obtained was not in good financial health. As a rule of thumb, the working capital ratio between current assets and current liabilities should be closer to 2:1, otherwise there is likely to be an insufficiency of capital available for ensuring that daily operations can proceed safely.

**Accounts**

If all transactions are completed on a cash basis, then accounting becomes a matter of keeping records only; but trading is not usually carried out on a strictly cash basis, many items purchased are not immediately re-sold. A system of accounts has to be set up to show purchases and sales with an indication of the activities in progress requiring financial aid for their completion. Accounts must at least be produced in a financial statement at the end of each calendar year, but six-monthly balance statement intervals are preferable. Although a balance sheet may be useful to interested parties outside the enterprise, (often as a legal requirement), on the financial health of the workshop; such information is of little help in the day-by-day management of a complex organisation.

Accounting is an essential part of financial management within an enterprise and, in addition to keeping the books straight, it provides management with information on the state of operations. The accounting officer has the duty to ensure that financial information is correct and available to the manager in a convenient form, but is not required to make operational decisions based on the analysis of the situation.
Running expenses

The manager will also be closely concerned with the day-to-day operations of the workshop and, in this respect, he must give constant attention to expenditure. He should be aware that when expenditure seriously exceeds income, this can signal a possible need to consider closing down an inefficient workshop.

The workshop should be envisaged as a body of persons who are taking actions and that, if something unusual is happening to an arm or a leg of that body, then the brain must know about it. In this analogy, the manager represents the "nerve centre or brain" and must receive immediate information on unusual changes in the body of the enterprise if they affect financial control.

In the same way that fixed and current assets can be separately identified, so running expenses can be divided into fixed and variable expenses. To make this distinction, it should be understood that:

(a) Fixed expenses are independent of changes in production output, e.g. rents, taxes, postal charges;
(b) Variable expenses are directly related to changes in output, e.g. materials, expenditure on electricity, casual labour costs, etc.

These expenses can be identified against the total operation, but a further breakdown is also used in small workshops, particularly when considering the effectiveness of homogeneous working groups.

This further sub-division considers direct and indirect expenses:

(i) Direct expenses are those directly affecting the value of a product or group of products, e.g. raw materials, labour costs;
(ii) Indirect expenses are incurred by the group of products, but do not increase the value of the product, e.g. inspection services, labour waiting time.

In this connection, it should be mentioned that workshop wages should be considered in both direct and indirect accounting. If the worker is producing, he is being paid a wage, but during his production cycle he may not always be productive because of waiting for instructions, etc. The ratio of payment for direct productive work in relation to indirect waiting time can have a substantial effect on product pricing if the indirect time becomes excessive.
Costing

Costing provides expenditure control through the maintenance of detailed expense records. These records provide information for estimating production costs and they also highlight those products which are costly to produce and also those which have the best production cost/selling price advantage. Costing, therefore, classifies, records and allocates workshop expenditure. When generated income falls below cost expenditure, then negative allocations (losses) have to be posted. Cost accounting continues on a daily basis and gives a good indication to the manager on the health of his enterprise before the regular financial statement, or balance sheet, is available.

The way in which cost accounting keeps a running control on expenditure can be illustrated as an example.

OPERATION: To make document folders from plastic sheets -
- Production output -- plastic document folders.
- Five workers are occupied in the cutting, seaming and finishing of document folders.
- Each can call on materials as and when he requires them.
- At varying times during the working period, each worker requests from the material store various items such as plastic sheets in rolls, plastic ribbons, sealing agent, metal fasteners.
- To obtain any of these items, they complete a stores request, or a stores request is completed by the storekeeper when he delivers the materials.
- These plastic document folders have a cost code identifier PDF81/4.
- The cost accountant debits the PDF81/4 production workshop account and credits the store account.
- Finally, the total credits to the accounts ledger in the cost accountant's office must agree with the total debits in the same ledger.
Also, the shop foreman, or leader of each work group, keeps a record of the salaried time spent on each coded job and this is sent to the cost office for posting to the coded account in the form of direct and indirect costs. With experience, the total expected indirect expenses of waiting time, work on faulty material, etc., for each working group, can be estimated in advance for each coded job and on-costed as a percentage average to each job. For each job, the building up of cost factors can be used as a basis for a pricing policy.

**Budgetary control**

The first step in setting up budgetary control is to prepare estimates of expected sales volumes for separate products. From the pricing policy referred to above, the income expected from the sales can then be forecast.

Production, distribution, sales and other functional groups within the enterprise are asked to forecast the resources needed to meet the expected demands and whether any sub-contracting or new equipment arrangements will have to be made. A budget is then drawn up for the next financial period of either six months, or one year or two years, and an estimate of monthly costs to meet sales demand prepared as part of management planning (see chapter 2).

When the operation commences (in the next financial period) actual costs are compared regularly with budget forecasts and action taken whenever a wide disparity between the two occurs. It may be necessary, if disparity continues, to go through the operation again and prepare a revised budget for the period. It must be remembered that preparing a budget is like reading someone's fortune or telling someone what will happen in their future life. The fortune teller is likely to be wrong. Budgets are not sacred writings, but can be revised whenever common sense dictates.

**Cash flow analysis**

Cash flow analysis is applied to expected cash inflow (income) and planned cash outflow (expenditure) so as to identify the dimension of available cash. Managers use cash flow analysis to help them plan their cash requirements, make optimum use of available cash, decide dates to pay creditors, forecast when they may be in need of additional working capital and the date on which it may be reimbursed.
To better understand cash flow, it is preferable to consider an example of a cash flow forecast. This cash flow forecast would be prepared at the beginning of an "operational" period and carefully monitored during that period to ensure that surprises resulting from shortage of available cash do not occur.

**SAMPLE OF A CASH FLOW FORECAST (x US$ 1,000)**

<table>
<thead>
<tr>
<th>PERIOD BY MONTH ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SALES DEMAND IN PRODUCTION UNITS</strong></td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>450</td>
<td>450</td>
<td>450</td>
</tr>
<tr>
<td><strong>CASH START AVAILABLE (A)</strong></td>
<td>35</td>
<td>42</td>
<td>(11)</td>
<td>16</td>
<td>66</td>
<td>65</td>
</tr>
<tr>
<td><strong>CASH INFLOW</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts</td>
<td>300</td>
<td>250</td>
<td>320</td>
<td>320</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>Depreciation</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>TOTAL INCOME (B)</strong></td>
<td>308</td>
<td>258</td>
<td>328</td>
<td>330</td>
<td>360</td>
<td>360</td>
</tr>
<tr>
<td><strong>CASH OUTFLOW</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed costs</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Variable costs</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>180</td>
<td>210</td>
<td>210</td>
</tr>
<tr>
<td>Interest payments</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Capital repayment</td>
<td>--</td>
<td>20</td>
<td>--</td>
<td>--</td>
<td>20</td>
<td>--</td>
</tr>
<tr>
<td>Taxation</td>
<td>--</td>
<td>--</td>
<td>10</td>
<td>--</td>
<td>--</td>
<td>10</td>
</tr>
<tr>
<td>Capital reserve</td>
<td>10</td>
<td>--</td>
<td>--</td>
<td>10</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL EXPENDITURE (C)</strong></td>
<td>301</td>
<td>311</td>
<td>301</td>
<td>281</td>
<td>361</td>
<td>351</td>
</tr>
<tr>
<td><strong>CASH AVAILABLE A + (B - C)</strong></td>
<td>42</td>
<td>(11)</td>
<td>16</td>
<td>65</td>
<td>65</td>
<td>74</td>
</tr>
</tbody>
</table>
From the cash flow forecast, it can be seen that accounts receivable in the first two months, dependent on goods previously supplied, are somewhat low. Particularly, the second month refers to a national holiday period when debtors will not be expected to credit their accounts.

Also, in month 2, capital repayment of a bank loan has to be made and this takes cash available into a negative balance to keep the negative balance as small as possible and to ensure a good recovery, no cash is transferred to the working capital reserve in months 2 and 3.

As the amount of cash available increases, higher transfer to capitals reserves are made in months 5 and 6. Capital on loans has to be repaid in months 2 and 5; and taxation covered in months 3 and 6.

Depreciation

In the cash flow forecast, within the section cash inflow (income), an item which relates to depreciation can be noted. Assets, in an accounting sense, are economic resources devoted to business purposes within a specific enterprise. A characteristic common to all physical assets held by an enterprise on a long-term basis, is that their useful lives are limited. In other words, their potential value declines over time to a point where it is, for practical purposes, used up or lost. Three major factors can be the cause of this decline:

- Wear and tear in daily use.
- Technical obsolescence.
- Commercial obsolescence through a fall in market demand for the asset.

