SOME IMPLICATIONS OF HUMAN ASPECTS OF CELL MANUFACTURE

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SUMMARY

Group Technology as a manufacturing system technique has been used in the United Kingdom for the past ten to fifteen years.

Initially it was installed as an alternative manufacturing technique to functional layout in batch type production. Economic advantages were obtained often being quantified by such factors as reduced work in process, reduced throughput time.

The need for reliability of resources in G.T. systems made management more aware of the need to consider the most important resource - the human operator, and this led often to a completely new management structure, more importance being made of the system aspect of G.T. rather than a manufacturing principle.

In spite of these proven advantages why is the incidence of G.T. application in industry only very small?

This Thesis examines existing situations in an attempt to answer the above question. In so doing it highlights the need for good human relations recognising that G.T. cuts right across traditional attitudes to work and the skill content of jobs.

The natural reluctance to change a system and the associated fears of redundancy are discussed and a procedure for implementation suggested which, if followed, will minimise the human resentment that can occur when a system or way of working is changed.

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INTRODUCTION

The prime objectives of most organisations are:

(i) to remain in business;

(ii) to operate at a profit;

(iii) to obtain a satisfactory return on capital invested.

To enable a company or organisation to achieve these objectives it is generally agreed that considerable attention must be paid and the correct emphasis given to the following:

(i) the allocation of resources relating to tools, hardware;

(ii) production of an organisation which is co-ordinated in all its aspects;

(iii) obtain the right people and place them in the right places;

(iv) pay attention to training and development of skills for the work that is to be done;

(v) take heed of the needs of the inner nature of man with respect to security, incentive and opportunity;

(vi) plan for the future.

The nature of the organisation will influence to a very large extent the interpretation and implementation of the above objectives. In a manufacturing organisation the type of product produced, the market for the product, the finance available to the organisation, the general economic conditions of the country in which it operates are the determining factors.

A historical survey of the growth of British Industry indicates that a large proportion has its roots in family concerns, in many instances one-man businesses.

Generally an owner-manager can directly attend to almost all of the work in running his business; seeking new orders, attending to customers, day-to-day running of his business, finance, legislation and so on. With expansion of his company, the stage is reached when he can no longer supervise all of the work directly and he then must learn to work through others by the delegation of authority for certain aspects of his business. Initially this delegation of authority produced what is often referred to as a military or 'line' organisation (Fig. I).

The diagram illustrates a direct flow of authority to the different sections. Each section head being responsible for everything within his section or department - for example the machine shop manager, planning, rate-fixing, inspection, discipline, etc. - a task which clearly has no defined limits, and one which could only be performed satisfactorily by a superman.

F.W. Taylor, an American engineer, in about the year 1880 gave considerable thought to this problem of the departmental head having to do too many things. Taylor's solution to the problem of having too much to do was to remove parts of the foreman's job and give those duties to specialists. He eliminated the old foreman's job completely and put all supervision in the hands of eight functional specialists (Fig. II). Every shop floor worker now had eight bosses! Understandably, Taylor's idea of an organisation did not work very well and never became popular. Taylor himself gave lectures, wrote books and was employed as a management consultant, and although his listeners did not adopt his functional form of organisation they did adopt the Line and Staff form, which has all the advantages of Taylor's functional form with only a few of the disadvantages. The 'Line and Staff' organisation (Fig. III) is a co-ordinated system and has for its foundation the joining of the functional idea with the direct flow of authority exercised in the line organisation, with side channels of authority flowing out from the main stream at different points in the form of functional or staff departments.

To clarify the distinction between a line and staff man, or a line department and a staff department, a basis for discrimination must be given.

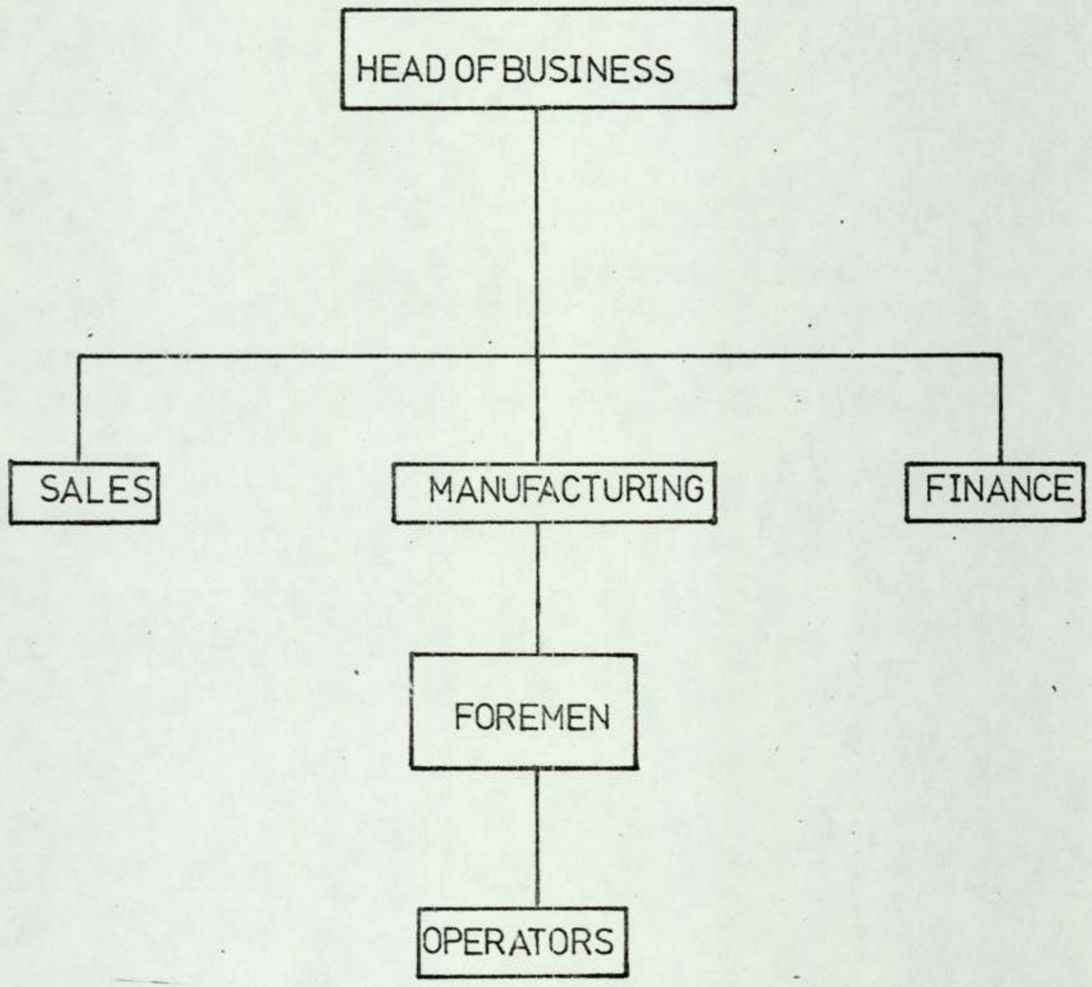
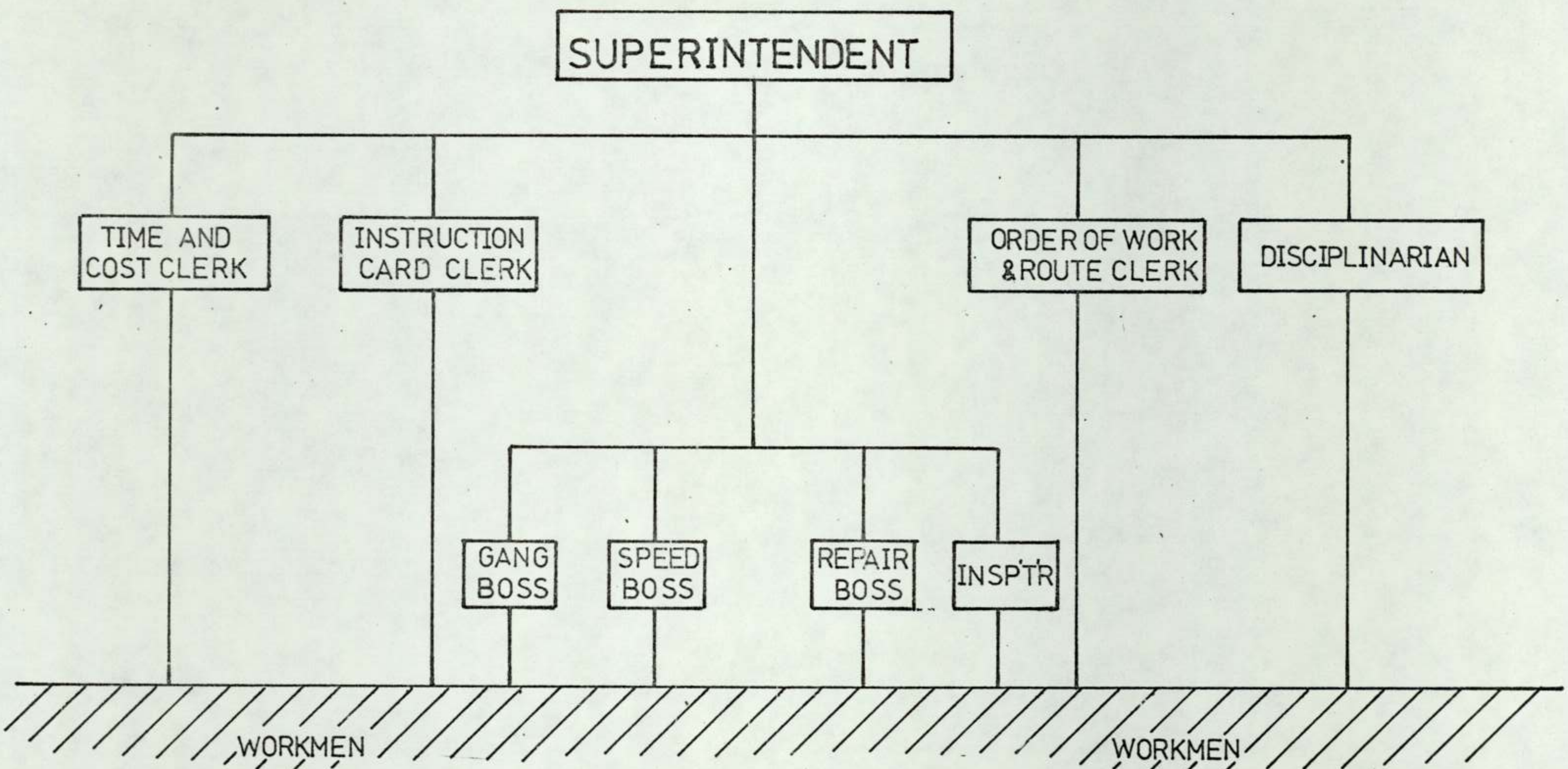

HEAD OF BUSINESS
SALES
MANUFACTURING
FINANCE
FOREMEN
OPERATORS

FIG.1



taylor's functional organization

FIG.II

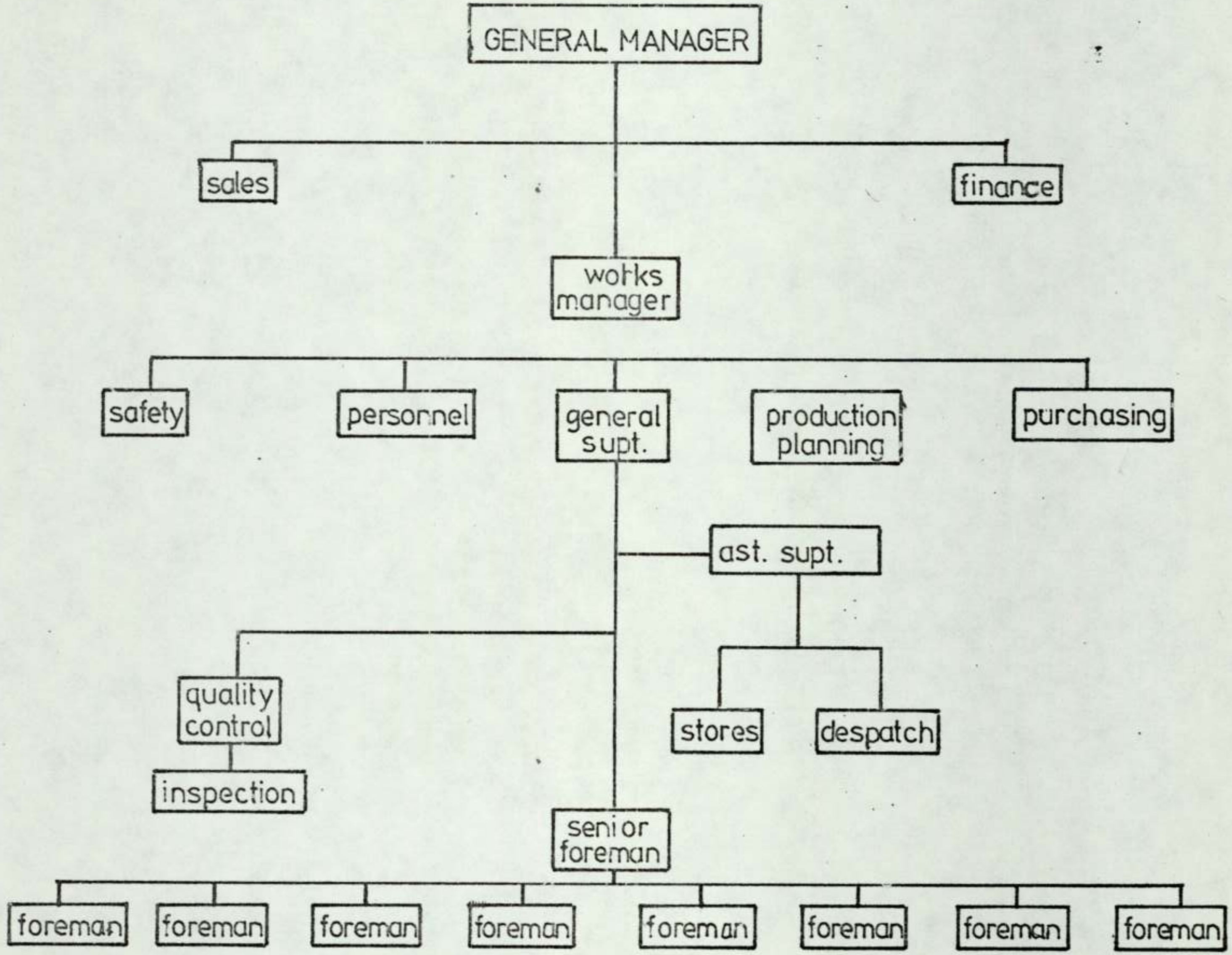

GENERAL MANAGER
sales
finance
works manager
safety
personnel
general supt.
production planning
purchasing
ast. supt.
quality control
inspection
stores
despatch
senior foreman
foreman
foreman
foreman
foreman
foreman
foreman
foreman
foreman

FIG. III

A line man is one whose work deals with more than one phase of his division of the business, and who has 'productive' workers under him. A staff man deals with one particular phase of the business or, if his work be of a general character, he does not control any 'productive' workers.

