David Evans and Roy Ford

CONTROL OF MANUFACTURE

LEVEL 3

HOLT
TECHNICIAN TEXTS

Control of Manufacture

LEVEL 3

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About This Book and How to Use It

The book

This book has several significant features:

1. It follows closely the order and sequence of topics set out in the BTEC Standard Unit Control of Manufacture Level 3.
2. Its scope is broad enough to apply to those working in a wide range of manufacturing concerns.
3. Examples are drawn from situations likely to be readily understood by most students.

How to use it

Students

1. Each chapter should be studied until the content has been understood. Any points which raise queries should be discussed with your lecturer or tutor.
2. You should then tackle the questions and exercises at the end of each chapter, as set by your lecturer or tutor.

Lecturers

1. The questions at the conclusion of each chapter can be discussed orally, either by asking individual students to reply or in small groups, or even by the class as a whole. Where time permits, one or more discussion topics can be considered.
2. The case studies can also be used in various ways. Set as individual assignments, a written 'homework' answer can be required, or one or more case studies could be included in a progress test. By discussing the cases in small groups, or even considering the cases in class, social and communication skills can be developed, especially by ensuring that each group elects a chairperson, a secretary and a group spokesperson for report-back sessions.

Preface

The various sections in this book aim to cover the list of topic areas included in the recently revised BTEC's Standard Unit Control of Manufacture Level 3. The overall objectives of the unit (and hence of this book) are basically to give students an awareness of the management structure and the organisation of the production and planning functions in a manufacturing concern. Implicit in such an appreciation is some understanding of the constraints and problems which could be faced by the managers of a planning and manufacturing process.

This BTEC unit, as laid out, combines both theory and practice. This dual approach is reflected in the layout of the chapters in the book: first, individual concepts are defined, explained and analysed in the text, followed (after summaries and review questions) by a series of practical, work-related activities, assignments and case studies. Rather less use is made in this text of discussion topics than in general management texts, as with only 60 contact hours allowed for the unit, there will be less time available to make use of them. Nevertheless, where appropriate, a few have been included.

Both authors have had long connections with engineering/manufacturing industries. They bring with them an intimate knowledge of the planning and production aspects outlined in the book.

The co-operation of the publishers is acknowledged in permitting certain material (albeit somewhat modified and revised) to be included from *Supervisory Management* by David Evans, first published in 1981.

DAVID EVANS
ROY FORD

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1
The Functions of Management

1.1 Introduction

In this section is a detailed examination of the structure of organisations and the various divisions/sections/departments/functions into which organisations can be split. After an overview of *all* the functions likely to be found in a manufacturing concern, there follows a discussion on the production/manufacturing function, which will have to be carefully defined.

Inevitably we shall tend to concentrate on the medium- to large-sized enterprise, because in the main it is only in such enterprises that the division into separate sub-functions (such as quality control as a distinct department) can be found, or indeed afforded. However, we must not lose sight of the fact that many large and flourishing concerns started life as very small family, or even one-person, businesses. Thus in the earlier years of the business the owner was not only the decision-maker but also sales representative, accountant and operative all rolled into one.

Gradually, however, the different functions became too much for one person to cope with and others had to be brought into the firm; jobs were then *delegated* or handed over to the new employees. In time, due to the increased need for *specialisation*, different activities became separate *departments* or divisions. Later still, they became even more complex, necessitating splitting into further sub-divisions as the technology advanced and techniques for information-handling improved. What were previously the activities of the owner/manager were now split up among separate departments, each emphasising one or more of these basic functions.

To achieve a better understanding of the role and function of the different elements of the production function it will be necessary first to examine closely the functions of managers and supervisors.

1.2 Fayol's five managerial activities

Henri Fayol (1841–1925) was an engineer who worked with a French mining and metal-producing firm, and after working his way up the managerial ladder became

(and remained for 30 years) its managing director. We shall discuss some of his 14 principles of management later, but here we are more interested in his concern with the *process of management*, that is, what he imagined the job of a manager to be. Drawing upon his years of experience as a managing director, he suggested that there are *five elements of management* which are universal to all managers of all organisations. In his words, 'to manage is to forecast and plan, to organise, to command, to co-ordinate and to control'.