As far as the cash flow forecast is concerned, depreciation is a value adjustment which reflects the loss in value between two successive dates. It is clear that, as obsolescence proceeds, "cash available" has to be utilised for the purchasing of replacement equipment or tooling, unless other capital reserves are available for renewal purposes.
Standard costing

Standard costing attempts to provide a control on current costs before they are incurred, by setting up synthetic standards which have their basis in information gathered from previous experience with operating costs, material costs, etc. Actual costs can be compared with standard costs in the same way that operational costs are compared with budget forecasts. Standard costs should always be based on normal operating conditions; there is a danger when fixing standard costs only to consider working in ideal conditions, but as this never exists in practice, the tendency should be avoided. On the other hand, where excessive waiting time or spoilt material is increasing, this should not be considered as a normal situation.

The purpose of standard costing is to signal rapidly to a manager when actual operating costs are going out of control by comparing with the pre-set standard.

Normally, standard costing cannot be applied effectively unless standard job specifications are drawn up for tasks and for all staff in the organisation. It may be that standard costs are not being met for reasons outside the control of the production sector. Each person's function in the organisation should be clearly described, including his authorities and responsibilities. To be effective, standard costing has to be based on good production methods, good specification and ordering of raw material and consumable components and good distribution possibilities to point-of-sale, coupled with an effective production and financial control system.

Summary

In brief, this chapter has indicated those areas in which it may be worthwhile to consult other literature on financial management and control. In any manufacturing workshop, sound financing ensures the prosperity and well being of all those employed within it, and must not be left to chance or given only minor attention if successful development is to be assured.
Work, particularly for the handicapped, is essentially a social process and a workshop a place where people not only work together, but also live together in a community. The workshop manager can do little on his own, he depends on others to support his efforts to get things done.

In this chapter, we are not talking about personnel management principles, methods, rules and administrative procedures, but more about the role in a working community of a workshop manager or supervisor.

The workshop staff go to work for a defined number of hours and days in each year but, as the old story says: "Someone told me that you work at the XY enterprise" - and the employee replies: "Oh, no!, but I go there every day".

The number of hours and days an employee is engaged in productive work depends largely on his or her motivation and the effectiveness of the manager in obtaining a positive work output from each employee.

Let us look at a bar chart of a typical working day of a handicapped person employed within a small enterprise.
Although the bar chart indicates that a 100% productivity ratio is much too idealistic, it also indicates that a 44% result needs attention and improvement. A more realistic productivity ratio of 75/80% can be achieved by the workshop manager studying and improving activity items B, C and E.

A major problem for many handicapped persons is mobility and, unless they are working at home or living in a community of which the workshop is a part, they will have to be provided with transport to and from work.

The workshop manager should ensure that the private or public company which is used to transport handicapped persons to and from work is effective. If it is not, then alternative arrangements have to be planned into longer term strategies, so as to remove loss of productivity through erratic arrival and departure times of the work force.
As some types of handicapped persons need access to medical services on a fairly regular basis, this can also be the subject of lost working time through absenteeism due to employees having to attend medical centres. Perhaps, at least in some enterprises, it may be possible to provide consulting facilities at the workshop premises and arrange for visits by medical practitioners on a regular rota. It should also be noted that, where machines, production aids or tools can be considered dangerous, the workshop has an obligation to provide first-aid facilities to deal with work incurred injuries. Such a first-aid centre could be arranged so that facilities are also available for a visiting doctor and so combine both requirements.

Handicapped workers, as a generalisation, tend to have higher rates of absenteeism than physically able workers and this must be taken into account in the management planning of work manning schedules.

The best way to resolve absenteeism is, as far as possible, to prevent it. Prevention begins at the time of employee selection interviews: questions must be asked of the prospective employee (and, perhaps, of his former employer) about his level of absence during previous periods of employment and the main reasons. At this interview, it can be stressed that every employee gives an important contribution to the productivity of the workshop and that absence from work of one employee can seriously affect the output of others.

As a follow-up, a supervisor should be instructed to meet with those employees who are returning from periods of absence, however short or long, they may have been. At such a meeting, following a long absence from work, either the employee should be given a briefing on what has transpired in the production process in his absence; or, for short absences, try to discover if low work motivation was the real cause.

In the Japanese system of workshop management, employees are involved in the process of identifying production hold-ups, eliminating waiting time, discussing reasons for absenteeism and asked to suggest changes in production methods which may lead to an improved quality of product. This "involvement approach" has proved, in an increasing number of applications, to lead to a greater sense of worker participation in production decisions and to bring about an improvement in
employee motivation. As motivation is one of the major factors affecting the handicapped, particularly after mental illness or similar states, any management technique which, within a given culture, will help the employee to achieve satisfaction in work should be introduced. As will be discussed in chapter 6, motivation also depends on positive influences from the layout of the work place and on the provision of fair working conditions within a good environment. Managers who want to have a productive work force should constantly ensure that both working conditions and the working environment do not deteriorate.

A further feature of good workshop management is to provide each employee with a job description which details the content of the task and also includes the authorities and responsibilities required from the person occupying the post. This procedure is not often carried out in those enterprises which employ a small number of handicapped persons, but is better instituted where it can be applied without creating suspicion. A well-written job description for each post within the enterprise, accompanied by a term of reference for the individual who occupies the post enables the manager to measure performance at suitable intervals, design training programmes to develop further the capacities of the employees as their productive skills increase and is also useful as a reference when arguments develop following ineffective performance. In setting out a job description and its relevant terms of reference, minute detail should be avoided; the major functions should be identified and any areas in which the employee is required to take decisions clearly specified.

It must be remembered that a manager's main objective is to try, as far as possible, to make the enterprise financially self-supporting and self-reliant. Employee performance has to be seen in this light and the concept that a handicapped person cannot be considered as a producer within a competitive system should be reduced to a minimum. The more effective and efficient the enterprise, the better will be the future prospects of those employed within it.

Once the employee is at his work post, he must not be subjected to hazardous situations. This infers that the manager must concern himself with the welfare of those in his charge and ensure that all working areas are as safe as possible. Safety, like product quality, depends on the attitudes of mind of both the manager and his employee. Unfortunately, there is a syndrome in most workshops that "Accidents happen to other persons and not to me. Other people should take precautions and use safety devices and protective clothing, but I am so clever, I do not need to be so careful". The manager has to encourage workers to guard against their own over-confidence and insist that all equipment is so safe that even an inexperienced person could use it without risk. International statistics show that approximately 1 in 3 accidents causing major injury are due to the neglect of the manager, the other 2 are mainly caused by the employees
taking risks or neglecting safe working procedures. Accidents causing severe damage to the body of a handicapped person are much more traumatic to all concerned - the employee, his family, his colleagues, the manager - than those which similarly occur to able-bodied persons. It is not only a duty, but also a moral obligation for a workshop manager to ensure that a handicapped person in his charge does not become more infirm as the result of an accident in his enterprise.

Other aspects of welfare have to be dealt with more carefully but must also conform to the best practice of other enterprises in the locality. Welfare privileges, once provided, such as catering facilities, sports associations, loan societies are difficult to cut back in times of financial stringency, without losing employee's good will. Such facilities should only be provided if there is a chance of their becoming financially self-supporting. Often, it is better to have catering facilities provided by an autonomous contractor rather than being charged against enterprise staff and budget costs.

What can a manager do when an employee, through lack of ability, lack of motivation or deterioration in physical condition, is no longer capable of performing his specified tasks? Each case has to be treated on its merits, but a manager cannot afford to retain workers for reasons of sentiment. According to the labour laws in force in the locality in which the enterprise is situated, he may not be able to terminate employment. In many employment contracts, it is possible with new entrants to hire for a probationary period, in the first instance.

When a vacancy occurs and a candidate is available, the interview procedures should involve capability testing. Having taken into account the requirements of the task and the suitability of the candidate to perform the required operations, irrespective of his physical or mental handicap, a practical test should be carried out in the workshop before considering the offer of a probationary period of employment. It is very difficult to measure personality traits and work behaviour patterns in a brief practical test; these have to be assessed during the three- or six-month probation. If the results of the aptitude test and also the performance during the probationary period are satisfactory, then a more permanent contract of employment can be offered. This approach ensures
that the need to terminate the employment of unsatisfactory performers is reduced. Where the situation develops and, by law, it is not possible to terminate the employment of an employee, the only solution is to identify a different occupation and retrain the employee for new, and possibly more suitable, tasks.

To maintain and improve the productive skills of the work force as a whole, the manager should consider training as a normal on-going activity. Whether we are considering training handicapped for gainful employment at home, in a rural community or in a manufacturing co-operative, their manager, although not necessarily a training expert personally, should know how to provide training for those within his care. Some small enterprises have a training role to play so that handicapped workers, after spending some time there, can move out to set up their own small enterprises or individual workshops.