There is a danger in this type of organisation, that staff men may tell line men what to do, and everything is supervised by experts. Foremen end up with smaller jobs, single accountability is upset, the areas in which they can make decisions are considerably reduced. Staff people can usurp the authority of a line man. They can give advice or orders, unaware of their effects outside of their speciality, and hence communications between the various functions tend to work against each other.

Figure III is a simplified organisation structure; in practice the features, functions and complexity of the organisation will depend on what the organisation produces, its size, and to a very large extent to the board of directors and their attitude to the delegation of responsibilities. Irrespective of the simplicity or complexity of the organisation it must be such that it is co-ordinated in all respects such that the highest efficiency in production is obtained by manufacturing the required quantity of product, of the required quality, at the required time, by the best and cheapest methods. In doing so, the three prime objectives will be realised, providing external influences do not operate against the company, but it does not follow that such a company will give the necessary consideration to the points made in (i) to (vi) above.

In the early fifties, Professor S.P. Mitrofanov of the U.S.S.R. gave considerable thought to the problems facing the majority of production engineering organisations, stating:

"The main problems in organisation and work preparation occur in small and medium-scale production, where the individual elaboration of the method for each new component entails an enormous amount of time and resources.

The development of technological processes, and the planning and manufacture of tools, account for 60% to 80% of production cost. Favourable conditions for the extensive mechanisation and automation of industry will not arise by themselves. Technical development today calls for the introduction of scientific principles in solving problems pertaining to the technical preparation of manufacture." (Mi/69) Mitrofanov then goes on to expound the basic principles of Group Technology initially related to technology of manufacturing.

It is also now generally accepted that the firm, the organisation, is a Socio-Technological System. A system which, for success, must integrate not only the economic and technological developments but also the aspirations of those that work in such environments. Much work has been done in this field by Margaret Fazakerley (Fa/73) who writes:

"It has always been the case that new technologies have led to the evolution of new social environments in which fresh social values find their place. It is unfortunate that before the technological impact is fully realised it is difficult to predict what the accompanying social values may be. However, it seems that the new production philosophy may well be based on the lines of cellular groupings. People value in their work such things as:

1. varied and intrinsically satisfying work;
2. the freedom to choose the methods and pace of work;
3. job security;
4. an adequate income;
5. participation on decision making;
6. personalised work relationships."

Recognition is now given by all enlightened management of the necessity to pay more than, as in the past, cursory or perfunctory attention to the human function in the system. It would also seem that recent developments in Group Working as practised by Volvo and Saab in Sweden have been occasioned as a direct result of acceptance by management of these companies that perhaps efficiency is better improved by concentrating firstly on the people and secondly on the processes and not in the opposite order as is the normal practice.

In Eastern Europe, Group Technology seems to be more easily acceptable but published data, such as it is,rarely mentions the human function concentrating on the technological and economic benefits. In the Western Democracies, G.T. is recognised as a complete manufacturing system, embracing all functions and involving everyone. Its success depends on everyone working together as a team, from the General Manager down to the lowliest of workers on the shop floor.

Among the 5000 engineering companies in the U.K. with 25 or more employees, probably only some 150 make use of G.T. This slow rate of introduction can probably be explained by the following:

1. Suspicion of the extravagant claims for G.T. made by some of its earlier promoters.

2. The highly technical nature of much of the debate about its merits which has little meaning or relevance for senior management.

3. The fear that its introduction necessarily involves a major organisational upheaval. (Experience shows that a gradual or phased approach is perfectly feasible and in many circumstances preferable.)

4. With so few installations the absence as yet of the competitive pressures which might have forced companies to consider its introduction more seriously. (In valve manufacture where leading companies have introduced G.T. such pressures have built up. They are beginning to develop in pump manufacture, and more recently in machine tools.)

5. Traditional attitudes and practices and the fear of industrial disputes inhibiting management from undertaking experimental changes on the shop floor.

6. The conflict of interest which arises from the transfer of responsibility to the shop floor and the simplification of planning and control procedures. Middle managers and supervisors and other specialist white collar workers are in some cases no longer required in the same numbers, or at least their roles may be seriously altered. Those who have applied G.T. or who have considered it believe that this problem lies at the root of much of the resistance to its spread. It helps to explain why so few applications of G.T. have involved any significant restructuring of work on the shop floor or reductions in the cost of administrating overheads. Only a firm commitment by senior management and active involvement of the interest of all employees, both in the factory and in the office, can be expected to overcome such resistance.

(The above six points are extracted from a booklet published by the Mechanical Engineering E.D.C. 'Why Group Technology?')

G.T. involves everybody and therefore there is a natural tendency for people to look upon it with suspicion. Questions are asked - 'how does it affect me?'; 'does it mean redundancy?'; 'if production will be increased what will my take-home pay be?' These and many other questions in a similar vein have been asked and not necessarily answered to the satisfaction of the enquirer.

The stage has been reached in the development and application of G.T. where the economic advantages are easily discernable although it might not be possible to measure these results accurately, nor to compare them with the best possible alternative practice. Likewise it should now be possible to determine the social consequences of G.T. and the fundamental object of this Project is to:

Investigate companies where Group Technology has been installed, successfully or otherwise, with a view to examining the Human Aspects with particular reference to the problems that were encountered, how they arose and were overcome. Resulting from the investigations it is envisaged that it will be possible to suggest a general philosophy as guide lines to companies contemplating changing to an organisational structure based upon G.T.principles.

CONTENTS

CHAPTER ONE

CONVENTIONAL METHODS OF PRODUCTION

1.1.1 JOBBING PRODUCTION

Here the quantity involved is usually small, quite often 'one-off'. This does not mean that the organisation is itself small for jobbing production embraces not only work for prototypes, for research, repairs, specials, etc., but also very large engineering structures such as ships, turbo-generating plant, materials handling equipment, chemical plant, etc.

Some of the organisations involved in jobbing production employ valuable and accurate machine tools and associated equipment together with highly skilled personnel and these usually provide a service in certain of the areas mentioned above. Also within this group are those organisations with largely old or at best reconditioned plant employing perhaps not more than twenty men, privately owned with the owner working on the shop floor with his employees and overheads kept to a bare minimum.

Jobbing production is also a very common feature of those industries producing turbo-machinery, oil drilling platforms, to mention only two. Here the total number of employees of all grades might total several thousands working in a capital intensive environment and within a very complex organisation structure.

1.1.2 BATCH PRODUCTION

This is concerned with the production of a number of identical articles. When production of the batch is complete then the plant is available for the production of the same or other products. Within the system can be found a variety of work, in batch sizes varying from say 1 to 1,000 all at various stages of manufacture. In certain instances, the end product is incorporated into the company's own goods and sold directly to the consumer; whilst in other organisations the results of their work is used directly in another company's product or forms the 'raw-material' to be used in another industry.

From the writer's industrial experience and that necessitated in gathering material for this work, this type of production is a very common feature not only of British industry but Western European industry generally. Batch methods of production being found not only in machine-shops, but in press shops, forging and foundry industries and of course being continued in the production of sub-assemblies as well as final assemblies.

1.1.3 CONTINUOUS PRODUCTION

Where large quantities are required coupled with a high consumption rate this type of production is found.

Invariably the machines and associated equipment are loaded with equal hours of loading, the operations to be performed have been broken down into small units and flexibility in parts produced or production methods is negligible. Considerable scope is usually found in this type of production environment for the design and development of special purpose machines, processes and equipment; this invariably leading to less and less worker participation in, and control of the process.

Work scheduling, planning and control when done for a single resource are relatively simple tasks since output is easily balanced against plant capacity. Such control becomes very complicated when the interaction between resources must be taken into account. This fact alone reinforces the initial comment of the Thesis that, whilst a single G.T. cell in a plant is perhaps one way of gaining valuable experience in a limited sphere, to exploit the full potential it is imperative that the complete manufacturing system is considered.

With continuous production, management involvement tends to be rather remote and, with a total work force of several thousands, many decisions, apart from the main ones such as - what the company produces - are arrived at through works committees of one form or another. This sort of environment, if recent industrial unrest in such industries in the U.K. is anything to go by, seems to engender an 'us and them' attitude and the comments by some well informed and experienced commentators of the industrial scene that, management must bear some of the responsibility for operating in a vacuum. On the other hand, the writer's experience of some of those organisations that have gone over to G.T. indicates that success in this venture is more likely to be ensured when management take themselves down on to the shop floor and become involved in a partnership and not try and impose conditions from above.

CHAPTER TWO

PLANT LAYOUT

PLANT LAYOUT

INTRODUCTION

Any arrangement of machines and associated equipment and facilities is a layout.

A 'good layout' is one that allows materials in process to move through the necessary operations rapidly and in the most direct way possible and all necessary non-direct services are readily available. It also envisages minimum space requirements and minimum distances consistent with safety between machines or operations.

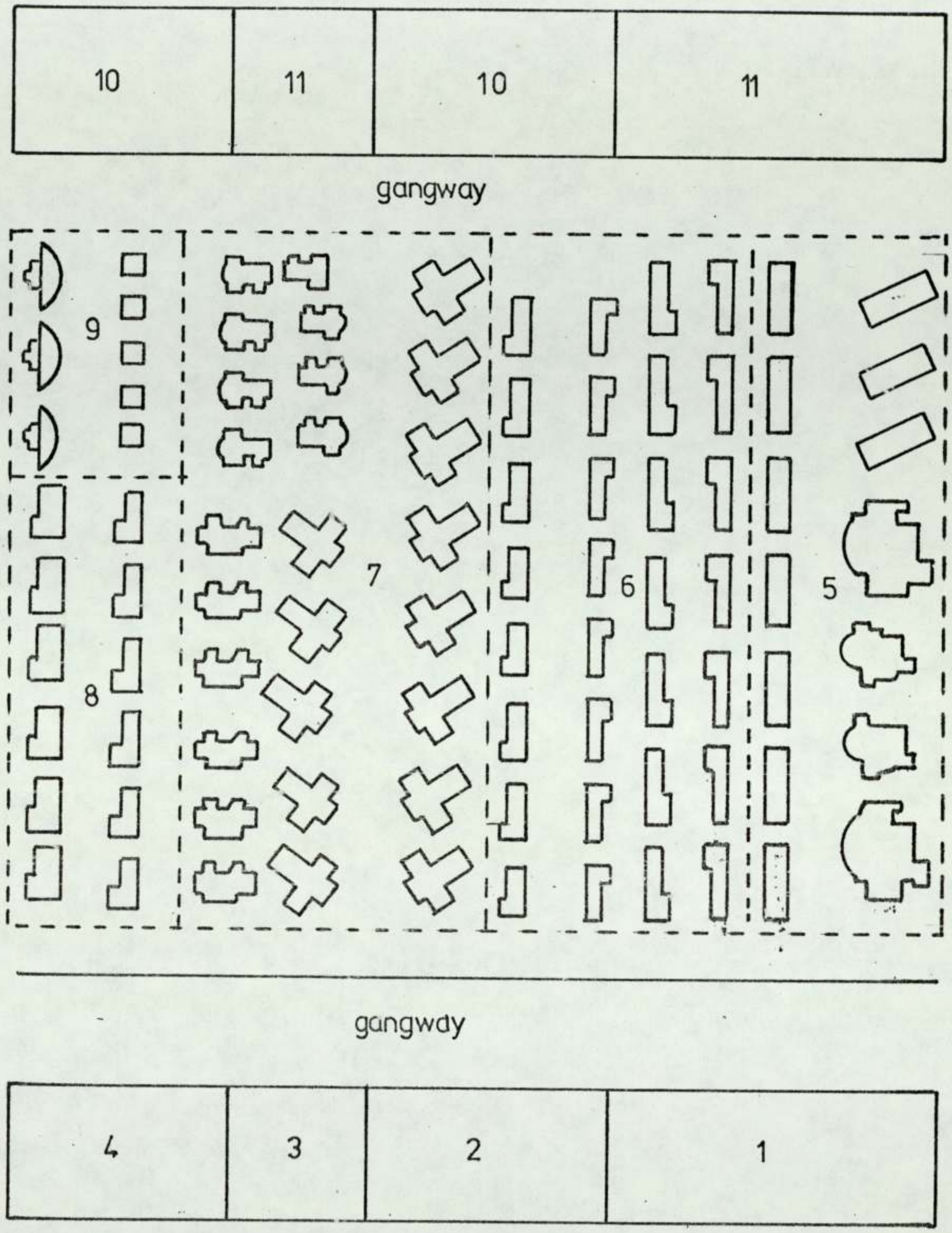
It has also been considered essential that a good layout must also be a flexible layout. The reason for this is the fact that most companies make many products, each following a different path through the machine shop; and that a good layout for one product would be poor for another. Design changes as well as production changes and therefore the layout must be flexible enough to be altered quickly and with the minimum of expense resulting in little loss of production.