To forecast and plan (prévoyance)

The French word *prévoyance* means 'foresight' or 'forethought'. Managing, then, means looking ahead, assessing the future and planning for it. Most contemporary organisations have taken this idea to heart (even though some may not be very successful in its practical application) and have both long-term and short-term plans on a company basis, expecting individual managers and supervisors to do their own planning to fit in with the overall planning.

To organise

By this Fayol meant the division of the material and human resources of the organisation. This includes not only the purchasing process for material and the recruitment procedure for personnel, but also the task of dividing up the work (specialisation) among the employees, determining the sphere of action of each person or group, and giving the appropriate training. All these lead to the best use of resources.

The unities of command and direction (discussed in Chapter 2) must be present and responsibilities clearly defined.

To command

Fayol was conscious of the need to keep everyone on his or her toes, to keep the organisation in an active, rather than a passive, state.

Commanding implies knowing the staff well and the business thoroughly, and issuing instructions in such a way that a high level of activity by the staff is maintained. By using leadership skills the manager gets the best possible performance from his or her subordinates.

To co-ordinate

The underlying theme here is *harmony*. Managers' efforts must dovetail with those of others, and they must keep their departments in line with the total, overall objectives of the organisation. Regular exchanges of information (including meetings) are necessary for the 'binding together, unifying, and harmonising (of) all activity and effort'.

To control

When all the activity has been put into motion, then it is essential that everything being done is in conformity with the plan. To use modern terminology, we want a *control system*, or inspection organisation to set standards, monitor performance and take corrective action if it is needed. Inspection must be impartial, so departments responsible for checking, inspection or quality control must be independent of production departments.

1.3 Modern views of management functions

Many definitions exist today of what a manager's job consists of, but all can be traced back to Fayol's ideas. Table 1.1 lists some of the most common versions of management functions. Fayol's list is on the extreme left.

Table 1.1 *Five summaries of the manager's role.*

To	*To*	*To*	*To*	*To*
Forecast and plan	Plan	Plan	Set objectives	Create
Organise	Organise (including staffing)	Organise staff	Organise	Plan
Command	Direct	Direct	Motivate	Organise
Co-ordinate	Control (including co-ordinating)	Co-ordinate	Communicate	Motivate
Control		Report	Measure performance	Communicate
		Budget	Develop subordinates	Control

There can be no *complete* agreement about precisely what a manager's job is, but it could be said that even apparently very different jobs call for *all* of these activities, but with vastly different emphases. Production supervisors give instructions, direct, control and measure performance most of the time, but at other times will need to plan their work, report back to superiors and motivate their staff; technical supervisors would probably be more concerned with organising, setting objectives, measuring performance and communicating, but they too will need to plan ahead, be creative and motivate at particular times.

It will be seen that there is a degree of overlap between the terms used. Of all the lists, the final one seems closest to a complete survey: creating, planning, organising, motivating, communicating and controlling.

Creating

It used to be thought that most people were not 'creative'. We even used the term 'creative people' to describe artists, authors and advertising staff; there are 'ideas people' in large organisations; and the government has a 'think-tank'. The notion that creativity belonged to a small, special group was dispelled by, among others, Douglas McGregor,[1] who concluded that 'the capacity to exercise a relatively high degree of imagination, ingenuity and creativity in the solution of organizational problems is widely, not narrowly, distributed in the population'.

Creativity can include innovation, synthesis and development. *Innovation* is where we find an absolutely new way of thinking about, or doing, something. Examples are the hovercraft principle and prefabricating buildings — innovations at the time they were revealed to the world. It is one thing, however, to have plenty of time to think about something new, another to improvise quickly on the shop floor; but when a supervisor makes 'bricks without straw', uses an alternative material for a job in an emergency, finds a quicker way round a job, works out a new procedure, then he or she is being innovative or creative.