To assist the manager in his task, one of the employees can be a full or part-time trainer. But let us ask the question: "Can this employee be trained in a standard training course provided for technical trainers?". The general answer to this question is clearly a "yes" but a further question has to be asked: "To what level of effectiveness can such a standard course help a trainer whose main duty is to train disabled persons having widely varying disabilities, so that their trainees may practice skills lead to gainful employment?".

Evaluation of the effectiveness of trainers of the handicapped made some time after their return from standard instructor training courses, has shown that their application of relevant training methods was much lower than could have been expected from the ratings obtained in end-of-course test results. When the content of the general course they had attended was analysed, it was found that, although specific topics were helpful in improving general training skills, they did not provide for the special needs of trainers of the handicapped. In other words, the knowledge and skills acquired were very good, but there was a lack of practice in applying those skills to a population of handicapped trainees.

If a manager requires one of his employees to be trained in the skills of training the handicapped, a new approach has to be found and experimented. The manager must also realise that, because a training programme has been highly demanding on the learner, who has achieved good results and who is highly motivated on returning to the enterprise workshop, this in itself does not guarantee that the new trainer will be effective in training disabled persons to carry out their tasks more effectively.
Frederick Herzberg, in his often quoted work "Hygiene factor influences on behaviour", showed that positive motivation to carry out a task, in this case the training of handicapped workers, can be seriously affected by negative influences arising within the workshop environment. The trainer returns from the training course highly motivated and positive thinking. He wishes to put his new found knowledge into practice as quickly as possible. He finds that negative influences within the environment inhibit his motivation and, in a short while, he gives up the struggle and lapses back into the same methods he used before attending the training course.

But what do we mean by negative environmental influences? Dr Galloway, former Director of the Production Engineering Research Association in Great Britain, referred to this as the H.I.P. barrier to progress in production enterprises.

"H" stands for "history barrier" ("-We have always used this method and we have no intention to change to a new method.").

"I" stands for the "incentive barrier" to doing something positive ("-My manager criticises everything I do, he never accepts my ideas, so why should I try to create anything positive or worthwhile?").

"P" stands for the "psychological barrier" ("-Look here, my friend, if you put into practice your new proposals our big boss will lose face, so I advise you to forget the idea.").
A method of training trainers, which departs from the traditional approach of attending a course of study for individual instructors, has been developed by the ILO's Turin International Centre. This newer concept of individualised learning is based on an approach similar to that used by engineering designers when investigating "User Behaviour Techniques".

Summary

To summarise, the manager of a small enterprise employing mainly handicapped persons has to be aware of those factors which will ensure that production workers are motivated towards optimum productivity. The ways in which he can achieve this are many and varied, but must be regularly applied if the most important resource being managed - PEOPLE - can realise its full potential.
SELECTING AND DEVELOPING PRODUCTS TO BE MANUFACTURED BY DISABLED PERSONNEL

Introduction

In small enterprises mainly employing disabled persons, or in modern rehabilitation centres and also in sheltered workshops, there are several strategies to be taken into account when considering the selection and development of products.

To know which of these strategies will lead to improvements in living conditions for handicapped persons, it is first necessary to develop an improved awareness and a greater skill in making both suitable and appropriate choices of products from the many possibilities that are available.

Selection of products

To improve this awareness, let us consider how small-scale enterprises decide upon which new product, or products, they can introduce successfully into their manufacturing system. Usually, they begin by trying to answer a series of questions. The questions are:

(a) DEMAND: Will there be a continuing demand for the product over a period of time?

(b) MARKET: Are product marketing facilities readily available? (Local/Export).

(c) COST/PRICE: Can the enterprise manufacture the product at a low-cost level which allows it to be sold at a price which is attractive to a consumer?
(d) CONSUMER: Is the product to be marketed attractive to the consumer, so that he will purchase from that enterprise, or its market agents, rather than purchasing from a competitor?

(e) RESOURCES: Are resources available, including finance, labour, materials, equipment, technical skills?

Technical questions also need to be considered, such as:

i) Is finance available to support the initial stage of the venture, or at least until the product is self-supporting?

ii) Can local material resources meet primary or secondary needs according to product specification?

iii) Is the local plant, with its machinery and equipment, able to manufacture the product?

iv) Are sufficient managers, as well as skilled and unskilled workers, available to carry out the manufacturing tasks?

v) Are technical skills sufficiently advanced in the manufacturing enterprise so as to allow a new technical production system to function effectively?

These same questions must also be considered by managers of rehabilitation centres and workshops employing handicapped persons if their enterprise is to be financially stable and economically viable.

Of necessity, the answers to equivalent questions given by a manager will be different when graded according to their respective priorities. For instance, the enterprise manager may be concerned with financial improvement and capital reserves as a first priority, whilst for a sheltered workshop a higher priority may be given to available material, plant and human resources so as to satisfy a social need.

From these considerations, it can be seen that a careful statement of managerial objectives is very important before decisions can be taken on the most suitable type of product to be manufactured by handicapped persons.
Setting up a Product Development Group

Once managerial goals and manufacturing objectives have been clearly defined, then the workshop manager should try to set up a product selection and development service.

In the first instance, it would be sufficient to employ one person partially on this task. The task of this product development officer would be to continually look at market outlets for the products of the workshop, set objectives for the development of new products and eventually decide on manufacturing methods to be used so that the new development can be introduced into the workshop without disturbing those production activities which are already in operation.

Product development may be carried out by one person alone; however, because human behaviour, social relationships and employment generation for handicapped people may be a major concern, then a group approach to product development is much more effective.

A product development group should contain a series of specialists, including those with experience in finance, market planning, system design, information gathering, manpower development, engineering processes, economics, human behaviour, etc. The members of the group should be complementary to each other, but do not necessarily have to be homogeneous in status, knowledge or skill. The development group can be part of, or closely connected to, a university department, or productivity centre, or training institution. The group members would not normally be on the payroll of the workshop, but may receive an honorarium.
One of the first problems for such a group is that which is concerned with comparing objectives and setting criteria for product manufacture which takes into account different time horizons. The group will have to compare objectives which include:

(i) short-term goals for solving immediate problems;
(ii) medium-term goals for providing a sound basis for development; and
(iii) the longer-term target for producing self-reliance;

and these will be affected by:

(a) technical factors;
(b) social factors;
(c) ethical influences.

(a) Technical factors

The ability to introduce a new product into an already existing workshop will depend upon those technical methods which fit within the workshop environment. Technical methods, in turn, will depend upon the types of disability and handicap within the working group and this, in turn, will affect objective decision making in respect of the development of suitable new products and the training for new skills.

(b) Social factors

In respect of social factors, the workshop has to operate so as to produce an equilibrium which suits the temperament of the society within which it is set up. The success or failure of a workshop can depend upon local social pressures which either support it or mitigate against it. Promotion and publicity for the workshop products can strongly influence public opinion and should be carefully considered with this aspect in mind.
(c) Ethical influences

These will affect the goals of the development group. If the development group considers that the major goal of the workshop is to improve the happiness of workers within the enterprise, to improve living standards of disabled people and to contribute to the welfare of the community as a whole, the type of product they will develop may be quite different from those products that would be manufactured if the major goal of the workshop is that it should operate on a sound market economy basis only.

Choice of product

What type of product should be developed in a rehabilitation centre or a production workshop? Firstly, it is necessary to consider who might be the major customer for the products of such a workshop. These customers can generally be classified as:

1. The government sector, which is likely to be interested in products concerned with education and training; hospitals and medical services; administrative supplies, etc.

2. The public consumer sector, which is likely to be interested in products for daily living such as housing, kitchen and clothing accessories.

3. The industrial and agricultural sector, which is likely to be interested in those small tools and accessories which are in constant demand and which tie up foreign capital where such implements are commonly imported from abroad.

4. The services sector, which is likely to be interested in all types of printed material, software, information processing and communication products.

5. Particular attention should be paid to the advance of new technologies based on the "silicon chip". A revolution is taking place in the production and service industries where the influence of new information and communication technologies is making demands for new skills in word processing and the utilisation of micro-processors. As an example, a workshop that could produce software for small computer use could have an assured market.
Specialised domestic products

A word of caution - Many workshops have tried to enter the field of domestic consumer production by manufacturing such items as telephones, industrial starter mechanisms, air conditioning fans, simple evaporation refrigerators, cold boxes, or heating stoves.

The major problem with these types of domestic consumer items is that they require either plastic injection moulding processes or some form of press for forming, stamping or bending metal. Whilst these processes are easy to operate by disabled workers, it is necessary to obtain or manufacture high precision dies or moulds to make a machine of this kind operate successfully. In most countries these have to be imported because local indigenous skills in precision die and mould making do not exist. Although numerical control technologies have been introduced into tool and die making, this activity still remains outside the competence of most workshops for the handicapped because of the initial capital required for the purchase of equipment.
Need for product rationalisation

Products should have uniformity; there should be a minimum of variation in production methods at each stage of manufacture but, at the same time, the product should give an apparent range of choices to the customer. If too many variations are allowed in the form or style of each item produced, then the more diverse will have to be the operations of management and control, workshop organisation and planning, production skills and worker training procedures.