2.1.1 PROCESS LAYOUT

This type of layout groups together machines doing like work, e.g. centre lathes; milling machines; grinding machines; presses; welding; painting, etc. (Fig.IV)

Such a layout is mainly employed in jobbing and batch production. Within each group are located the auxiliary services considered necessary to keep each functioning, but not such services as jigs and fixtures, cutters, materials, except in isolated instances all services are usually kept separate.

Because most components require a variety of operations the individuals can identify themselves with say the 'jig and tool stores' and not with component manufacture.



1 stock of rough castings
2 grinding section
3 tool stores
4 office
5 heavy turret & vert. lathes
6 universal lathes
7 milling; planing & slotting
8 turret lathes
9 boring machines
10 inspection
11 stores

FUNCTIONAL LAYOUT
(after thornley)

FIG. IV

2.1.2 PRODUCT LAYOUT

Fixed routes for materials, and hence the machines etc. are located along the product flow line. Automatic equipment can be used and materials can usually be moved by automatic or mechanical handling devices or conveyors (Fig.V).

This type of layout is suitable for continuous types of production. Service areas, stores etc. being located in close proximity to the flow lines.

2.1.3 HAPHAZARD LAYOUT

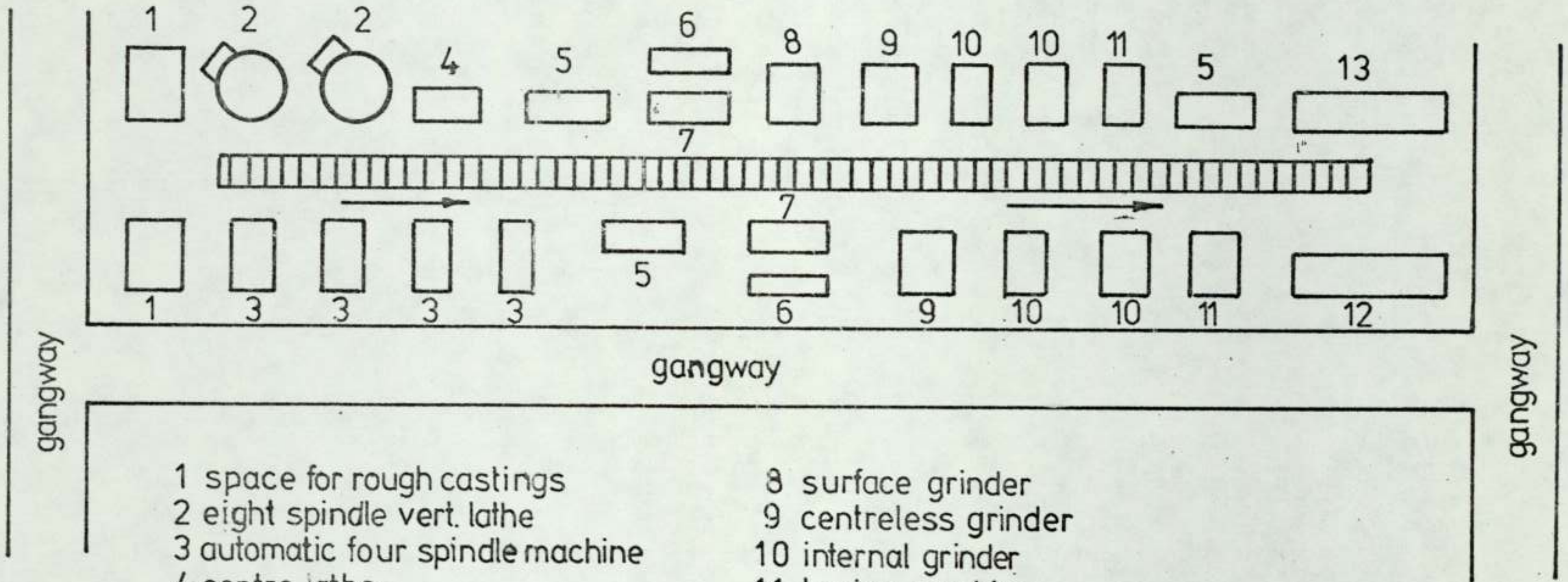
A very large number of the smaller engineering plants in this country engaged in jobbing or batch production have their machines and equipment so arranged that there appears to be no logical reason for its disposition (Fig.VI).

Little or no thought has been given to machine location and, as machines have been acquired, they have been placed where a sufficiently large enough space is available or the making of such space by moving existing plant.

Material does not move smoothly and the shop floor tends to become part of the stores.

2.2.1 ADVANTAGES OF PRODUCT LAYOUT

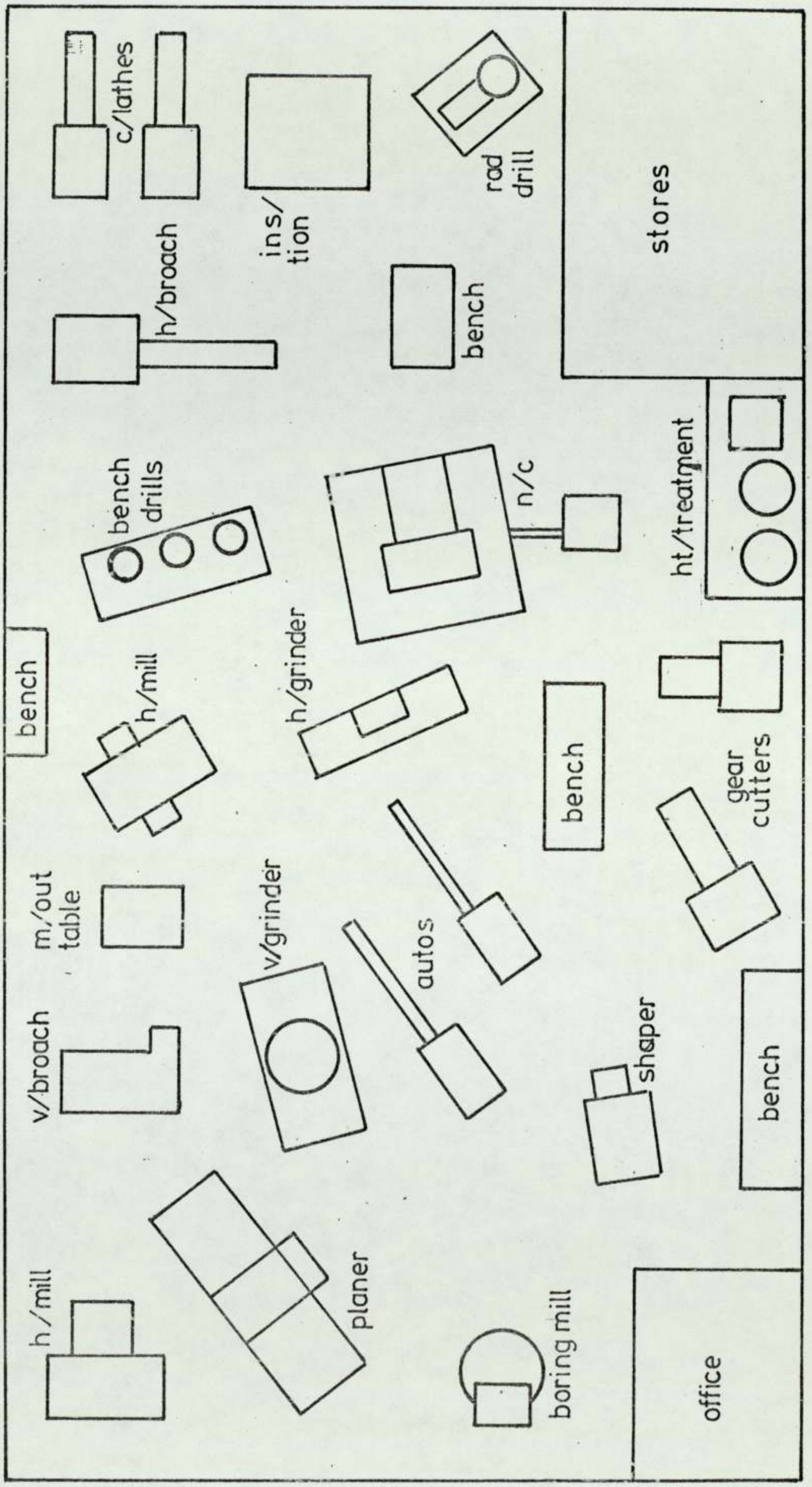
1. Layout corresponds to sequence of operations, resulting in smooth and logical flow lines.
2. Reduced materials handling, since the machines are located so as to minimize distances between consecutive operations.
3. Small amounts of work in process, as the work from one process is directly fed into the next.
4. Less space is occupied by work in transit and for temporary storage.



1 space for rough castings
2 eight spindle vert. lathe
3 automatic four spindle machine
4 centre lathe
5 technical control
6 control panel
7 heat treatment
8 surface grinder
9 centreless grinder
10 internal grinder
11 honing machine
12 assembly
13 packing

LAYOUT OF EQUIPMENT FOR THE FLOW MACHINING OF BEARING RINGS
(after thornley)

FIG. V



HAPHAZARD LAYOUT

FIG.VI

5. Total production time per unit is short.

6. Simple production planning and control systems and simplified supervision.

7. Little skill is usually required by operators at the production line; hence training is simple, short and inexpensive.

2.2.2 ADVANTAGES OF PROCESS LAYOUT

1. Flexibility in equipment or manpower allotment for specific tasks. Thus load distribution can be controlled, and this is particularly of importance in case of breakdowns, for maintenance schedules and for multiproduct manufacture.

2. Better utilization of machines available time; consequently less machines are required.

3. Comparatively low investment in machines is required.

4. Each section can benefit from specialised supervision.

5. The diversity of tasks offers a more interesting and satisfying occupation for the operator (Ei.62).

2.2.3 ADVANTAGES OF HAPHAZARD LAYOUT

1. Layout makes it easy for same men to perform several successive operations on the same part with minimum transportation distances. The worker is in very close proximity to the next machine.

2. It is easy to change things around.

3. Greater possibility of machines dovetailing together, since shape of machine determines its position. Some machines are long and narrow, others are round, and some nearly square. Some require considerable space above ground, others may require areas below floor level.

4. Layout is flexible and changes cost very little money.

2.3.1 LIMITATIONS OF PRODUCT LAYOUT

1. Layout is determined by the product and leaves little room for flexibility. A change in product design may need major alteration in layout.

2. The 'pace' is determined by the slowest machine; hence speed of machines is deliberately reduced or machines have excessive idle time.

3. A breakdown of one machine may lead to a complete stoppage of the line that follows that machine.

4. Comparatively high investment is required, as identical machines (a few not fully utilized) are sometimes distributed along the line; also, machines may be required to stand by in case of breakdowns.

5. Supervision is general but not specialised.

2.3.2 LIMITATIONS OF PROCESS LAYOUT

1. Long flow lines; hence more expensive handling.

2. Comparatively large amounts of work in process, waiting for the next operation.

3. Space and capital are tied up by work in process.

4. Production, planning, and control systems are more involved.

5. Total production time is longer, owing to time consumed in materials handling and to waiting times.

6. Because of the diversity of the jobs in specialised departments, higher grades of skill required (Ei.62).

2.3.3 LIMITATIONS OF HAPHAZARD LAYOUT

1. Materials do not move rapidly through plant.

2. Congestion of men, machines and materials.

3. Little convenient space for operators, gangways, and storage.

4. Inadequate and inconveniently located service areas for products and

employees.

5. Impossible to confine objectionable operations, i.e. those that are noisy, create dust, or make fumes, or heat, etc.

6. Control of production is difficult and costly since exact location of product or employee is not precise.

2.4.1 GOOD LAYOUT v POOR LAYOUT

The characteristic of a good layout is stated on page   and the converse must therefore be true of a bad layout.