Synthesis is where we take ideas from two distinct sources — for example the computer and the typewriter — and combine them, in this case to produce a word processor.

Development occurs when we take a basic idea and extend it. For example, the original idea of the car has been altered out of all recognition, its use extended to freight carriage (lorries), warfare (motorised guns, half-tracks), medical use (ambulances), and so on.

The department within the production function which performs most of its creative activity is variously known as the design department, research or research and development (R & D), design and development, projects department, or even new products department.

Product design and development. We live in an exciting era of ever-accelerating change: every day new techniques and new uses for existing techniques, materials and skills are discovered and old ones discarded. Fashions in technologies, techniques and materials change, and companies cannot hope to survive, never mind prosper, without reviewing their product lines regularly.

This could entail product replacement, that is, an entirely new model, or, more usually, significant modifications to existing models. In some industries innovations of this order are incorporated in production as a result of some research breakthrough or arise in the research and development department, but it must not be overlooked that ideas do come from customers, from looking at the product ranges offered by competitive organisations, or from suggestions from employees, especially those working in the sales/marketing function. (Often the marketing department has its own product research teams.) Whatever the source, it will normally be the production function's research and development department which will have the tasks of analysing and developing the idea and vetting it thoroughly. It is important to ensure that an idea has at least a reasonable chance of being translated into a useful and

[1] McGregor, D. (1960) *The Human Side of Enterprise*. New York: McGraw Hill.

saleable product before beginning an expensive design/development/production programme.

The product life-cycle. Ever since the Industrial Revolution dramatically increased the number of manufactured products it has become apparent not only that products have a 'life', with stages very similar to those in the human life, but that they eventually 'die', that is they become obsolete, outmoded or of no further use as progress has passed them by. This process can be expressed diagrammatically as in Figure 1.1. However, what is more significant is that the demand for the product will vary over time, as shown in Figure 1.2.