This does not mean, however, that, although the choice of product given to the customer is restricted, this cannot be overcome by making small changes in the finishing operations which produce more customer appeal from the same product by variations in packaging, or presentation.

Effect of type of disablement on choice of product

Work demands which continually change will require the handicapped worker to keep changing manual and mental skills from one process to another and this can create confusion, particularly if handicapped persons have some degree of retardation which lowers productivity.

Therefore, in selecting products, it is also necessary to identify a range of alternative manufacturing processes that can produce the same product. If an ordered, discrete sequence of operations can be found for manufacturing a product, this should always be chosen in preference to another manufacturing method which depends on a non-sequential production pattern, particularly if the work is being performed by blind persons.
Comparison has to be made between the range of mental and physical skills required to manufacture a product and those which exist in the available work force. This indicates that all product manufacturing operations have to be carefully analysed in terms of job skills and the requisite psycho-motor capabilities carefully defined and noted. The ILO has developed guidelines for matching task requirements with skills available in a handicapped work force.

The workshop manager should also obtain a precise estimation of the physical and mental capabilities contained within groups of handicapped persons who will be involved in producing selected products. Often persons having different disabilities can be combined into groups, so that the technical skills needed exist not separately but in combination.

The worker's thought process should be step-sequenced during manufacturing operations, this then enables a retarded person who is presented with a repeating series of thought steps to learn quickly, improve his manual skills and develop his physical responses so that they gradually become more accurate.

For physically and mentally handicapped workers, the design of production operations should be based on reducing all movements, skills and mental requirements to the simplest form possible, but with a low level of requirement to make comparative judgements. However, the operations should not be simplified to such a level that there is a reduced job interest, loss of personal dignity or loss of positive motivation.

In time, with a gain in experience and confidence, the handicapped worker can be moved stage by stage to tasks requiring decisions to be taken, after which he may be able to leave rehabilitation and accept a normal post in local industry or commerce.

On initial entry to an enterprise, or to a rehabilitation centre, the worker should be given tasks so that:

(a) Each act of perception is of the same dimension and amplitude and can be taken in logical sequence;

(b) The motor skill pattern has an average norm, so as not to impose undue stress in changing from one manual dexterity to another.

After the rehabilitation or training period has been completed, the handicapped worker should be manufacturing products within a system which permits him to:

(a) Gain useful employment outside the rehabilitation centre or in a full productive capacity within a small enterprise;

(b) Develop mental competence and make small decisions on a progressive scale;
(c) Develop from simple to complex motor skills because of their arrangements in progressive sequence;

(d) Gain both competence and a higher level of job satisfaction.

Examples of Products suitable for manufacture in home industries, community developments, small enterprises, co-operatives, vocational rehabilitation centres and sheltered workshops

1. Government Sector

(a) Schools and training establishments:
   - Classroom furniture
   - Desks
   - Chairs
   - Chalkboards
   - Gymnasium equipment
   - Training aids
   - Preparing or reproducing videotapes and sound cassettes

(b) Hospital and medical services:
   - Ward furniture
   - Beds
   - Chairs
   - Trays
   - Patient supports
   - Walking aids
   - Wheel chairs
   - Trolleys
   - Stretchers
   - Prosthesis
   - Blankets
   - Bed covers
   - Mats
   - Screens

Packing of:
   - Dressings
   - Bandages

(c) Transport:
   - Bicycles
   - Road furniture
   - Road signs
   - Pallets and stillages
   - Air-line supplies
   - Air-line passenger head-phones
2. **Public Consumer Sector**

(a) **Household goods:**
- Cooking utensils
- Household gadgets
- safety pins
- hooks
- chains
- bottle openers
- vegetable racks

(b) **General:**
- Cutlery
- Toys
- Games and puzzles
- Sales packaging
- Tailored clothes and knitted garments
- Umbrellas
- Plastic flower assembly
- Cane furniture
- Dry cell battery manufacture

(c) **House construction:**
- Concrete block and brick making
- Building construction accessories
- Electrical installation accessories
- Plumbing and water system accessories
- Screws, clips, fastenings
- Window and door frames
- Doors
- Light weight fixed furniture

(d) **Printing and reproduction:**
- Printed materials
- Packaging and box making
- Bills, tickets, order forms
- Document reproduction services
- Book binding
- Silk screened posters
- Plastic bag making
3. Industrial and agricultural items

(a) Industrial items and processes:
- Industrial tools
- Plastic headed hammers
- Chisels and punches
- Screw drivers
- Light trucks
- Wheel barrows
- Panel beating
- Assembly of electronic equipment

(b) Agricultural items and processes:
- Hoes, rakes, drills
- Spades, shovels
- Seed and fruit boxes
- Plastic tube accessories
- Netting
- Pumps
- Irrigation accessories
- Leather tanning
- Animal husbandry
- Flower and plant growing
- Gardening
- Fish farming
- Rabbit and poultry farming
- Fruit growing
- Fruit bottling and canning
- Egg production
- Packaging fire wood
4. Service sector

(a) Information systems for:
- Banks
- Hotels
- Government departments
- Transport organisations

(b) Work and data processing:
- Micro-processor software development
- Electronic games
- Automatic accounting
- Typing and stencil cutting

(c) Hospitals:
- Para-medical assistance
- Laboratory analysis

(d) General:
- Car washing
- Laundering
- Bottle labelling

(e) Repair services:
- Radio and television
- Domestic machines
- Watches, clocks, industrial controllers
- Boots and shoes, including orthopaedic

(f) Tourism services:
- Souvenirs
- Pictures
- Ceramic goods
- National dress
- National craft products

Product development

There is a range of factors to be taken into account if an enterprise is progressing well and the product range could benefit from being expanded to meet widening opportunities.
An obvious factor is that, if there appear to be opportunities, these must be real and tested out by a feasibility study. Many enterprises, in trying to make the change from small into medium volume activity, have failed and gone into liquidation through chasing new opportunities that were more imaginary than real.

Real opportunities mean definite promises of contracts to purchase new products; verbal agreements are notoriously weak. With a small change downwards in a market economy, verbal promises are soon forgotten, leaving the enterprise with a full stock of new items which it cannot sell.

An enterprise should attempt to have several product lines which are attractive to different markets, in order that, if one sales line diminishes, there may be the possibility of balance with another product line for which demand increases. As a golden rule, avoid selling to one client only and, at the same time, taking raw materials from a single supplier. In such a situation, both the client and the supplier seriously influence the financial stability of the production workshop.

On the other hand, having too many clients and suppliers, can lead the enterprise into excessive correspondence, control of accounts and small market outlets. A balance between the two extremes has to be found.

Each product line should be self-supporting and, in an optimum situation, production costs are at a minimum. A high level of staff, materials and equipment utilisation is essential if costs are to be kept at a minimum. Sometimes this involves manufacturing products which have a short market life to meet a seasonal demand or to meet a fashion. Toys and games are good examples of demand which change with fashion. An enterprise manufacturing the puzzle "Rubik's cube" would have had a good market for about one year but, after that, the fashion changed and the demand for the cube largely diminished.
Other factors

In the day-to-day activities of a workshop, it is very easy to overlook the development of worker potential and, through it, workshop potential. Therefore, one of the main goals of the workshop manager should be to continuously up-date production methods. More precise estimations of the physical and mental capabilities and vocational skills of workers who will be involved in the production of the new products should be carefully carried out at regular intervals.

Barriers to the sale and development of new products should be carefully studied and attempts made to overcome those bureaucratic procedures which hold up production through non-availability of indigenous or foreign materials and the need to obtain foreign exchange permissions.

The final aim of production should be to reach as large a market as possible, and this will eventually mean looking at not only the local market, but also at the requirements of customers further abroad. Often, products which have been successful for a long period of time in the local market will need to be considerably changed if customer appeal is to be developed in an export market. This factor should be taken into account in the development of new products.

Summary

To summarise, the difference between success and failure in a workshop depends initially on the manager's choice of product range which meets changing market outlets and customer appeal, whilst staying within a minimum production cost. At the same time the manager has to manage and develop those human and physical resources which are contained within the handicapped personnel under his direct responsibility.

Finally, he should ensure that his work force will be able to live a better life than would be possible if the workshop did not exist.
SETTING UP A WORKSHOP FOR GAINFUL ACTIVITIES

Introduction

This chapter, which looks at the application of industrial engineering methods to small enterprises, is divided into four main sections:

1. Workshop layout for equipment and services which lead to efficient production operations.
2. The case for homogeneous production groups.
3. Management of small tools, equipment and stores.
4. Avoiding production stoppages through effective maintenance procedures.

Workshop layout

There are four major types of layout, although in practice a combination of two or more may be found in the same workshop.