Unfortunately for a large number of organisations the solution is not simple or easily achieved.

Any productive organisation should review continuously its capacity to ensure operational balance. This in effect means constantly adding machines in some places and taking them out in others. Also since most organisations are in a continuous state of growth, machines, plant and equipment must be added to as well as replacing outdated or worn out plant.

The layout is in a continuous state of flux.

Gallager and Knight (Ga/73) report a reduction in manufacturing costs per piece of 40% after the application of group technology and the necessary re-organisation that G.T. implies.

Any improvement in layout usually results in savings far beyond the costs involved in the alterations. Savings should be in the areas of labout costs and improved productivity. Other savings result from the reduction in materials handling and transportation and these can be as high as 55% (Ga/73).

When a company makes a variety of products and these pass through the various production stages in batches and therefore are at different points in the development of their completion, under these circumstances it is almost impossible to tell whether the layout is good or bad.

It is therefore much better to look carefully at the following points; if they exist the layout is not a very good one:-

1. Slow movement of materials and components through the shop.
2. Gangways and workplaces congested with part finished components.
3. Picking up and putting down and material transportation costs are excessive.
4. Large numbers of personnel employed in material transportation.
5. Service areas and departments inconveniently located.
6. Excessive damage and loss of components in process.
7. Excessive number of progress chasers.
8. Failure to meet due dates.
9. Stores overloaded with material.

Hence a good layout will have eliminated or at most minimised the above points.

CHAPTER THREE

HUMAN RELATIONSHIPS WITHIN THE ABOVE SYSTEMS

HUMAN RELATIONSHIPS WITHIN THE ABOVE SYSTEMS

3.1.1 PROCESS LAYOUT

Each machine in each group has basically the same characteristic functional purpose. For example, in a centre lathe group, the functions performed are the production of flat or cylindrical surfaces, special types of form such as screw threads and concial surfaces. Hence it is seen that each machine will produce similar types of work.

The workers in the group, even though they may be operating identical machines, do not necessarily have the same skill ability and even if they do the possibility of all carrying out the same operations is very remote. Also they work as individuals, not as a group.

Based upon the author's experience and contacts with industry, this situation can lead to a hierarchical grading of labour, with those considered to have less skill, late workers, or those finding disfavour with the group leader at the bottom. It can also mean different rates of pay within the section, this being particularly so where there is no local or national agreement or if each job within the plant as a whole has not been subjected to a job evaluation exercise.

Invariably each operator is responsible for his machine. This can lead to a certain amount of pride in seeing that the machine is well maintained and cleaned at regular intervals. It also means that each operator gets to know various 'wrinkles' applicable to his machine relating to its method and accuracy of operation, thereby contributing to the production effort of the group.

Since the groups are relatively small, perhaps not more than ten workers, each knows what everyone is doing and this might be conducive to harmonious relationships and be reflected in performance figures from the combined group. The internal relationships within the group depend on the attitude and quality of supervision.

If the foreman is a responsible person, who gets on well with his men, the men will respond accordingly. Such a foreman will get to know his men extremely well, will assess their physical and psychological attitudes to the work and put such information to good use. For their part, his men will know that he is their link with functions external and yet vital to the section and will look after their interests. Invariably within the group a good spirit prevails.

On the other hand a weak attitude on the part of the supervisor can be detrimental particularly if he allows the opinion to prevail that he is a "boss's man" or a "yes man".

Quite often the supervisor has been upgraded from within the section and as such he feels a certain amount of allegiance to his workers and his sympathies can often be on their side in any dispute. In a process layout there is little flexibility available for continuing production should one group be disruptive.

A fact often overlooked is the need for the supervisor of a group to be given specialised help in enabling him to handle people responsibly.

Many foremen of sections also plan the work loads, schedule jobs, see that materials are moved, etc. They will also see that materials are used economically and that quality is up to standard. They should also ensure efficient methods are followed, particularly when this means more economic methods of production. All these things must be done in such a way that worker morale does not suffer, absenteeism and labour turnover kept to a minimum. This becomes very much easier for the foreman if good and amicable relationships exist within the group.

Arising from the various conversations that the author has had with foremen most, in deference to the lack of variety in a process layout, like their jobs and would not wish to change. Some expressed the feeling that they always seemed to be on the wrong side when things went wrong and rarely received praise. One, as in Case Study No.2, was bye-passed when it suited management, whilst others thought that they should be given more information particularly about immediate and future plans.

3.1.2 PRODUCT LAYOUT

Invariably the human content of all the necessary operations in this type of layout has been studied very carefully resulting in little skill required and yet the operators themselves become skilled at the simple tasks each is called upon to perform. This de-skilling of the work calls therefore for semi-skilled or even unskilled workers, since they can be trained fairly quickly for the tasks required. The success of the layout does of course depend upon skilled setters and the backing of good management systems. Worker boredom is invariably endemic in this type of layout and quite erroneously, as in the automobile industry, possibly pressurised by unions, been thought by management that it can be overcome by paying high wages either in the form of piece work or using some premium system. Many voices in the field of Industrial Management view such a policy as abrogation of management.

Product layouts operate within a functional type of structure, where specialists are brought in to institute and then control their specialities on the shop floor. Quality Control and Production Control are two such specialisations. They provide a service to supervision - this is ideal if all that is wanted is for everything to be controlled by 'experts' but it is bad from the supervisory angle. Supervisors in such an environment know that they can influence neither the work content or how it is performed - these and other areas are now the forte of the specialists. Supervisors feel that they have little authority left, this leading to poor quality supervision and supervisors.

Absenteeism in product layouts is usually quite high, souring still further relationships between workers and between workers and supervisors.

It is also fairly common to find labour turnover in such systems at a fairly high level exacerbating relationships still further.

Certain industrial concerns have started to look at the above problems with the Phillips organisation in Holland and Volvo in Sweden evolving new production techniques based upon much smaller units where each worker can perform a variety of tasks and therefore returning to a more corporate atmosphere (Jo/75, As/74).

3.1.3 HAPHAZARD LAYOUT

It is difficult to draw any hard and fast conclusions from engineering industries where the plant and equipment layout do not appear to follow any pre-conceived pattern or plan.

On the one hand we have a very large company where the physical size of the product is not very conducive to an orderly layout - such companies tend to be few and far between. Whilst on the other hand we find, usually privately-owned, equipped with second-hand plant and equipment, the owner invariably working on the shop floor for part of the time.

Prior to 'safety at work' legislation, conditions in the private sector was usually sub-standard or barely complying with the then legal requirements. Rates of pay are sometimes below the accepted norm for the locality and this fact along causes problems by attracting mediocre labour and with lack of capital and other limited resources such conditions tend to be accepted as the norm. The foreman or supervisor in such situations is often a dedicated man possessing a high level of skill, being called upon to perform all manner of duties from those of a technical nature to those dealing with the human side of the business.

Because the owner is closely associated with all his employees, the supervisor finds that in many, many instances his judgment and decisions in practically all matters and on all occasions undermined by the workers appealing to the owner. Where this does not occur then, whenever even a minor dispute involving the work content or a small grievance leads to workers leaving at very short notice, with the inevitable of either engaging others of the same ilk or a greater workload falling on the shoulders of those remaining, especially the foreman.

In spite of the above it must be mentioned that there are a very large number of such plants producing quite remarkable work, and providing a unique service to other industries, research institutes, etc.

CHAPTER FOUR

NEED FOR CHANGE IN MANUFACTURING SYSTEMS

NEED FOR CHANGE IN MANUFACTURING SYSTEMS

History to many people is a record of events on an international scale, on a national scale, and on an individual scale affecting the ordinary man and woman.

On the international scene we have seen the evolution of power blocks, the demise of empires and the rise of passionate nationalism. Because of such changes as these there has been a corresponding change in relationships at international level. The so-called 'gun-boat diplomacy' of several decades ago would, if practised today, soon lead to a grave international situation particularly from those countries espousing the 'new freedoms'. Events on a national scale are perhaps best illustrated by reference to the Industrial Revolution that is characterised by the introduction of new methods of manufacturing and bringing more power to the elbows of the worker. In spite of early resistance to change brought about by the Industrial Revolution, by workers who at the time could only see their replacement by machines and a de-skilling of their crafts, the changes continued. Arising from the Industrial Revolution were large manufacturing concerns particularly for the spinning and weaving of cotton goods, in the manufacture of steam locomotives and associated equipment, and in the making of ships to name but a few. The age of the cottage industries was dead!

It is impossible to prevent change, it can be diverted, it can be halted for a short time, but inevitably it will continue. Some maintain that the Industrial Revolution is still continuing and, if its concept of bringing more power to the elbow of the worker is accepted, then the introduction of numerically controlled machine tools is a clear indication that we are still involved with the Industrial Revolution.

Inevitably as a result of changes in an international and national scale the lives of the individual are also altered. No longer do we have to maintain large armies and navies. The need for manpower has been considerably reduced in the armed forces. Opportunities for a career in the services has diminished. Also with the development of more complicated equipment there has been a move toward a different breed of service man compared with his predecessors.

Similarly the newly emerging nations have, and quite rightly, a strong desire to control their own destinies, both politically and economically. Hence we find them setting up their own manufacturing industries. India is a good example. On gaining independence it set about establishing its own iron and steel industry, aircraft industry, setting up research establishments equivalent to the N.P.L. and A.E.R.E. etc. This, so far as British industry is concerned, meant a dimunition in the call for British products and services.

With the advent of the steam train, the population became more mobile, towns and areas of the country became more accessible. The automobile brought about increased mobility and a newly found freedom of going anywhere and not as previously only where the railways thought fit.

The government of the day, rightly or wrongly, accepted the challenge, reduced the rail network and embarked on a new road system.

It would now appear that, with the estimated ceasing of large volumes of oil at the turn of this century, change must surely come once again to our methods of transportation or we retreat to the horse and cart and all the restrictions that will entail.

Perhaps the latest change affecting many of the population of certain countries is the introduction of the digital watch. The combined output of ordinary watches from Switzerland, Russia and Japan a few years ago was estimated to be in excess of 100 000 000! Each watch containing perhaps fifty or more parts and the price range for the finished article ranging from a few pounds to several hundreds. The first digital watches, with no moving parts and a guaranteed accuracy of a second per day, cost somewhere in the region of £300. Today a similar watch manufactured by a company with no connection with watch manufacturing retails at under thirty pounds!

Traditional watch manufacturers in Switzerland, Russia and Japan must be seriously worried about the challenge of the digital watch.

What of the labour force?

Another prime example is the ordinary ballpoint pen. These pens were introduced on to the British market in the middle forties with a retail price of about four pounds. Today, ballpoint pens are given away as souvenirs, as sales gimmicks and the cheapest ones retail for a few pennies.

The above examples are given solely to indicate that with the changing pattern of life dictated by international, national or individual level, there must be a corresponding change in all stratas of society.

Of course, few people accept wholeheartedly the need for change. There are still isolated instances where shopkeepers refuse to price the goods they sell in the new decimal coinage; even though they must eventually accept the new coinage from their customers. Some even closed shop rather than accept the change. The same resistance is encountered as metrication is applied more and more to goods and services.

Fortunately with such changes as decimalisation and metrication the schools, from the earliest age onwards, play a most important part. Youngsters these days are taught these new systems and know no other and so, whilst the old practices are slow to die, die they most surely will.

What of our industries?

Many born in the throes of the early periods of the Industrial Revolution, others as a result of the vastness of the British Empire when, for many peoples in those different lands, Britain was the 'Workshop of the World'.

Many of these industries employing relatively small numbers of people, perhaps not equipped with the latest types of machine tool and equipment and, as suggested earlier, such plant and equipment poorly laid out. Yet in the past contributing, and many still contributing, in spite of difficulties, to the economic life of the country.

How can such industries carry on, let alone cope?

If an industry employing a large workforce experiences difficulties that it finds difficult to surmount the result is blazoned across the headlines of the press, on television, radio and the other popular media. Government intervenes. Public money is invariably forthcoming and in the minds of certain people normality returns.

What of the smaller industries?

Collectively they employ many more. They do not have the same resources, expertise or the ability to influence government. Their cries for help are seldom heard or if heard little help, if any, is forthcoming.

What problems do they face?

Invariably it is competition. This might be local, national or competition from another country.

Sometimes it is the problem of rising costs for raw material, labour and overheads. Sometimes it is the problem of insufficient labour of the right type of skill or just insufficient labour.

What can they do to survive?

Should the company have sufficiently attractive assets then it can become subject to a take-over by a more successful or more wealthy organisation. It may be bought out by its competitors. It might be subject to an asset stripping operation.

But what if it is not taken over or indeed may have no wish to be taken over? How then can it survive or must it go to the wall? Many companies faced with the above or similar situations and, accepting the need for change, both on the part of management and workers, have re-organised the structure of the company and its methods of operation based on Group Technology and the results are generally available for all to see.

Such companies have invariably surmounted and overcome their initial difficulties and problems and have found additional bonuses that were very far from their original thoughts when first contemplating Group Technology methods of manufacture.

CHAPTER FIVE

GROUP TECHNOLOGY

5.1.1 DEFINITIONS OF GROUP TECHNOLOGY

1. Group Technology is defined as an organisation principle that can be applied to all departments of an enterprise concerned with production.