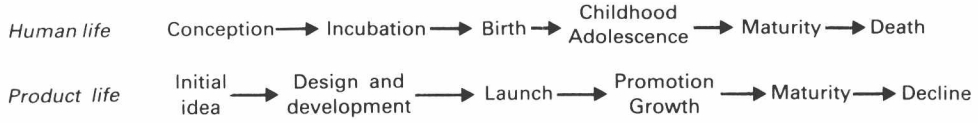

Figure 1.1 *Comparison of human and product life-cycle.*

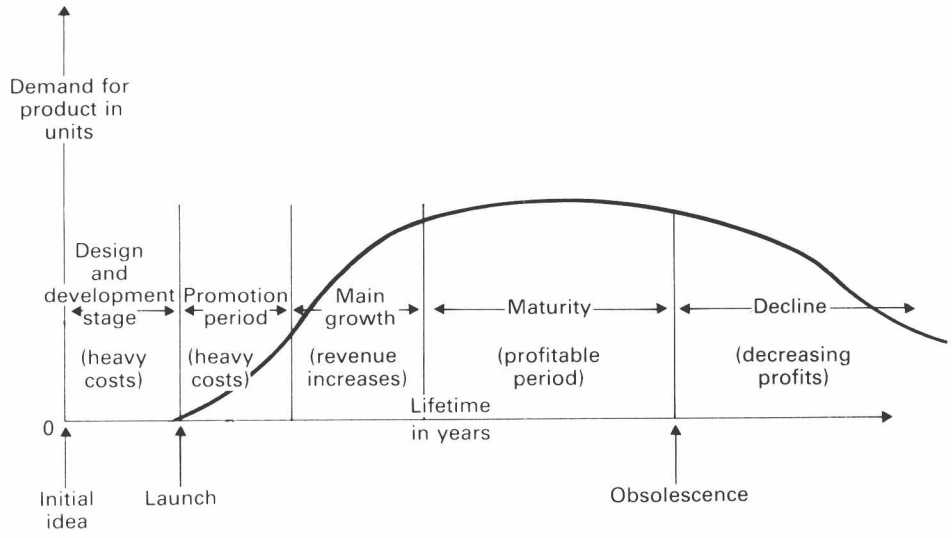

Figure 1.2 *Typical product life-cycle.*

Just because a successful product has been launched, it does not mean that the innovation process is over. Eventually the product will become obsolescent and will contribute less and less revenue to the business. The time to develop the next product is therefore well before the maturity period of an existing product ends. A company's success depends on a continuous product replacement programme, as outlined in Figure 1.3.

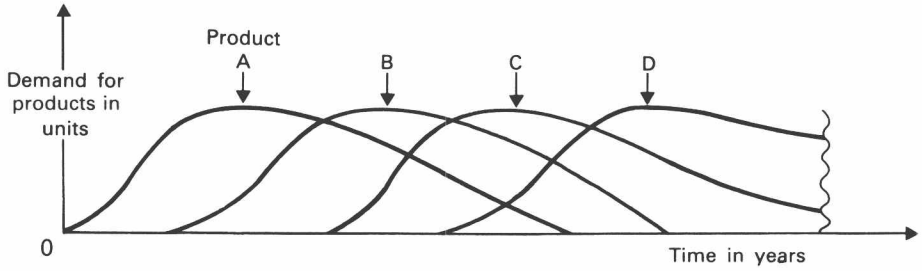

Figure 1.3 *Product replacement programme.*

Finally, we should note two recent and very significant trends in production demand within advanced Western nations and Japan. First, there is a trend towards shorter and shorter life-cycles. Products, particularly in fast-developing fields like electronics, word processors, and information systems technology, are becoming obsolete within a few years of launch. Compare this with the nineteenth-century steam engines which often had lives exceeding 50 years.

The second trend is one away from long-run totally standardised mass production towards shorter-run, more sophisticated products. The days have gone when Henry Ford I was able to say that customers could have any colour of car they liked, as long as it was black! Now, for example in military aircraft, weaponry and motor vehicles, there are numerous 'versions', which provide a greater flexibility in use as well as a larger potential market; and again, in 'customised' cars we can see variations round a common theme.[2]

Planning and forecasting

Forecasting means looking into the future, while planning means making decisions about what course of action should be adopted to meet the challenge of the future.

No one can plan in the abstract. Planning implies having precise aims or objectives and working out how to achieve them. Thus planning is involved in:

(a) setting goals;
(b) deciding on the means by which the goals will be achieved.

At company level this could mean:

(a) setting a target-line, for example a £7 million turnover next year;
(b) deciding to sell abroad as well as to the home market, as a way of achieving this (higher) target.

Forecasting is an art, not a science, and no one can predict the state of the economy or an organisation's probable situation in ten years' time with a great degree of accuracy, but the better the forecasting, the better the plans can be.

[2] Students who would like to read a full and well-argued account of this trend are recommended to consult Toffler, A. (1980) *The Third Wave*, pp. 189–196, 239–242. London: Pan/Collins.

Planning at different levels. All levels of management are involved in planning, but as the plans of lower levels depend on those of the higher, then higher-level plans must:

(a) be developed first;
(b) be more long-term;
(c) be more flexible.

Top managers should therefore concentrate on overall *strategies* and *long-term* plans; what the organisation's goals should be two, four, five or even ten years ahead.

Middle management should concentrate on *tactics*, or how the overall strategies are to be achieved. This often entails devising and operating short-term plans, from six months to two years ahead.

Supervisors should plan work activities such as how to meet this month's production quota, and decide what each member of the workforce will be doing at any given time. Such plan time-scales can vary from a few minutes ahead to a year or even longer.

Production planning departments. Before looking at specific departments concerned with planning in the production process, it must be realised that not all planning is carried on in these departments. For example, selecting the factory site and the most appropriate type of building, planning the shop layouts, and deciding on the type of labour to be recruited and the appropriate training for that labour are all tasks that could be carried out by individual senior managers, or groups of them. However, this section concentrates on planning carried on immediately prior to production.