1. Layout by fixed position. This arrangement is used when the material to be processed does not travel round the workshop, but stays in one place; all the necessary equipment and machinery is brought to it instead. This is the case when the product is bulky and heavy and when only a few units are made at a time.

2. Layout by process or function. Here all the operations of the same nature are grouped together: for example, in the garment industries, all the cutting of material is carried out in one area, all the sewing or stitching in another area, all the finishing in a third area and so on. This layout is usually chosen where many products which share the same machinery are being made and where any one product has only a relatively low volume of output.
(3) Layout by product, or line layout, sometimes popularly referred to as "mass production". In this layout, all the necessary machinery and equipment needed to make a given product is set out in the same area and in the sequence of the manufacturing process. This layout is mainly used where there is a high demand for one or several products that are more or less standardised, such as electronic assemblies.

(4) Layout making possible group production methods or group layout. Recently, in an effort to increase job satisfaction, several enterprises have arranged their operations with a group of workers working together on a given product or on a part of a product and having at hand all the machinery and equipment needed to complete their work. In such cases, the workers distribute the work among themselves and usually interchange jobs. This is referred to below as the Homogeneous Production Group (H.P.G.).

Layout techniques can be applied to a number of locations such as multi-storey factory buildings, commercial offices, wholesalers' stores and holding warehouses, etc., but, as most sheltered workshops, rehabilitation centres and small enterprises tend to be single-storey buildings, with departments interconnected at one level, this chapter will concern itself with single-floor layout only.

Developing layout techniques

The following steps are involved when a layout of a work area is being developed:

(1) The equipment and machinery needed for processing is determined by the type of product or products to be manufactured.

(2) The number of units of each machine and item of equipment needed to manufacture each product is determined by the volume of expected sales (based on sales forecasts).

(3) The space requirements for machinery are determined by calculating the dimensions of each machine and multiplying by the number of machines needed.
Provision is made for the space needed for materials (both for raw materials and for the storage of finished products), for goods-in-process and for material-handling equipment.

Provision is made for additional space for auxiliary services (washrooms, offices, cafeteria, etc.).

The total space requirement for the workshop is determined by adding the space for machinery to the space needed for storage and for auxiliary services.

The different departments with their respective areas are so arranged that the most economical flow of work is achieved.

The plan of the building is largely determined by the position of work stations around storage areas and auxiliary services.

The size and design of the site is determined by allocating additional space for parking, receiving, shipping and landscaping.

Expanding these items further: when a manager has to lay out a new workshop for disabled persons or has to change the existing set-up of a workshop that has been operating for quite some time, he should think in terms of a check list and this list should contain items such as:

(a) Where should machines, work places and storage areas be placed in respect to external access and exit doors?

This is important because, with disabled people, in case of a fire or other emergency, it is necessary that the personnel should be able to leave the workshop easily and without obstruction.
(b) Will all external and internal doors permit the passage of invalid chairs or other equipment used by handicapped personnel and is it necessary to put ramps between one floor level and another, even though it may be a single-storey building?

Following the same principles, it is necessary to establish the minimum width of gangways, or passage ways from one work station to another, along which handicapped workers must move, taking into account the minimum radius on corners of gangways, or roadways, so that wheel chairs or other devices can pass easily in two directions at right angles.

(c) What is the minimum distance that must be allowed between one work place and another so that work in progress can be stored in a bank on the workshop floor or in racks or shelves?

For this kind of workshop, centralised storage of raw materials, tools and completed work, which will later have to pass another production operation, is not satisfactory. By locating tools, raw materials and components in progress at, or near the working post, the requirement for handicapped people to continuously move from one location to another, so that they can continue their work effectively, is greatly reduced.
Following the decision on the type of product, or products, to be manufactured in the workshop area, a production operation breakdown can be compiled. This breakdown will show in logical sequence the operations to be followed for the production of each product, stage by stage. At this point, it is advisable to make a flow process chart which will reveal where operations have been carried out, when inspections or quality checks are needed between processes and where delays are likely to occur in the production operation sequence. By comparing the production operation breakdown schedule and the flow process chart, it should be possible to determine where homogeneous working groups should be located.

Each working group will need machines, tools, or production aids and the location of this equipment has to take into account installation requirements and maintenance needs. For example, work stations should be near to service points if electricity, gas, water or compressed air is required. Similarly, positioning of machines and equipment has to take into account the fact that, at some future time, maintenance work will have to be carried out on the items installed. Often, equipment is placed against a wall, or in the angle made by two adjoining walls and, at the time of maintenance, it is impossible to remove motors, belt drivers or other parts of the equipment without serious interference. Most production processes produce waste material at the operating stage and this has to be collected, stored and later disposed of. In planning the workshop layout, facilities for processing waste material should not be overlooked.

Layout techniques

PAPER SHAPES: the simplest layout technique is to use a drawing board approach. That is, a plan of the workshop is laid out to scale by a draughtsman who indicates the position of each item of equipment, work post, gangway or walkway, storage area and power supply point. The main difficulty with this approach is that if, at a later stage of planning, it is decided to change the layout, the drawing has to be modified, adapted or re-drawn, which is a time-consuming process.

A better method is to use a hybrid system, that is, to draw out to scale the main external features of the workshop, including the entry and exit doors. Next, to cut out paper shapes, to scale, for each storage area, work post, machine or other item of equipment which will be located in the workshop area. This system allows for movement of paper shapes, within the layout of the main features of the workshop, until the best solution for effective production has been decided upon. At this stage, the paper shapes are fixed in position with scotch tape or by pins, and the layout is considered as
being the master layout until such time as changes may be decided upon. Where changes have to be made, it is simple matter to move the paper shapes to new locations, without having to completely re-draw the whole situation. Once the final version has been decided upon, it is possible to mark in, in colour, locations for each power supply that will be required at the workpost.

ADHESIVE AND ACETATE: an improved method for this form of two-dimensional layout is to:

(a) Draw out the main external outlines of the workshop, including entry and exit doors on plain white paper.

(b) Cut out the machines and equipment shapes to scale from an adhesive sheet, similar to that used by designers or by housewives for decorating shelves, walls or cupboards, etc. These adhesive shapes are stuck on to clear acetate sheets, like those used for overhead projector transparencies.

(c) A second overhead transparency sheet is used to mark the position of power supplies such as electricity, gas, water or compressed air.

(d) A third transparency is used to mark the position of gangways and storage areas between work posts.
With this method the three overlays can be placed on top of the original drawing and the total presentation of the workshop layout can be quickly seen. If it is decided that the machine positions, for instance, are not in correct location with respect to power points or gangways, one or other of the transparent overlays can be modified or substituted. This gives a flexibility in layout planning which is not possible with the previous method.

THREE-DIMENSION MODELS: the only criticism that can be levelled at two-dimensional layout is that it is difficult to get a three-dimensional impression of how the workshop will look after the new layout has been installed. For this reason many planners prefer to use three-dimensional models and certain enterprises specialise in making replicas of common machine-shop equipment to architectural scales. There is no need to go to this expense because simple wooden shapes, or even, where available, polysterol sheet, (cut with a hot wire to form a scale model replica), can be laid on to the outline workshop drawing to produce a three-dimensional impression. The work is then completed by drawing in gangways and power points as before.

Homogeneous production groups

One of the recent developments in manufacturing has involved groups of persons working together to make part, or all, of a particular product rather than dividing the work up according to individual machine processes, or on separate production lines, as had traditionally been done before. For a small production workshop, this idea gives the opportunity for enlightened managers to develop an environment where disabled work people can be fully involved. Handicapped persons can be allowed to take more responsibility in their dealings with processes which they understand and this will not only enhance the total success of the workshop but, equally important, it will allow the development of a contented work force and develop a feeling of pride and respect in each disabled worker; a factor which is often missing in many work situations where handicapped people are employed, often in isolation.
Success in obtaining benefits will depend on the workshop manager being more innovative than previously and on his giving sufficient confidence to the workers to let the development of the groups happen gradually. Homogeneous production groups allow for the systematic organisation of work into balanced stages. They also allow for variations in work flow from one stage to another. This can be obtained by setting up groups which take into account those differences in physical disability and mental speed which occur between one worker and another. Further, it allows for systematic training of each work group through modular methods based on the development of those individual skills required by each person within a group. These skills then being acquired gradually by all members of the group if their disabilities permit.

For homogeneous production groups to be successful, a number of rules have to be followed.

Firstly, objectives should be defined for the tasks of each group in order that there shall be no conflict between one group and another and each individual knows his authorities and responsibilities within each group.

Secondly, it is necessary to develop a communication system between the separate groups and the workshop manager so that there is a constant feedback of information, from and between each group, in respect of the objectives set for them.

Thirdly, the work of each group must be meaningful and interesting and lead to clear-cut production targets.