This principle is based on the systematic grouping of identical or similar components by using classification systems.

All components combined into a group are subject to common planning and machining, thus achieving a high rationalisation effect, particularly in the case of single and small batch production. This application of Group Technology is generally known as part family manufacturing.

Further rationalisation can be achieved by applying the same principle to other production areas, mainly through standardising all production data and through simplifying and automating the necessary planning activities using electronic data-processing systems (Ev and Mi.74).

2. Group Technology is a method of organising production processes such that specialised shop floor machines and their operators (drilling, turning, grinding, etc.) are grouped into cells containing an assortment of machines which together perform all the operations on a 'family' of products or components; as opposed to the more traditional grouping of these machines into large shops each containing all of one type of machine. (Bo and Co 75).

3. Group Technology or 'Parts Family Manufacture' is a method of achieving some degree of mass production technology in the batch production industry. It is a technique which enables the benefits of large batch production to be extended to the manufacture of small and medium batches. Sequences (families of similar components) are formed from small batches of identical components and is achieved by grouping the components in accordance with those features which influence their manufacture. This grouping leads to a reduction in setting time and

increased productivity with the available labour. Increased machine utilisation may or may not result from the re-organisation depending upon the circumstances. In general key machines will be better utilised but lesser important machines may well be under-utilised. It is therefore important that in order to fully utilise the labour force available, certain members of the team will need to be conversant with the operation of more than one machine (Blacknest G.T. Centre).

4. Group Technology is the replacing of traditional jobbing shop manufacture by the analysis and grouping of work into families and the formation of groups of machines to manufacture these families on a flow-line principle with the object of minimising setting times and throughput times (Du.70).

5. Group Technology is the realisation that many problems are similar and that, by grouping similar problems, a single solution can be found to a set of problems, thus saving time and effort (Pe/66).

6. The logical arrangement and sequence of all facets of company operation in order to bring the benefits of mass production to high variety, mixed quantity production (Ra.72).

7. The approach of line production as applied at present, with each machine permanently assigned to one component, has two major requirements. It can be used only for products made to standardised designs, and it can only be used when there is a large market demand for the products. Because of these limitations, it is employed to meet only a small part of the world's requirement for manufactured goods. The rest of this requirement is met by batch production methods, in which the machines and other facilities are each used to make a wide variety and diversity of different components and finished products in successive batches. In batch production there has been no important advance since the Industrial Revolution. We have made technological progress and improvement in

methods but our general approach to batch production is much the same as that used in the Arsenal in Venice in 1350, and in the Soho Foundry in Birmingham in 1780.

Group Technology is a new approach to the manufacture of products in batches. It represents a major breakthrough in the field of production which is comparable in importance with the introduction early in the present century, of line production for the manufacture of mass produced goods (Bu/69).

Many engineers make the point that G.T. is not new and that they have personal knowledge of using it many years ago, some even go back to the 1914-18 War. One vital point is omitted from all these deliberations and it is not until recently has G.T. been applied to the complete manufacturing system embracing all functions and all personnel.

8. Group Technology can be considered as a means to provide for the mass production of the similar components needed for batch-produced products. Group Technology attempts to apply some of the benefits of mass production to the batch production of products. This objective is pursued through the grouping of parts or components to provide families of items which are sufficiently similar to permit the use of a flow, but not necessarily linear, type of processing system. The term 'cell-system' refers to the organisation of men and machines in this situation. A cell is therefore a group of facilities associated with the manufacture of usually one, or perhaps more, group or family of items of components (Wi/73).

9. Throughout the industrialised world a substantial variety and types of product are manufactured by batch production methods. Under these conditions the conventional plant layout involves a large number of transport operations with associated stocks of raw, semi-finished and finished materials, attempts to improve the situation have resulted in numerous production and management techniques with the aim of producing

goods at minimum cost.

Group Technology offers a possible solution to the batch production problem by determining the similarity or relatedness of the design and sizes of products and the processes used for their manufacture. By bringing together families of related components, lines or groups of machines can be established which, in effect, simulate flowline production conditions. This opens up many other possibilities including rationalising the products, developing sophisticated intra-operational techniques and inter-operational transport which together accelerate the flow of work and reduce overall costs (Gr.73).

5.1.2 HISTORICAL BACKGROUND OF GROUP TECHNOLOGY

"There is nothing new in the world, everything awaits discovery." This could well be true of Group Technology.

Many of our more elderly Production Engineers will relate the methods used by them during the 1914-18 period, and indeed some can put forward concrete evidence that they were using certain principles which we today readily associate with Group Technology - namely scheduling a variety of components requiring very similar operations along a line of dissimilar machine tools.

Various technical journals have contained vociferous communications alleging that it is wasteful in both manpower and money for the Department of Trade and Industry to set up such organisations as the Group Technology Centre at Blacknest; for the Academic Staff of Universities to engage in activities connected with G.T., even for Institutions such as the Institution of Production Engineers to form and support a specialist division in Group Technology.

"A Production Engineer engaged in and responsible for batch production, if he is worth his salt, should be practising G.T.!" No doubt the arguments will continue.

Perhaps there is nothing new. Invariably it is the case that a variety of reminiscences are culled to try and disprove the claim. Possibly certain individuals resent their past and present activities being questioned. They are fully aware of each and every situation, stick doggedly to past practices and only those ideas, innovations and methods that emanate from themselves have any merit!

Fortunately such individuals are few and far between, but are nevertheless quite formidable opponents.

The history of Group Technology, so far as documented evidence is concerned, originated in the Soviet Union during the Second World War (Pe/66).

"Group Production as a progressive method of organising production sequences was used in the machine shops at certain machine-tool works. It was here that the first steps were taken in setting up specialised component sections and flowlines for the machining of specific groups of components with similarities in design and machining sequences. Straight-line batch flowlines, or as they were termed 'group flowlines with changeable work places', were organised at the 'Krasnyi Proletarii' and 'Ordzhonikidze' Machine Tool Works in particular, for the machining of a wide range of relatively simple machine-tool components of similar shape, such as gears, spline-shafts, handles, bushes, and levers. Group Technology was taken further at other engineering works engaged in medium and small-batch production in the years following the war, particularly between 1950 and 1957.

During this period many enterprises improved the production structure of their main workshops by abandoning the obsolete principle of bringing similar equipment together into machining sections, in favour of the simpler and more effective 'group' organisation of production processes.

Specialised sections, established for certain groups of parts, were set up and brought into full production.

As the foremen and operators gained experience, the machining techniques and sequences were corrected and to some extent standardised. Those employed in the sections concerned became familiar with Group Production Techniques and took a more responsible attitude to the quality of their work and the delivery of scheduled batches (groups) of components on time.

Finally, the system was integrally tied up with improvements to the system of operational planning, since it reduced the degree of dependence on the performance of other sections. Apart from the advantages in respect of production organisation and planning, the setting up of specialised sections was found to improve the shop and works cost figures significantly. One of the biggest cost advantages of the closed-section system is that it increases labour productivity, since each workplace can be specially designed for a definite operation on a specified component. This results in the reduction of labour and general production costs.

Specialised sections can operate on a much shorter cycle time, because of the major reduction in what is known as 'inter-operational delay'; the components take less time to pass through the production cycle. A shorter cycle time leads in turn to a smaller volume of work in progress and a quicker release of tied-up capital.

Sections organised to make specific components produce a better article, since narrow workplace specialisation facilitates the adoption of rational techniques and the skill of the workers is improved.

In spite of these undeniable advantages, component specialisation has some inherent faults. The work loads on the different sections may become out of proportion, and there are difficulties both in keeping the equipment fully in use if the production programme is subject to sudden changes, and in organising the servicing and planned preventive maintenance of the machines etc. On the other hand, when the enterprise itself is specialised and tied to a steady output programme, these faults become less serious and are more than compensated by the great inherent advantages of this undoubtedly progressive system of specialised sections.

Examples are given of labour productivity increases of 12 - 20%; the cost per unit value of finished product falling by 2 - 3%; reduction in the duration of the machining cycle of 25 - 35%; with the average value of work in progress falling by 15 - 20%. Experience has also confirmed that the re-organisation of machine-shop production structures, particularly on the basis of specialised component sections, offers advantages in that it creates a real organisational basis for the wider use of flowline techniques and fully mechanised production sequences under batch-production conditions.

The second important prerequisite for the organisation of multi-component and, in particular, group flowlines is the idea of standardised or type production techniques, first developed scientifically about thirty years ago by Professor A.P. Sokolovskii (this system is based on a classification scheme which reveals products that have a common sequence of operation)(Pe/66).

So long as group flowlines and sections are subject to interruptions in production flow, it is impossible to adopt the most progressive techniques and high productivity equipment or to eliminate all the difficulties of planning production. Much time is still lost when the equipment is reset. Before interruptions in output at the workplaces in group lines and sections of the batch production enterprises could be eliminated technical measures were required to raise the level of specialisation at each workplace. This became possible with the discovery of the Group Machining Principle.

Group machining represents one of the most important steps forward in the standardisation of production processes, since it in fact eliminates the unjustified variety in techniques, tooling, documentation and so on.

In the early years following its introduction (1956-60) the group machining methods were adopted primarily for simple components machined in a two- or three-operation sequence, and for isolated machining operations in more complicated components. Experience at a number of works has shown that within two to three months of the installation of mechanised group flowlines in which the machines are not subject to re-setting, the labour costs in component machining drop by 25 - 30% and the labour productivity rises by an average of 40%.

Group flowline machining improves the quality of the components, since most if not all of the operations are carried out with the aid of special tooling. As a result scrap losses are much lower and the production cycle time is cut 30 - 50% of its former value. The volume of work in progress drops by 30 - 50% and less working capital is tied up in this form.

According to the records of the Industrial Economic Studies Laboratory at LIEI (P.Togliaatti Institute) the once-only cost of designing and constructing the tooling and mechanical handling devices and organising the group flowlines under discussion was recovered within 10 - 15 months.

The use of Group Production in the Soviet Union is continually increasing!

According to the Head Section on Group Technology at 'The Scientific Research Project-Design Institute for the Technology of Machine-Building', there are at present more than 1800 group product or subsections, including flowlines, section and shops, in operation within the engineering and instrument making enterprises of The Russian Soviet Federal Socialist Republic alone! More than 59 000 machine tools are in use for group machining. The saving resulting from the adoption of group machining runs to more than 13 million rubles.

In the enterprises in and around Leningrad, where the method was of course originally developed and put to large-scale use, about 11 520 units of equipment and 205 flowlines, sections and shops are devoted to Group Technology (Pe.66).

Mitroianov (Mi.66) makes reference to Professor A.P. Sokolovskiy of the Soviet Union who suggested and developed the idea of 'Typification of Technological Processes' and stated that 'typification is the systematisation and generalisation of the experience of the entire machine building industry; and, in addition, it is the systematisation of new thoughts and ideas'. Further, Professor Sokolovskiy was of the opinion that the typification of technological processes would be a way of transforming the technology of machine building into a science.

Mitrofanov's book is devoted to the technology of 'Group Technological Processes' - and is a development of the idea of typification - one of the new variants which makes it possible simultaneously to solve a number of problems and to insure the introduction of a scientific basis for the development of technological processes and the organisation of production planning for piece, small-batch and mass production.

Not surprisingly little is mentioned, in any of the Russian publications, directly related to any human aspect of worker involvement apart from increases in productivity, labour costs, labour content and the various management functions.

No doubt all grades of labour are conditioned to accept without questioning the dictates of the hierarchy!

In 1969 a seminar on Group Technology was held at the Turin International Centre for Advanced Technical and Vocational Training (In.69). Fifteen papers were presented to the Seminar by speakers from ten different nations. Four films of Group Technology were shown from France, the United Kingdom, and the U.S.S.R. There were 77 participants from 20 different countries.

Only one of the papers presented was exclusively connected with the human side of Group Technology and that was related to 'The Management Problems of Introducing Group Technology'. Perhaps after only a brief period of thirty years since its supposedly inception in the U.S.S.R. the remainder of the world was more concerned with the techniques with little thought for the workforce which was to be caught up inextricably with the rearrangement of their working lives!

Since 1969 there has been a slight improvement in the situation and it has been noticed that more and more managements are being made aware of the fact that industry is a partnership and if maximum benefits are to be obtained then all levels of the workforce must be involved.

Over the past four years many meetings, seminars, workshops, conferences, etc. exclusively devoted to Group Technology have been organised over the length and breadth of the United Kingdom. At these events more and more emphasis is being placed on the effects that re-organisation of production methods has on the workforce. With time, more and more information is being recorded and documented relating to the experiences of the most vital asset of production - the people involved.

Group Technology is a new concept. It involves a fundamental change in attitude and awareness and, without the whole-hearted acceptance at all levels, of the principles and the need for change in attitudes, the economic and social advantages pale into insignificance.

Finally, the author believes that those who say that they have been using Group Technology for very long periods do not really understand or appreciate all of the implications. They do not understand the need for component classification, the use that computers can play in scheduling etc. Because of this lack of understanding they cannot possibly conceive the total savings and benefits that can accrue.