The main aims of production are:

(a) to produce goods, articles or products which, as far as is practicable, comply with the specifications, quality, quantity and delivery requirements laid down by the customers;
(b) to produce these goods, articles or products in such a way as to make the best possible use of the resources of the organisation — workers, money, machines, materials — at least possible cost;
(c) to produce these goods, articles or products in a balanced, continuous programme as far as is practicable, and to minimise excessive fluctuations in the rate of production.

Although these three major objectives are not in themselves incompatible, it must be recognised that in attaining the first, and main, objective (unless the planning departments are extremely efficient and flexible in approach, and luck runs one's way) the other two objectives may have to be sacrificed to a greater or lesser degree. Too often it happens that, in an endeavour to get repeat business by supplying goods on time, excessive overtime is worked, materials are ordered at higher prices, work is put out to competitors and quality control standards are less strictly applied. All these things are done to overcome some deficiencies in the system, such as insufficient material stocks, inadequate maintenance programmes, or even lack of communication between departments.

To attempt to meet the three major objectives, we need to make decisions about a wide variety of activities, the most important of which are:

(a) the allocation of suitable types of labour to the various departments;
(b) the precise sequence of operations to be followed in executing a customer's order;
(c) the precise deployment of labour in any given department involved in the production sequence (often with the aid of such techniques as network analysis and method and work study) where jobs are continuous or routine;
(d) the purchase and storage policies in respect of raw materials and bought-out components;
(e) the provision of suitable space for finished goods;
(f) the establishment of an adequate information-gathering system to record all production activities in such a way as to assist their control.

How these activities are allocated in any given manufacturing organisation will depend on a whole host of factors. Basically, however, once the R & D department has decided on the product's design and specification, the *materials control* department will be involved in the purchase and availability of the raw materials and their storage, and the *production planning* department will be involved in establishing layouts, production methods, operations sequences and job timings; this department could also be involved in the scheduling and loading of individual orders, but often this is the work of *production control*. Once the order is in hand it passes out of the planning stage and is dealt with by a *progress department*, but if there are production difficulties, problems are referred back to production planning for further guidance and amendment as required.

Organising

Organising is the next stage after planning. Organising can be broken down into:

(a) working out the actual jobs needing to be done to fulfil the plans agreed on;
(b) grouping activities into a pattern or structure;
(c) giving specific people in the organisation specific jobs to achieve the agreed objectives.

Thus if a cricket test team is selected to tour Australia, a plan is worked out to win the series. It might be, for example, to use the fast bowlers in spells of eight overs each, with spinners held back until later in the match, in which case organising would involve drawing up details of the bowlers to be used and the type of field to be used. In the light of the way play develops, decisions can be taken on the order of the bowlers and the setting of appropriate fields. (The hallmark of a good sports team is the way in which they function apparently without orders, though obviously everything has been planned and organised in advance.)

The *organisation chart* (see Chapter 2) is a picture of the formal organisational relations within the organisation.

Co-ordination. If there is a series of plans covering not only all departments in the organisation, but also each individual in each department, it is essential to ensure that all their efforts move together in the same direction. Co-ordination is, then, an essential part of organising, rather than a function in itself.

Bureaucracy. The organisation's role and purpose were explained by Max Weber. In his *Theory of Bureaucracy*, organising had a central position; specialisation, hierarchy of authority, rules, and trained managers in precisely defined jobs — all these are facets of organising.

Summary. Organisation is a method of ensuring that:

(a) the work required to fulfil plans is broken down into parts and given out to various individuals in the organisation;
(b) there is neither duplication nor 'underlap' of work;
(c) all efforts are harnessed to a common goal.