Fourthly, the work unit must be equipped with the necessary tools, equipment and production aids and take into account differences in personal skills and equipment facilities so that each group can achieve, maintain and control its specified objectives and outputs.
Advantages of the homogeneous group concept in enterprises for the disabled

The way in which a group will pursue its assigned objectives will depend foremost on those objectives being clear. A sense of purpose is the vital element which differentiates this homogeneous production group from any other aggregate of people.

Organisation into groups can contribute significantly to the workshop manager's job of target setting; it makes targets meaningful for the workshop as a whole and for the sub-groups within it. It makes it easier for workshop managers to communicate with workers when discussing production targets. It leads to better work scheduling and improved control of production, because of the clearly defined objectives for each group.

When feedback is effective, problems are highlighted and the necessary action to resolve them can be more quickly put into effect. With homogeneous production groups, communications about work problems start to flow upwards and suggestions about how to remedy the faults begin to be discussed horizontally between the disabled workers themselves. They start to talk with pride about their successes, relative to quality and productivity and that all important negative factor - low motivation (which often affects disabled workers) - disappears.

Finally, as work experiences become more positive, the aspirations of the workers will grow and, at this point, their jobs can be enlarged and enriched.

Horizontal job enlargement takes place by adding to a given job module a pre- or post-modular task.

Vertical job enlargement comes with development of skills and the willingness to take on more responsibility.
A total production control system for a sheltered workshop can operate where a manager is using traditional manufacturing methods, but if a workshop manager is willing to accept an exciting challenge and completely re-organise his workshop, on the basis of homogeneous production groups, his rewards will be in the economic development of the workshop and increased job satisfaction for the personnel employed within it.

The H.P.G. - A workshop within a workshop

A homogeneous production group (H.P.G.) is a completely self-contained production unit and as such will require:

(a) Materials to arrive at the correct time and in sequence.
(b) To be supplied with all necessary tools, equipment and working aids.
(c) To be presented with pre-determined production output targets.

Work posts can be designed so that a task may be completed by using more than one method and this allows for different types of handicapped persons to work at the same task even though members interchange jobs and tooling with each other.
The H.P.G. is different in that it permits workers to move from one task to another, provided that their physical or mental handicap will allow them to do so. Therefore, as a general principle, the work posts (which may be either individual or combined) are designed according to task needs and not according to the physical or mental handicap of the workers. Thus, within the group, workers can move from one post to another, at any time of their working day, so long as the group is in agreement. There will be exceptions to this approach because some workers may be so handicapped, or disabled, that they can only work at one specially designed work post. In this case the individual will not be able to move around the group in the same way that other workers can and it may be necessary to provide other means of improving motivation and thereby reducing monotony.

For the handicapped worker, long delays between one operation and another lead to boredom, lack of interest and general dissatisfaction with workshop management. The H.P.G. concept of dividing a total production into units of work carried out by separate groups, with each group autonomous in itself, allows the manager to be aware of:

(a) The situation and condition of tooling in each group;
(b) The equipment being used by each work group and its condition;
(c) The work in progress at or between each work stage;

much more easily than in other forms of manufacturing pattern.

Management of production time in HPGs

The first objective of production management is to eliminate or prevent waste occurring and the major item under this heading is the waste that occurs through loss in production time. A main cause of loss of time is through workers having to search for tools, equipment or materials which are needed before the worker can continue his process. A new approach to the elimination of this type of waste is to analyse the tasks which have to be performed by the work force to complete a process. For industrial purposes, the main analysis can be broken down into the following steps:

(a) The total process is divided into a sequence of logical operations.
(b) The tasks involved in each operational step are then identified and recorded.
(c) Finally, the required manual skills and their associated mental aptitudes for each sub-task are identified and recorded.

In a small enterprise employing disabled persons, it is usual to find wider variations in manual skill capacity and mental ability than would be the case in a more standard form of industrial workshop. For this reason, when thinking of applying task analysis to a rehabilitation centre, or sheltered workshop, one has to think in terms of applying task analysis to the working group rather than to individual cases. As a consequence, the capacities and abilities required to carry out a series of tasks in a production process can be matched with the manual skills and mental levels of a number of persons contained within a homogeneous production group.
From the information obtained through job and task analysis, a list can be established for each working group which sets out production requirements in terms of:

(a) Tools and equipment;
(b) Frequency of supply of new tools and equipment or reconditioning intervals for existing tools;
(c) Materials and components to be supplied;
(d) Frequency of materials inwards supply;
(e) Size of buffer stock to allow the group to work when (d) is unavoidably interrupted;
(f) Frequency of collecting completed work from each group;
(g) Storage capacities for tools, raw materials and finished items.
(h) Human engineering factors (ergonomics).

Control of stocks

STORAGE OF TOOLS, EQUIPMENT AND MATERIALS: Storage of these items in small enterprises, co-operatives and sheltered workshops is too often neglected or given a low order of importance, with lines of responsibility poorly defined. The storekeeping function should be thought of in the same way and with equivalent importance to banking. Stores are accountable for keeping tools and equipment in good order; supplying a service which allows production to continuously function; and maintaining records of materials so that orders for new items can be prepared in time. Stores are often a source of cash wastage through maintaining stocks which are too high and tie up unused capital, or too low, thereby causing production hold-up, although loss of cash discounts occur when goods are too frequently ordered in too small quantities. Stores tend to over-issue materials and tools which then lie around the production workshop unused until they are lost or utilised for purposes for which they were not intended. Another important aspect of the accountability of stores is in the control of unauthorised "borrowing".

Many employees, when needing tools or materials for a job "at home", borrow these from the workshop, usually with the good intention to return them when the "home" job is completed - but they never return the goods. Experience shows that in many small workshops goods "borrowed" amount to about one fifth of the total expenditure on tools and materials and that stores should be secure areas, isolated from general personnel and only entered by delegated officers. Stores often start off with this type of control but quickly deteriorate into giving a general access; this should be rigidly prohibited if losses are to be avoided.

A store can be described as single storage spaces growing vertically by columns and horizontally by rows. These spaces may also be supplemented by floor platforms to accommodate heavy single items, drums for holding liquids and wall racks for suspending metal bars, rods, timbers, plastic sheets, etc.
Tools, because of their specific purposes and high value, are usually stored in a separate section of the storage space from that utilised for raw materials or finished products.

The most important factor in any storekeeping system is that the time taken to locate a stored item should not be longer than that required to enter it into the store when it was received.

This infers that a coding system has to be developed which clearly identifies any item and does not lead to duplication or confusion. Codifying by name is inefficient, for example the component shown was stored by a small enterprise in 42 different locations because of differences in name. Some of the titles attached to it were:

- shelf holder
- bracket
- left-hand support
- vee form
- angle support
- bearer
- chassis corner
- body angle
- etc.

The item was identical in all respects of dimension, material, finish, etc.

The letter or number-coding system should not be over-detailed and should have the feature that it can easily be expanded when the number of items to be stored increases.

Many systems are available and are outlined in texts on production workshop management, it is not necessary to re-invent the wheel. An alternative possibility is to adopt and adapt one of the standard classification systems used by libraries.
To avoid deterioration of stock, the methods of storing should ensure that "first-in goods are the first to be issued out". Many storekeepers, for convenience, operate "last-in, first-out" systems, but this leads quickly to stock damage and obsolescence.

Storerooms should be laid out with goods handling in mind; those items which have a fast turn over should be located as closely as possible to the point of issue. Items rarely called for can be stocked on the higher shelves, or at a further distance from the issue point. A visit to a well organised supermarket and a talk to its manager can provide a lot of information on stores layout, the stocking of short-life items, inventory control and the prevention of pilfering.

Effective maintenance procedures

The three basic objectives of effective maintenance procedures are:

- Firstly, to establish a programme of maintenance for workshop machinery, production aids and tooling;
- Secondly, to ensure that a programme of simple maintenance is carried out continuously;
- Thirdly, to develop easy methods for recording repair and maintenance activities, maintenance costs and other relevant information.

This first objective is achieved by the introduction of a maintenance schedule based on a production equipment register. Into this register must be entered a complete inventory of those items of plant or production aids in every day use in the workshop which have to be maintained. This is better prepared as a loose-leaf manual or as a card index system, so that items can be added or removed easily. Maintenance schedules should detail the inspections, lubrications and other preventive measures necessary if each item on the production equipment register is to be kept in daily working order.

To meet the second objective, a control system has to be introduced which triggers off the necessary maintenance work at the correct time. The simplest form of triggering employs a manually operated two-box card file system. In one box the cards are arranged according to the plant and equipment inventory and in the second box the cards are arranged on a daily activity basis. Where a machine or other item of equipment breaks down in service, the history of previous maintenance work can be quickly found by referring to the first card. The
second card index has a different purpose in that it allows the manager to follow up essential maintenance tasks on a day-to-day basis. In this way, maintenance work can be carried out by selected workers from the homogeneous production group without having to maintain a staff of maintenance and repair personnel constantly in the workshop complex.