Their outlook is, to say the least, quite narrow. Those individuals would do well to study carefully Fig.VII and really understand what it implies. They too should visit various firms who, from his own experience, have been only too eager to explain their own re-organisation and what they set out to obtain and indeed gained from Group Technology. Should they still be in doubt then, organisations like P.E.R.A. will carry out a realistic survey and arrive at a conclusion conveying as much information as possible relating their own products, plant and equipment to Group Technology methods of manufacture, together with an assessment of the objectives that could be attained over a given period of time.

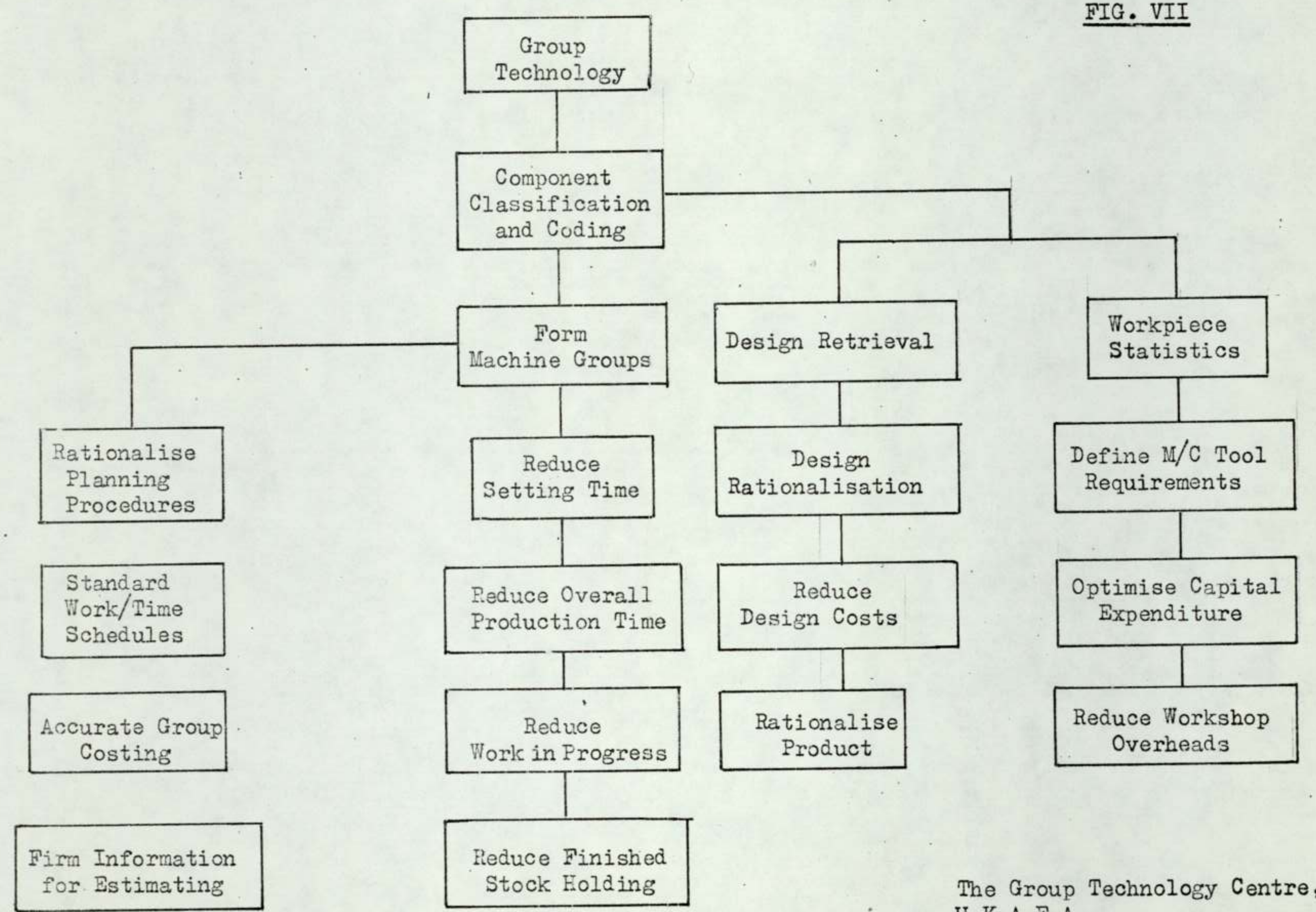
Alternatively, they can copy the experience of many firms who have sponsored suitable employees on post-graduate courses at the various Technological Universities; specifying that the industrial content of such courses should, so far as their own students go, be involved with Group Technology within their own Company. With this method the company then has at its disposal the considerable and varied experience of the academic staff who, it must be remembered, as with many other innovations play a most important part in the development and introduction of Group Technology into the industrial life of the country.

5.2.1 ADVANTAGES CLAIMED FOR GROUP TECHNOLOGY

Arising from a large number of discussions with people in industry who have been directly concerned with either the implementation or initial investigation into the application of Group Technology methods of manufacture in their respective companies one very soon comes to the conclusion that there is no single reason for accepting the philosophy.

Strangely the reverse is true when they have considered G.T. and

FIG. VII



The Group Technology Centre,
U.K.A.E.A.,
Blacknest, Brimpton,
Nr. Reading RG7 4RS,
Berkshire.

rejected it. The reason offered for rejection usually conforms to one of the following:-

1. We have too much work in hand to allow disruption to our production.
2. We have been applying Group Technology methods of working for a very long time.
3. It is too expensive to implement at this particular time.
4. It is not suited to the particular types of product and components that we produce.

On closer analysis it is found that the personnel concerned have not really understood the basic philosophy of Group Technology and quite often, with the exception of (2) above the reasons they offer are precisely the same reasons why they should change their methods of manufacture to comply with Group Technology principles.

It is also a fact that considerable ignorance exists in the Production Engineering Industries regarding just what Group Technology is and what it can do in terms of increasing productivity without incurring at the same time excessive expenditure. This fact is very much substantiated by the number of quite responsible people who think that Group Technology is simply working in Groups! As one individual remarked, Group Technology is nothing new - we have been working in Groups for about fifty years!

Another company assured the author that they had complete plans for re-organising on G.T. lines and were just waiting for the Order Book to stabilise!

Quite often one suspects that the real reason for not wanting to re-organise is simply resistance to change. Perhaps this attitude is understandable when it is the Chairman or Managing Director who must make the decision; lacking courage and not wishing to disturb the status quo, adopts therefore a negative attitude. Such difficulties as this have been overcome by enthusiastic staff who have obtained the necessary approval for a small scale experiment or partial G.T. or the establishment of one cell. Carefully monitored its performance and then armed with hard facts and figures obtained the necessary approval for the continuation and enlargement of the experiment.

The Group Technology Centre, Blacknest, offered the following as examples of the advantages claimed by four companies with experience of Group Technology:-

1. SERK AUDCO

Aim	- To increase overall company efficiency
Manufactured Stock	- Reduced by 44% = £550 000
Product Manufacturing Time	- Reduced from 12 weeks to 4 weeks
Value of Despatches per Employee	- Increased from £2 220 p.a. to £3 203 p.a.
Average Income Per Employee	- Up 35%

2. ENGLISH ELECTRIC CO. LTD.

Aim	- To improve component production on individual machines
Machine Output	- Increased by 70%
Machine Setting Time	- Reduced from 50% to 5 - 7½%

3. FERRANTI, EDINBURGH

Aim	- To reduce component manufacturing time using multi-machine groups
Component Manufacturing Time	- Reduced from 26·5 days (average) to 3 days
Machine Setting Time	- Reduced by 66%

4. HOPKINSONS, HUDDERSFIELD

Aim	- Rationalisation of spare parts production
Spare Parts Stock	- Eliminated
Setting Times	- Reduced by 68%
Machining Times	- Reduced by 34%

Some Production Engineers have questioned the validity of the above claims, not from the viewpoint that the claims are false but from the quality of management. They argue that pre-G.T. production methods and the planning and control systems must have been very very poor that, when carefully studied and rearranged should lead to such phenomenal increases or reductions as catalogued above.

Another authority on Group Technology (Cr.72) suggests the following main advantages to be gained when moving from functional layouts to cellular manufacture; and qualifies each statement with certain restrictions:

5.2.2 REDUCTION IN SETTING TIME:

It is of great importance to achieve minimum set-up costs and that any possible saving is a function of:

(a) the nature of workholding;

(b) machine tool capability related to its size;

(c) relative movements in several planes of workpiece and tool.

The developments of consolidated set-ups should be slanted towards producing set-ups which are low in cost to operate and which are either comprehensive, that is capable of producing a variety of components with no tool change (a limited solution) or flexible, that is able to produce a variety of components with minimum tool change.

5.2.3 INCREASED MACHINING CAPACITY:

In some cases the implementation of G.T. may lead to an overall reduction in effective machine capacity. Certain machines will be under-utilised, essential that in the construction of cells high capital cost machines are fully utilised. Balance of machine loading is somewhat dependent on the scale of the family range and variation of batch size. Conflict between large cells with a balanced work load and smaller cells based on narrow families which, in the ultimate, can lead to gross under-utilisation.

5.2.4 REDUCTION IN TOOLING INVESTMENT:

If the plant is being established from 'scratch' with properly designed cells, the total tooling investment could certainly be less than that required in a functional layout. This situation is rarely met in practice. Most concerns will be moving from a functional layout to a G.T. layout which initially will probably make some existing equipment obsolete and which will certainly require additional expenditure on tooling. Furthermore, even in the best run batch production shops, equipment and tooling are frequently developed and used on the shop floor unknown to the Production Engineering Department; the disciplines required by G.T. cannot accept this situation and provision has to be made for the withdrawal, identification and formalisation of the use of such equipment or, in some cases, agreed replacement.

5.2.5 REDUCTION IN HANDLING COSTS:

In most cases, the proximity of sequential machines in cells reduces the length of the material flowline. It is generally necessary in establishing cells to provide improved handling facilities or, at least, a restructuring of existing facilities, particularly for larger components.

5.2.6 REDUCTION IN THROUGHPUT TIMES:

Correct application of G.T. procedures would generate substantial reduction in work in progress, AND THIS IS THE PRIME REASON FOR MOST COMPANIES' ACTIVITY IN THIS FIELD.

First reduction stems from quicker throughput times. Secondly, far closer coupling of the production programme to the constantly changing order input. Controls stemming from this facility enable changes in overall levels of business to be reacted upon more quickly and, of even greater importance, random changes in demand for particular products can be recognised and dealt with more speedily.

Thirdly, opportunity can be obtained from a combination of lower stock holding in finished parts stores and the manufacture of smaller batches. The quicker throughput time enables changing market needs, errors, random demands, etc. to be quickly dealt with and for stock-out to be corrected more quickly.

5.2.7 UNIFACTION OF RESPONSIBILITY:

The close involvement of work people with one another's activities, particularly in the inter-action of inter-dependent operations such as turning for grinding etc. enable common problems to be solved quickly. The need for flexibility of labour gives the opportunity for work people to gain additional skills. The self-containment of the cell produces a better morale which, among other things, leads to quicker correction and reduction of faults. A direct operator contribution is the improvement of quality and other positive attitudes stemming from the feeling of belonging to a reasonably small unit.

The supervisor requires a much broader experience and such people may not easily be found. The supervisor's tasks are somewhat different from those of the conventional foreman; progressing functions, for example, either disappear or reduce, or are modified, and one of the prime qualities a supervisor needs is good production engineering experience.

Reference to the various Case Studies indicate that those companies who have considered the human aspects of G.T. and considered the key importance of supervision are the ones who have generally been the more successful with their endeavours that those companies who have mainly concentrated on the technology largely ignoring the human factor.

It was also noticed that in certain firms (Case Studies No.8 and No.9) certain groups of workers, largely middle management, requested to be brought into the scheme and tended to resent their non-inclusion. In both instances these groups are now happily contributing to the overall system.

CHAPTER SIX

MONEY; MATERIALS; METHODS; MACHINES; MEN

MONEY; MATERIALS; METHODS; MACHINES; MEN

INTRODUCTION

Basically the Production Engineering function is:

"the organisation of resources of a Company to produce a system to take someone else's finished product, perform various operations changing its general form and in doing so make it more useful and at the same time more expensive".

To perform this function adequately it requires the use, direction and control of MONEY, MATERIALS, METHODS, MACHINES and MEN.

MONEY: to purchase or occupy the building, to purchase the materials, to purchase or lease the machines, to pay for the services of its employees.

MATERIALS: on which it performs the various operations together with supporting materials without which it cannot fulfil its function.

MACHINES: this is the equipment on which the various processes are to be carried out.

MEN: this is the total work force. Not only those who operate the various machines but those who have a controlling function and are either directly or indirectly involved with the Production Engineering Function.

The organisation is the systematic arrangement of building, plant and equipment and individuals in order to achieve a definite objective. It is the actual method of management, the direction and control of all the factors involved in manufacture, and the plan by which individuals work separately and collectively to accomplish a task.

6.1.1 MONEY

This commodity can be obtained from a variety of different sources. If it is a private concern and the owner is comparatively wealthy he might have no need to borrow. Should this not be the case he can resort to the Joint Stock Banks, Commercial Banks, Finance Houses, or he might be able to borrow from friends and acquaintances. Public concerns borrow money from Insurance Companies, Finance Houses, Pension Funds, or can use the facilities of the various Stock Exchanges.