Organising is essentially an activity carried out in the production function by the various *managers* and *supervisors*, who make decisions on a day-to-day (even minute-to-minute) basis about the allocation of work to particular machines or the use of particular members of the workforce — all in the cause of fulfilling the objectives and plans already laid down. (It is essential, however, that these managers and supervisors are fully aware of the plans, predetermined layouts, task sequences, chosen materials and job methods before the jobs arrive in their departments.)

Thus for the manager organising would include ordering materials needed for the production schedules, ordering tools and other equipment needed in the department (large, expensive items might need authorisation at a higher level), and ensuring that the best use of the available labour is being made.

In short, organising is making *all* the arrangements for production.

Motivating

The importance of motivation of *all* staff in an organisation has in recent years at last begun to be recognised. The problem of finding ways to motivate staff employed in the production function is possibly greater than in other departments, probably because of the nature of the tasks which production workers are called on to do. Certainly, production workers are more likely to strike than administrative, office or managerial workers; because of this, the control of manufacture is all the more difficult an operation.

D. Katz[3] said that there are three basic types of behaviour essential for an organisation to function properly and effectively:

1. People must be induced to enter and remain within the system: labour turnover and absenteeism can be costly and unproductive if allowed to get out of control. However, physical attendance is not enough.
2. People must do their appointed jobs in a dependable fashion: organisations, if they are to function at all, have to rely on a continuous, fairly stable pattern of relationships over time.
3. People must on occasion (and depending on the job) be innovative and exhibit spontaneous activity in achieving organisational objectives which go beyond those which are laid down for them.

[3] The motivational basis of organizational behavior (1964), *Behavioral Science*, **19**, pp. 131–146.

A great deal of work has been done in trying to find the 'magic formula' which would ensure that all these three types of behaviour were always present in all organisations. A discussion of all the various theories and the ideas and research on which the theories are based would be out of place in a book such as this,[4] but we might think the following propositions worthy of consideration:

1. Human beings like working in groups, and many of them prefer to identify with a group.
2. Many people like to be consulted about the work they are to do, and to feel they have a say in how their work is to be carried out.
3. Certain people are underemployed (i.e. not enough use is made of their talents), and this is a cause of dissatisfaction.
4. Repetitive assembly work is likely to be less attractive in the long run (and more conflict is likely to be generated in such surroundings) than work demanding the use of skills and decision-making. Playing about with the job surroundings rather than trying to make the job more interesting is likely to have little effect.
5. Money is not the only motivation, but it can be regarded as a levy exacted in a society which asks some workers to work at repetitive tasks.
6. People want status and a superior position in relation to others, and very often the need for a certain status is a strong motivator. (For example, in pay claims there is often talk about 'relativities'.)
7. It is up to the supervisor to try to find what motivates his or her group most, and to convince each subordinate to want to do what he or she has been assigned or asked to do.

It can be seen that there are no 'motivating departments' in the sense that specific departments exist to carry out tasks such as creating, researching, planning, marketing or producing. Motivating the workforce is the task of all managers and supervisors, an 'across-the-board' activity. While the basic motivating 'package' (pay structures, fringe benefits, welfare provision, etc.) and management attitudes are decided at board level, it is up to individual managers and supervisors to work out how best to lead their own work groups, to identify which management style is best for them.

It is true to say, however, that these managers and supervisors will need to rely heavily on the assistance, advice and often training provided by the *personnel department*, in acquiring the skills of group management, such as team building.

Communicating

As with motivating, this fifth function of management is not confined to one department, but is again the task of every manager. A subject like 'communication' is so large and complex that it requires fuller treatment. However, we should clearly identify what is involved.

By 'communicating' we mean the transfer of an idea from my mind to yours in such a way that it is understood. Good communication occurs when a useful or appropriate idea is transferred efficiently. Bad communication has many causes, but it results in either the non-arrival of a message or the arrival of a distorted or inappropriate

[4] See Evans, D. (1981) *Supervisory Management: Principles and Practice*, pp. 90–94, 130–134, 170–174. Eastbourne: Holt, Rinehart and Winston.