Of course, the occasion will arise when a complicated repair is required and maintenance staff of high specialisation are not available in the workshop. To meet this emergency, the manager can contract local craftsmen to carry out the work for him. As a matter of policy, this method is cheaper than maintaining skilled maintenance and repair men permanently on the payroll of a small enterprise.

The third objective is achieved by training the workers to complete simple work sheets or other documents which indicate repair work done, faults located or spares fitted during their maintenance tasks. This type of recording is necessary because management control depends on knowing how much is being spent on maintenance and repair, including overhead costs, from one planned budget period to another. Once cost figures show that, for certain items of equipment, maintenance costs are reaching a high level, the manager has then to consider whether to continue this piece of equipment or whether it should be adapted, modified or substituted and a request made for new capital funds.

The workshop manager should regard maintenance procedures in a similar way to that in which a doctor considers his patients. In other words, it is better to prevent loss of condition than to have to later cure a serious illness and
there must be a balance between how much time and money can be spent on preventing loss of condition and the excessive costs of remedying breakdowns when they occur.

One of the most difficult questions for a manager is: how to achieve a balance between planned maintenance and breakdown repair? The answer will vary with the complexity of equipment in use, the size of the workshop and the type of product being produced but, as a general rule, it can be said that when the total annual breakdown costs approach 8% of the value of the product being produced, the manager must give serious attention to reviewing his maintenance procedures.

A large volume of material has been prepared by various authors on the subject of maintenance systems, mostly applicable in large industrial undertakings. They usually refer to:

- Emergency or breakdown repair;
- Planned maintenance systems;
- Hybrid planned/emergency systems;

and

- Maintenance control and accounting.

Although valuable information can be gained from such texts, in essence systems applicable in large enterprises are too sophisticated for the small workshop. In the latter case, keeping the workshop in good running order is a matter of common sense and particular attention to housekeeping. This entails keeping machines, tools and equipment clean and in good condition by preventing deterioration through lack of lubrication, damage to hand tools through bad storage and keeping machines, tables, lifts and walkways free of waste or scrap material.

Special attention should be given to preventing fire and explosion, the first by storing inflammable materials outside the workshop area, the second by keeping pressurised gas, cylinders away from hazardous work areas. Welding gas supplies should be piped from cylinders stored outside the workshop to the point where the gas is required.

In high-risk areas, such as paint spray booths, cleaning and degreasing tanks, wood or paper working processes, it should be mandatory not to
permit smoking. Most fires, particularly those which occur outside workshop production hours, are due to equipment over-heating or electrical short circuits. To combat the first cause of fire, insist that all items of equipment should be TOTALLY disconnected from power supplies before production finishes on each work day. In the second case, it is wise to have all electrical installations checked by a competent technician bi-annually and not to permit unqualified personnel to make electrical connections at any time.

Summary

Management of workshop equipment and tooling can be much improved by setting up individualised or group work posts in units, according to the homogeneous production group principle.

When designing these work units, a manager should be able to make full use of creative thinking by taking into account both the ergonomic needs of the worker and his work place (for example, to allow a worker, if at all possible, to change his position or work post from time to time, rather than being fixed to one operation).

Human engineering or ergonomics covers a field which in recent years has expanded to an extraordinary degree and whose boundaries are far from clear. Ergonomic measures may, however, be defined as those that go beyond the mere protection of the worker's physical integrity and aim at ensuring his well-being through the attainment of optimal working conditions and by the most suitable use of his physical characteristics and physiological and psychological capabilities. Productivity is not the primary objective of ergonomics but is usually one of the end products.

The task is to develop the most comfortable conditions for the disabled worker as regards lighting, climate and noise level, to reduce the physical workload (in particular in hot environments), to improve working postures and reduce the effort of certain movements, to facilitate psychosensorial functions in using levers and controls, to make better use of spontaneous and stereotyped reflexes, to avoid unnecessary information recall efforts, and so on. Many ergonomics measures are of a kind that should be introduced at the design stage of a building, appliance or machine, or when equipment is being installed, since subsequent modifications are generally less effective and much more expensive.

The design of the homogeneous group approach to production should take into account the importance of an effective stores system and the way in which parts and components can be easily transported to production points and work stations from centralised store locations.
A revision of workshop layout techniques, which take into account the working conditions and the satisfactions of handicapped personnel who will spend most of their daily life within the workshop boundaries, should be given serious attention. The fact that a workshop is not new, does not mean to say that workshop layout techniques should not be kept constantly in the back of the mind of the manager; technological methods are often changing and an original workshop layout may soon become out-dated.

One item which is often forgotten in the planning and layout of a new workshop, is that machines, tools and equipment grow old relatively quickly. In the euphoria of obtaining funds for a completely new workshop, it is very common to forget to make financial provision so that in five years time a fairly large injection of capital can be made to renew worn-out equipment.

Finally, the manager should set up an effective maintenance procedure which strikes a balance between production needs and maintenance needs and should not relegate maintenance and repair to that item which is only to be considered when production operations have completely failed.

Maintenance of the workshop system also infers that the workshop should not fail through preventable causes such as fire, explosion or similar grave incidents. "Acts of God" are not within the reach of the maintenance supervisor, but that is not to say he should not give their prevention some thought.
Three main forms of production organisation are applied to the manufacture of marketable products:

(a) Job production;
(b) Batch production;
(c) Flow production.

As we are considering the employment of disabled personnel, "production" is being used in its broadest sense and for the purpose of this chapter can also be considered as including providing technical services. In this context, examples of job production would include activities where each person carries out all the functions required, such as:

(a) To print one set of safety posters;
(b) To write a micro-processor programme;
(c) To repair an alarm clock.

Examples of batch production would include:

(a) Soldering components, in sequence, on to ten electronic control boards;
(b) Assembling 200 cigarette lighters;
(c) Making 500 shoe brushes.
Examples of flow production would include:

(a) Making radio transformers including:
- Cutting metal sheet to size;
- Stamping out transformer laminations;
- Assembling the laminations;
- Winding the transformer coils on to the laminations;
- Connecting the coils to terminals;
- Fitting the transformers into protective housings;

as separate, but connected, operations where transformers satisfy a continuing market demand.

Some workshops are engaged in all three forms of production whilst others specialise only in job or batch or flow types. No system is more advantageous than another: the pattern depends on local conditions and market demand and the form of production adopted should optimise product output when compared with the other alternatives. Once production activities have been organised, the practical operations have to be controlled.

Production control

The first task of production control is to forecast manufacturing schedules for fixed periods of time, such as one year. This, of course, is like gazing into a crystal ball; but up to the present there is not system or method by which accurate forecasting can be made. The workshop manager has to rely upon experience gained from implementing previous manufacturing plans in his workshop and, also take into account those demands he expects may occur in a future period of the workshop operation. During the period for which the forecast has been made, orders will be received from customers and customer demand has to be balanced against the manufacturing schedule forecast; obviously, there will be a variance in customer demand when compared with forecast and this will require a forecast correction.

The second action to be taken is to develop a day-by-day production schedule or projection for the forecast period, and forecast corrections will make daily adjustments in the production schedule in terms of output required from the workshop according to new variations in customer demand.

Thirdly, the production schedule will be further adjusted according to a production schedule correction, which is based upon daily measurements of the quality and quantity levels of workshop output. These three corrections, effectively applied, ensure that production levels meet the demands of customers on time.

There are two main classifications of production control systems best suited to small workshops:

(1) Stock control systems.
(2) Flow control systems.

In stock control a buffer of materials and parts is constantly available within the workshop and this is maintained by ordering new quantities of depleted items each time stocks drop to a predetermined order level.
In flow control, however, quantities of material and bought-out components are pre-determined from the production schedule and, based on orders received or sales projected, a materials order plan with specific dates is established. This approach, flow control, keeps materials and components moving through production and reduces parts-storage dead time to a minimum.

To arrive at an efficient flow control system for a small workshop it is also necessary to think in terms of single cycle ordering and manufacturing.

This can be represented by:

\[ I = \text{MATERIALS INPUT} \]
\[ W = \text{WORKSHOP ACTION} \]
\[ O = \text{PRODUCTION OUTPUT} \]
\[ l = \text{lead time} \]
\[ p = \text{time to manufacture one product (through-put time)} \]
\[ t = \text{time to manufacture a batch of products (batch cycle time)} \]

From this diagram it follows that:

(a) To plan materials input requirements the forecast of product output must be specified.

(b) The forecast of all items needed to put a batch manufacturing cycle into operation must be made at least \( l + p \) days before the cycle is due to begin.

(c) The accuracy of forecasting the product output depends on the date by which the forecast can be made. Shorter durations of lead time \( l \) and product through-put time \( t \) bring about more precise definitions of cycle time.