In whatever way the money is obtained a very tight control is usually exercised over the way the money is spent and the resulting fortunes of the company monitored quite closely.

6.1.2 MATERIALS

Basically these are primarily selected for their physical and chemical properties in order to ensure that the component from which they are made will function satisfactorily. If several materials will meet these requirements, the cheapest is usually selected. The choice of material can also be determined by the available plant and equipment.

6.1.3 METHODS

Invariably these are determined by the materials that are to be used together with the plant and equipment available. For example, if a part could be made either by machining or using powder metallurgy techniques, and powder metallurgy would yield a considerable saving in production costs, such a method would not be used if the organisation lacked the facilities unless of course there was special reasons for purchasing the necessary equipment and expertise.

6.1.4 MACHINES

Represent initially a very high capital outlay and the prime objective should be as full a utilisation as possible that is consistent with economic production. It should always be remembered that an idle machine is occupying valuable floor space and costing money. The purchase or acquisition of machines and conversely their disposal should receive very careful consideration. A machine that has an enormous appetite is only economic if there is sufficient work to satisfy its appetite and keep it fully utilised. On the other hand it does not always make economic sense to dispose of a machine that is only used at infrequent intervals.

6.1.5 MEN

This is the most precious commodity of any organisation. All the non-human things in a business must be run by humans. Whilst it may be possible to standardise machines and equipment within the factory, there would appear to be no such possibility when the human element is under consideration.

The old idea was that there were certain jobs to be filled and these were filled with qualified men who were paid a reasonable wage. No interest, or very little, was shown in any grade of employee as an individual and surely an employee's attitude toward his work or why he felt the way he did was of no concern of the employer; how could knowing your workforce in this way influence the amount of work that he did?

Case Study No.6 still indicates that the above attitude still exists, whereas in Case Study No.4 most of the mental effort is being directed towards the human aspects of preparing a G.T. system. Fortunately there were some enlightened employers and Taylor's early work in the development of 'functional' organisation together with the growth in scale and size of manufacturing organisations led to the setting up of a separate Personnel Department, that in many many instances assumed responsibility at first for the Owner/Worker relationship which had by the time the number of employees was more than 200 an impossible relationship for the owner to continue, especially when his commitments in other areas did not diminish but quite the reverse - increase.

Also on the employers' side voluntary associations of companies to protect their interests started to emerge. These can be broadly classified as:-

1. <u>INDUSTRIAL</u>: whose members are engaged in the same trade of activity;
2. <u>REGIONAL</u>: to protect the interests of industry and commerce in a town or district;
3. <u>NATIONAL</u>: with membership drawn from the whole country and from widely differing industries.

The craftsmen and shop-floor workers too began to organise and reference to the Trade Union Amendment Act, 1876, and the Trade Union Act of 1913, define a trade union as:

"any combination, whether temporary or permanent, for regulating the relations between workmen and master, or between workmen and workmen, or between masters and masters, or for imposing restrictive conditions on the conduct of any trade or business".

We now see in place of the close relationship between master and men, two clearly defined groups, both concerning themselves with labour questions. The Trade Unions, however, being more concerned with wages and working conditions and any other topic that has a bearing upon the well-being of the worker. Whereas the employers associations concern themselves with labour questions, matters of interest to their industry as a whole, the encouragement of research and the dissemination of information for the benefit of their members.

It is also interesting to note that few organisations of professional institute status have a direct bearing on policy formulation. Professional societies are concerned with sectional interests of their members. Any member of the workforce, qualified in engineering, metallurgy, accountancy or other technology will be a member of the appropriate professional institution and will act in accordance with the ethical code of his profession. Such professions seldom if ever engage in deliberations with employers, either individually or with their associations to establish conditions of service for their members.

It is interesting to note that recently members of some professional institutions have been urged to join a suitable trade union as a means of improving or protecting their status.

In between the technologists and managers at the top and the shop-floor worker we find a large number of 'blue-collar' workers. The work that these people do is nearly as important to the success of the organisation as the manager at the top or the shop-floor worker. Apart from several fairly isolated instances these workers do not belong to any form of Union or Association and because of this find themselves at a disadvantage especially when it comes to trying to improve their pay or conditions of service. Also in any re-organisation they have poor channels of communication and little bargaining strength.

The introduction of Group Technology implies a complete re-organisation not only of the structure of the company but the shop-floor layout and all the work force. The first change that the majority of companies will have experience of. If money is required a simple exercise can determine the approximate amount and the time period required after re-organisation for its recovery. Methods might or might not change depending on circumstances. This is true also of the materials. The machines do not present too difficult a problem, after all they can be moved around, redundant machines sold and new machines purchased if necessary.

What of the Men?

Here there must be a complete re-thinking and attitude. The success or otherwise of G.T. depends on the efforts of the whole group, from the man right at the very top down to the lowliest of worker on the shop floor.

Sectionalised interests at the best must be forgotten, at the least modified. Management must remember:-

1. Efficient human relationships are the foundation of a successful business.
2. Security and self-respect of the individual are the foundations of these efficient relationships.
3. Security and self-respect must apply not only to the material needs of the worker, but also to his intelligence and his spirit.

Ian Gordon-Brown, Director, Industrial Participation Association, makes three comments which he considers are specially important for any company contemplating worker participation:-

1. If the top management of a company does not actively support the participation plan, it will almost certainly fail. This holds good for enterprises in several of the Socialist economies of Eastern Europe, as well as in the West.
2. Most of those who have introduced employee participation say: "We wish we had spent more time both in preparing for our scheme, and in education, and training people to work it."
3. Successful participation normally calls for joint planning and discussion between management and the whole workforce, not just between management and the shop stewards before a scheme is introduced. This is often as vital as the suitability of the scheme itself.

Of course Group Technology is not what is normally meant by worker participation. The author is firmly convinced that its success depends more on active participation by workers than on the technique itself. Case Study No.2 makes reference to the complete non-co-operation of workers and because of this the inability of the company to re-structure a group of machines to comply with the technology of G.T. Similarly a situation can be envisaged where middle management is lackadaisical in scheduling work to cells resulting in erratic throughput; or top management giving half-hearted support with spurious reasons for not allowing a complete re-structuring. G.T. can just as surely be destroyed, or optimum results not achieved by the non-co-operation of the man at the very top and just as surely by one of the cell workers.

If for no other reasons than these, Production Engineering must give top priority to the human aspects of the system and no effort should be spared in this direction to ensure that every single individual in the organisation is fully aware of the part that he plays, is completely sympathetic and prepared to give the necessary help and co-operate to the best of his ability.

CHAPTER SEVEN

GROUP TECHNOLOGY TECHNIQUES

GROUP TECHNOLOGY TECHNIQUES

7.1.1 THE SINGLE MACHINE SYSTEM (MACHINING CENTRE)

Known as the Composite or Complex Component Technique. Using a classification and coding system families of similar shaped components are brought together. By analysing the production requirements of the families, these may be combined together to form a production family. All the features of the components, found to exist by examination of the component drawings, are entered in an integral drawing, this drawing represents the composite component (Th.73).

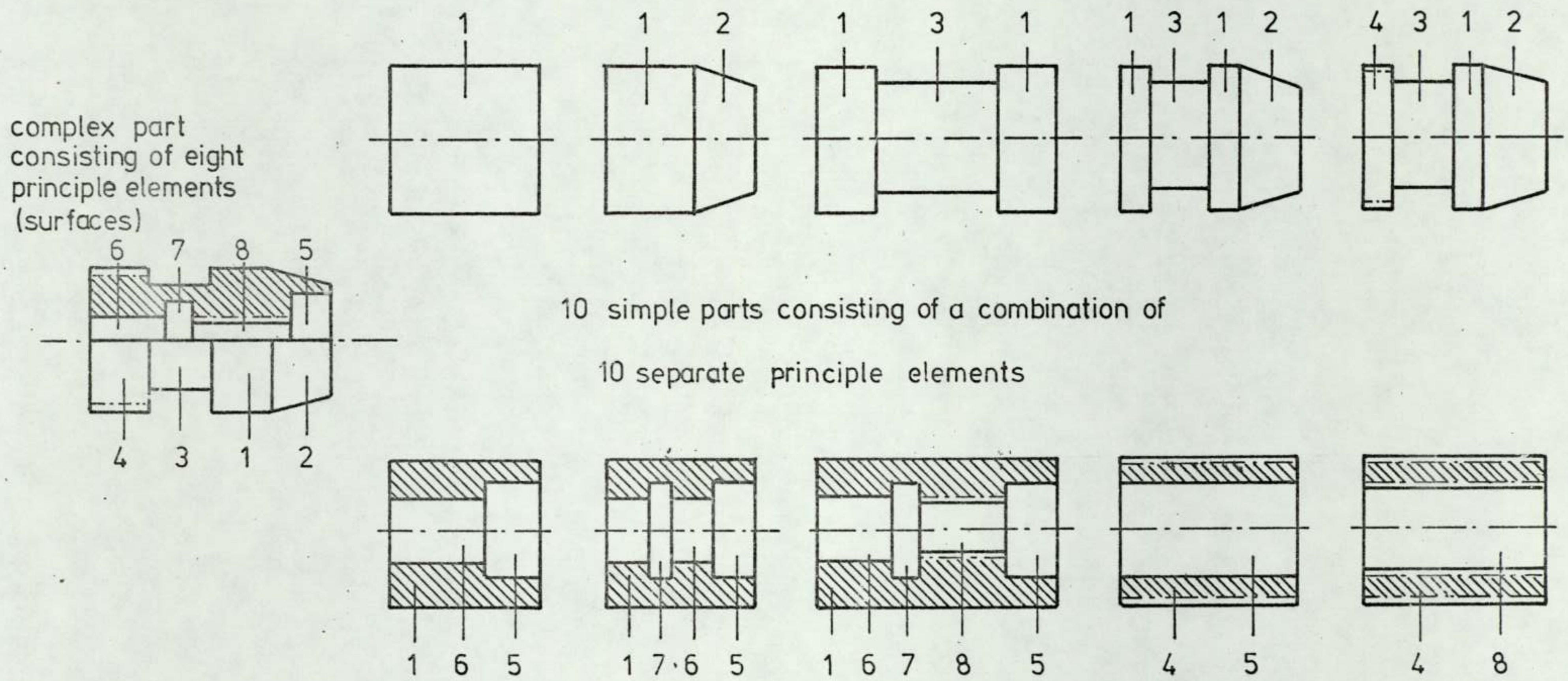
This idea was stated by Mitrovanov in his principle of the composite component. Giv.VIII shows a number of similar but different parts and one part - the COMPOSITE COMPONENT - which combines in its design all the features of the others. One can set up a capstan lathe to make the composite part, in such a way that it can make all the real components (Bu.75).

Many Companies would find that analysis of their components would reveal the possibility of considerable developments in this area. Of course it does mean in certain instances that the advice and co-operation of the tooling engineer is desirable for the design of special tooling, itself of a composite nature.

Durie gives examples of additional tools placed in positions in the tooling stations of a turret lathe and yet still preserving the basic settings.

7.1.2 THE GROUP LAYOUT SYSTEM (THE CELL)

With Group Layout, the plant is divided into sections known as GROUPS or CELLS, in such a way that each cell has a sufficient variety of machines to enable it to perform all the processes necessary on a family of parts. Whereas in the single machine system it may be necessary for some parts to



EXAMPLE OF COMPLEX COMPONENT
(after mitrofanov)

FIG. VIII

have, say, a milled slot or hole at a peculiar angle drilled in it, which will necessitate transportation to another bay, in the Group Layout the part does not leave the group until it is completed (Th.73). The families used with group layout are lists of parts which are similar because they are made in the same group of machines. The parts are not necessarily similar in shape, quite often very dissimilar.

Fig.IX shows four components which are almost identical in shape. Because there are major differences in manufacturing tolerances, requirement quantities, materials, and special features, which will require the use of different machines, it is unlikely that these parts would all be in the same family (Bu.75).

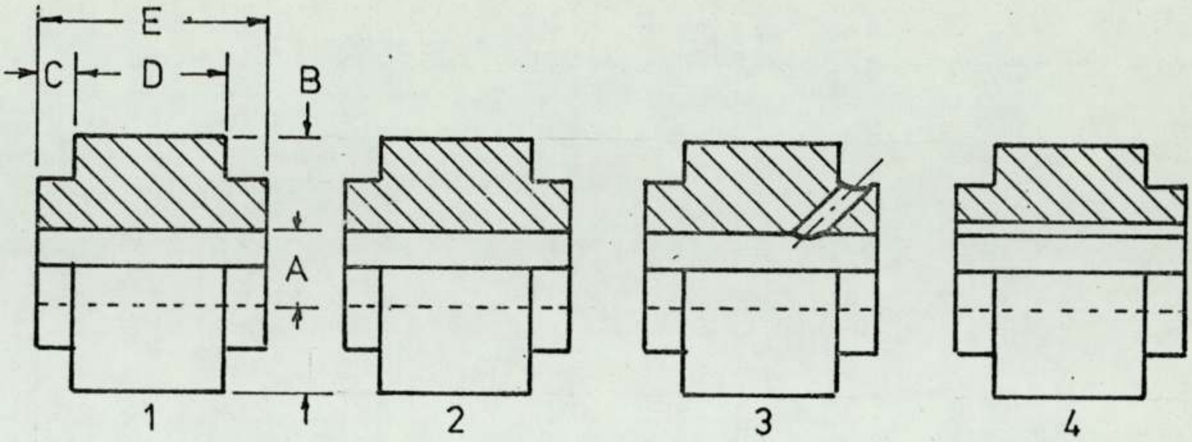
Fig.X shows a number of parts which are very different in shape, but they are all approximately the same size and require lathes, drilling machines and milling machines all of approximately the same capacity for their production.