(d) Through-put time \( t \) is efficient if the material flow and production operations are smooth and effective with minimum delays and stoppages.

(e) To reduce lead time \( l \) it is necessary to have well defined purchasing and stock-keeping policies in effective operation.

Production flow control systems are referred to as Period Batch Control (PBC) systems and have the following advantages:

(a) They can follow changes in market demand with minimal waste.

(b) They can operate efficiently with a low stock investment and high stock turnover.
(c) Because material is short-time ordered in small sets, obsolescence is minimised.

(d) They are ideal for manufacturing products having seasonal sales patterns.

Production scheduling

Production scheduling is concerned with the pre-planning of production activities, whereas control is associated with those techniques which have to be employed to maintain activities in balance.

In a small enterprise, rehabilitation centre or sheltered workshop, if it were possible to produce each customer's order immediately, without stoppages, then the production schedule would be extremely simple. Unfortunately, this is seldom the case, and there are many factors which affect the issue, such as:

(a) Machine breakdown;

(b) Wastage of material;

(c) Loss of production through worker illness;

(d) Variation in motivation of the workforce, particularly where mentally disabled workers are concerned;

(e) Variation in production rates caused by changes in working speeds of handicapped personnel.
To make a workshop mainly employing disabled persons run steadily, an almost continuous process of adjustment must go on, by which the amount of work done by disabled personnel is adapted to the amount of product output demanded externally.

Even in cases where the demand for the product is sensibly uniform, fluctuations in availability of resources and the productivity variations of the workforce make production scheduling and control a necessary operational function.

Many of the manufacturing weaknesses of small workshops can be attributed to the lack of attention to production scheduling and control. This can be seen in those workshops where excessive quantities of material are stored, product delivery promises are never kept and the morale of the disabled workers is low through too much idle or waiting time.

Target and goal setting

It can be seen that for a total production control system to be operated, the setting of targets for the production schedule is of major importance. Many workshop managers state that because of the complexities involved in handling physically and mentally disabled workers it is not possible to set production goals but, unless production goals are set, a realistic production schedule cannot be achieved and therefore the whole system fails.

The types of goals that have to be considered are those concerned with producing in the required volume, at the right quantity, at the right time, within a price that the market will absorb. Scheduling is defined as that activity concerned with the determination of the dates on which each and every production operation must be performed to meet an agreed delivery date. Consequently, schedules must be based on information relating to operations required, delivery date, material availability, capacity of resources and the availability of the work force.

In the majority of small workshops, work is carried out in discrete stages and, owing to the nature of batch and jobbing work, the total through-put time of the workshop is not equivalent to the sum of the individual operation times; indeed, allowances for delays due to queueing and parts held in progress, through material and work delays, are often considerably higher than the actual synthetic production time. To give a visual presentation of the day-by-day situation, a chart is used. The most common and versatile technique is that known as GANTT charting; GANTT charts and the method of their construction and operation are included in many text books on production management (reference may be made to the bibliography). The main advantage of visual charting is that the loading on a workshop, or a section of a workshop, or a process, is seen quite clearly and the consequences of additional loadings are immediately obvious to the workshop manager.

Workshop loading

Whilst the master plan for scheduling production operations over a period of time is the concern of the enterprise or workshop manager, loading is the daily duty of the work or operations supervisor. The supervisor's job is to break down
the requirements of the schedule into daily operating terms and make adjustments for emergency orders received, breakdown of equipment, absence of personnel, late arrival of materials from suppliers, etc.

Two terms have significance; these are:
- load on the personnel and equipment of the workshop
- capacity for manufacturing products.

Where Load is equal to Capacity the workshop is fully loaded
Where Load is greater than Capacity the workshop is overloaded
Where Load is less than Capacity the workshop is underloaded

It is the supervisor's task to smooth load as far as practicable, so that overloads and underloads are as near to balanced capacity as possible. To achieve this, the supervisor needs to break down the master schedule into a work plan per day or per week and GANTT charting (horizontal bar charts) is the most satisfactory visual system for controlling loadings. The ILO's publication "Introduction to work study" (see bibliography) contains information on workshop loading methods. The task of workshop loading, balanced against existing capacity, is that which gives the most problems and often excessive nervous tension to an effective supervisor.

To minimise complexity, the supervisor should aim to:
- Suggest to management those products which can be rationalised in terms of product range. Some products require complex operations, but bring in little revenue. Other products are more simple to manufacture and lead to the highest sales value. If customer goodwill can be maintained by eliminating those products which have high operational cost and low sales return, this should be done.
- Reduce the variety of raw materials or bought-in components. The supervisor should talk to the product designer, so that, whenever possible, new products are possible by manufacturing from existing material stocks. Often, designers produce new designs which require new materials and components and, over a period of time, the diversity of small quantities of bought-in products works against maintaining a low inventory.
- Carry out worker training on a continuous basis, so that more flexibility exists in staff capacity and each worker can effectively operate on a wider range of tasks.
- Utilise sub-contractors when extended overloading occurs. This is more effective than purchasing new equipment and hiring new staff only to find that six months later they are surplus to requirement. However, where new products lead to a sustained increase in capacity, a gradual programme of equipment purchase and staff hiring can take place, utilising sub-contracting for a short period, until the new expansion is in place and working effectively.
- Keep close contact with sales staff (if they exist as a separate entity) so that nasty surprises, such as salesmen accepting large orders on short-term delivery dates, do not occur too frequently. Often return discussions with
clients can obtain some relief on delivery date pressures by spreading the bulk over several delivery dates, rather than waiting until the full order is completed before delivery.

Where the supervisor has taken all these measures and finds that daily loading problems continue to exist, he has to recommend to his manager either to:

- off-load some of the work to another manufacturer
- discuss extended delivery dates with clients
- revise the production schedule master plan
- expand workshop equipment and personnel
- introduce more working shifts (overtime)

This last proposal is the least advantageous because, often, overtime working introduced to meet an emergency becomes standard practice. The employees get used to a higher pay packet, adjust their standard of living upwards and find hardship when overtime is cut back. This leads quickly to loss of motivation and a low morale in worker-management relationships.

Setting up batch production.

Workshops employing the disabled usually produce their products in small batches. Where products are manufactured in batches, there is a problem of calculating the most economic batch size, bearing in mind that the larger the batch the more economic becomes the activity, but against which must be weighed the increased costs of storage. It is normal practice to keep storage to a minimum level and to try and produce the batches to meet customer target dates; in this way storage costs are reduced to a minimum (P.B.C.). If we adopt a total-cost approach, we can quantify the various factors to determine the economic batch size.

Let \( U = \) batch size in number of units
\( I = \) storage cost per unit, per unit of time
\( B = \) set up cost for each batch
\( D = \) rate of demand per unit of time

Then

\[
U = \frac{2DB}{I} = \frac{2 \times 50}{2} = 85
\]

Example

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The annual demand for a particular hand tool (e.g. a tree saw) is 5,000 per year, the setting-up cost, including overheads is US$ 50 per batch and the storage cost US$ 2. The economic batch size would be:

\[
U = \frac{2DB}{I} = \frac{2 \times 50}{2} = 85
\]

\[
D = 5,000
\]

\[
B = \text{US$ 50}
\]

\[
I = \text{US$ 2}
\]
\[
\begin{align*}
2 \times 5000 \times 50 &= \frac{5000000}{2} \\
&= 500 \text{ units/batch} \\
5000 \text{ batches/year} &= \frac{5000}{500} \\
&= 10 \text{ batches}
\end{align*}
\]

It is possible to show that if an increase or decrease in demand is not allowed to raise the cost beyond an additional 10%, then the batch size may be decreased to 320 or may be increased to 780 units to allow for seasonal decreases or increases in productive capacity.

The approach outlined above is somewhat idealistic and concerns a single product line. When several product lines are involved which utilise machines and employees, modifications may have to be introduced which take into account maintaining buffer stocks to allow two batches or more to be produced on the same equipment. Similarly, some orders have higher priorities than others and material supplies may have discount rates according to size of order quantity. All these items are covered in the extensive texts on Production Scheduling indicated in the bibliography.

Summary

To summarise, production control should be seen as positive and helpful and, as such, a promoter of a healthy financial situation for the workshop. The steps to be taken to achieve this are:

1. Draw up a production plan based on order forecasts.
2. Make a schedule of production to be achieved by due dates and inform all managers concerned with ordering, producing and supplying.
3. Make a workshop loading chart which takes into account workshop capacities, new orders received and operational deviations due to equipment failure or worker absence.
4. Make a schedule for work in progress measurements and apply them at defined intervals.
5. Compare production progress measured against the production schedule.
6. Report any significant deviations of production volume from that forecast by schedule.
7. Take corrective action as necessary.
8. Revise the production plan as necessary, do not wait for determined dates if substantial factors affect the schedule.
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