Some components come together in the same production family because they all have a particular feature, requiring the use of a special machine. Examples are splined shafts, gear wheels, broached surfaces, heat treatment operations, honing, etc. It is important to remember that the transfer of work is normally unacceptable, the economics of certain situations make this a reality.

From the above it is seen that a number of factors affect the choice of family for a component. There is no reliable method of finding families which looks only at components.

Components only come together in production families because they use the same machines. The significant information when looking for families is that which tells on which machines each part is made.

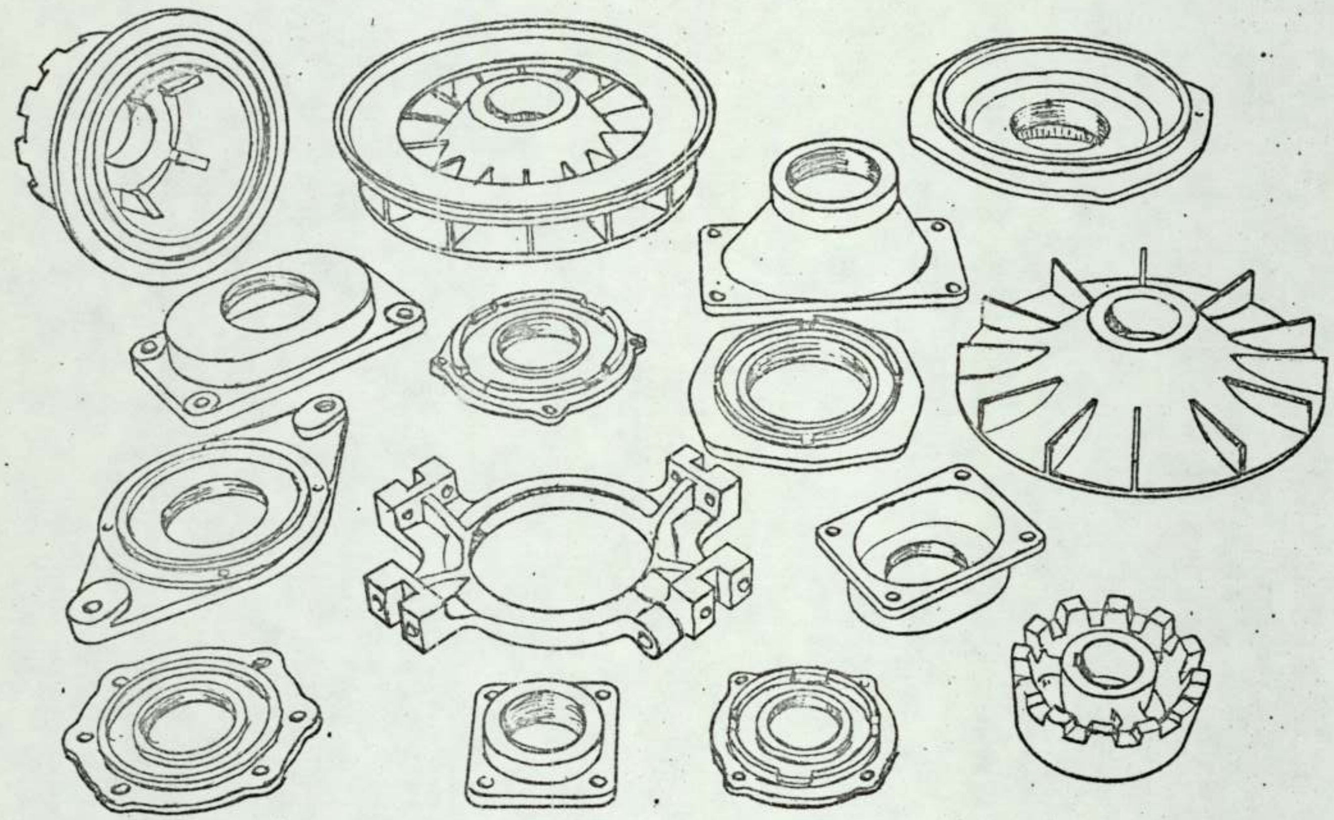
The Group or Cell contains a number of machines necessary to produce a given family of parts, for example, Turret Lathe, Horizontal Milling



part	tolerances ± 0.0001					annual requirement quantity	special features	material
	A	B	C	D	E			
1	10	50	50	20	50	100 000	heat treat	H.T.S.
2	20	50	100	30	50	2 000	cr. plate	H.T.S.
3	1	20	2	2	20	2	oil hole	M.S.
4	10	100	20	50	100	70	key way	M.S.

parts similar in shape but in different families
(after burbidge)

FIG. IX



parts different in shape, but in same family
(after burbidge)

FIG. X

Machine, Vertical Milling Machine, Radial Drill, Pillar Drill, Surface Grinding Machine, and Hole Broaching Machine. The best layout for the machines seems to be in a logical fashion according to the general sequence of operations for most of the components of the family, and that the machines be arranged in a rectangular pattern, conforming as it were to a completely self-contained entity within the factory - a cell of machines - a factory within a factory.

Numbers of machines within Cells vary - it may be only three or four machines or perhaps as many as thirty. The actual size of Cell being determined by the component family, whether it is a very large family with many operations, thus requiring a large number of machines, or whether it is a large family with few operations.

Economic factors are also a determining factor in the size of the group. Basically, smaller cells of which there may be a high number in total will require a large number of machine tools, with the probability of duplication. Larger cells may be fewer in total but each may contain a wider variety of machine tools, but overall fewer machines.

The ideal situation in a manufacturing industry is where each machine is loaded with equal hours of work, and each operation is performed in exactly the same time. This ideal is seldom if ever achieved, because operations proceed at differing speeds. It can be overcome to a certain extent by a duplication of those processes which are the slowest.

This is not a cheap solution especially if the equipment that requires duplicating represents a high capital investment, requires highly skilled personnel to operate it. Such a situation as this will not be solved by the application of the Cell System of Manufacture.

There will always be machines that are heavily loaded and others which are lightly loaded. Furthermore, because all of the components within a family do not necessarily require all of the operations that the

Cell can perform, certain machines within each Cell can be and are idle, even though at any time within the Cell there are many components from the family at various stages of completion or processing. This means that it is common practice to find within cells more machines than there are operatives.

7.1.3 THE GROUP FLOWLINE SYSTEM

One of the most effective methods of making still further improvements in the organisation of engineering production, and one that both brings about a major increase in labour productivity and improves the other technical and economic performance criteria of the enterprise, is the adoption of flowline principles (Pe.66).

This system requires that the plant is divided into groups similar to the Group Layout System, with each line catering for a family of parts. The difference in the two systems lies in the actual physical placing of the machines and in the sequencing of operations.

For the flow line system the machines forming the plant required for any one family are arranged in the order sequence of the operations required for the production of the family. Furthermore, to achieve the flow of work, the machines are usually connected by some form of conveyor system. A component only visits once any machine in the line and then only in the line sequence order. It is not necessary that every part in the family visits every machine in the line, but only the ones performing the particular operation required, in the order that is required. Redesigned jigs and fixtures or the introduction of N.C. machines for key operations can lead to improvements in material flow by increasing the process to setting-time ratio. The important fact of this is that the correct improvement for the process now becomes definable, and the selection problem of the best machine for the job made easier (Th.73).

In certain instances it is possible to arrange several flowlines in parallel such that the various families of components are machined simultaneously in parallel.

Depending on the type of family to be produced and the frequency of demand of the various batches will depend whether the equipment is permanently allocated and requires little if any re-setting or whether frequent re-setting is necessary.

Also it is possible to apply Group Technology Principles to the tooling required by ensuring that as many different components in the family can be machined with the same set-up. An example of this could be an N.C. machine where all the tool holders were loaded to accommodate a family of parts, with the necessary tools being programmed for each component. Similarly composite Jigs and Fixtures can be provided that can accommodate several components within the family.

CHAPTER EIGHT

OPERATOR REQUIREMENTS FOR GROUP TECHNOLOGY SYSTEMS

OPERATOR REQUIREMENTS FOR GROUP TECHNOLOGY SYSTEMS

INTRODUCTION

The real measure of the success of a business is its real efficiency: the efficiency of its direction, its planning, its commercial foresight and, as a foundation for all of these, the efficiency of its human relationships.

8.1.1 THE SINGLE MACHINE SYSTEM

Briefly this is where a family of components are completely machined on a single machine; the machine having been modified to suit the composite component with certain tooling stations being redundant for some components and ideally the provision and adaptation of the machine to make it more versatile.

Such a machine will in all probability be set by a skilled setter. He must therefore be given the necessary insight of the requirements of Group Technology and how it differs from those for a purely functional layout. Why there is a need for composite set-ups and the fact that for certain components some tooling stations will be redundant and that such tooling must not be removed. It must be carefully explained to him that setting is not necessarily easier but it relieves him of the arduous task of removing all or at least most of the tooling when changing from one set-up to the next.

It is also important to ensure that the correct steps are taken to see that the planning department are made aware of the need to adopt a different approach and see that the scheduling of work to each machining centre is such that the minimum setting and re-setting are called for as the family of components progresses. The operators of such machines also require adequate instruction. Firstly to ensure that the machines are operated correctly. This is of particular importance when the standard machine carries modifications or unfamiliar attachments. It might also mean that for the machining of certain components within the family it becomes a more arduous task. For example,if the turret on a lathe has all its stations occupied with tooling fitments and that for certain components only two stations are required. For such components, the operator may not be able to index from tooling station No.2 back to tooling station No.1 in one operation and must perform four indexings, and together with the associated tooling this can become a fatiguing task to perform. An unenlightened operator under these conditions can react irrationally such that faulty operation of the machine occurs with subsequent reduction in quality of the resultant work it can also mean scrap work. The same attitude on the part of the operator might also occur if the machine was tooled or adapted in such a way that it could now perform an operation that was not normally carried out on the basic machine. Such a case would be if an attachment on a turret lathe provided a facility for producing radial holes from a drill mounted on the cross-slide.

Even the tools in a single machine situation must be treated with more than the usual respect. Often they are complex, often more bulky than the conventional type, often because of the increase in bulk, clearances between the tools is reduced, swarf clearance becomes a very important part of the operator's task and unless the right atmosphere is created, the single machine system can become a liability.

Management must appeal to, must be cognizant not only of the operator's material needs but also his intelligence and his spirit.

8.1.2 THE CELL SYSTEM

Here each Cell contains a variety of machines, such that each part is completely machined in the cell.

Theoretically the Cell should contain one setter for each type of machine and also a variety of operators who can operate the machines. It is also very important to remember that in the Cell certain machines will be idle, that some components can back-track to an earlier machine or may even go back to a previous machine more than twice. This very fact alone means that if the work under these conditions is to flow smoothly through the cell then the operators within the cell must be capable of operating all types of machines within the cell, and be prepared to move to machines that require operating, and if these moves can take place without direction from the foreman, chargehand or cell leader, so much the better. Difficulties can be experienced in this area particularly if the operators have been graded and that the machines within the cell do not have the same skill levels. This would mean that the more highly skilled might resent having to operate a machine of a lowly order of skill requirements. Conversely the worker who is happy and contented doing quite menial tasks might find it frustrating, leading to periods of absence, bad work and at the very worst mental difficulties with the knowledge that at any time he could be called upon to perform a task which to him is completely beyond his capabilities. Yet the requirements of the cell are such that the operators must be prepared to move within the cell. A similar situation exists in the cell with respect to the machine setters and this is particularly so when an organisation has re-organised from a previous functional layout. An example would be a capstan setter now finding himself in an environment consisting of a variety of machines, many of which he is not familiar with when it comes to setting and adjusting. Some authorities on G.T. maintain that the setter is a key figure in the cell - this must indeed be so particularly if he is a conscientious man and accept the requirement that machines must be set and waiting for the next batch of components, thus enabling the operators to move from machine to machine with the least possible delay. It is also important for the setters in G.T. to be given information relating to the scheduling of work through the cell - this information enables them to plan ahead and make sure that all difficulties are removed or at least minimised before machining begins.

If we go along with the analogy that a cell if a factory within a factory then the cell must as far as possible be self-contained. It must have within its sphere of activities functions such as inspection, delivery and removal of components to and from the central stores to the cell, swarf removal, machine cleaning and if the cell is large enough, even a maintenance engineer. All of the personnel performing these functions must be sympathetic and have a real understanding of Group Technology principles and what in their particular instance its targets and objectives are.

8.1.3 THE GROUP FLOWLINE

Here as explained earlier the machines for a particular family of components are arranged in a straight lime, the machines being connected by a conveyor system, and that whilst certain components within the family do not require all the operations to be performed on them, the components do not back-track, when they come off the end of the line they are completely finished. Operator requirements for this type of configuration are the same as for the cell system, with the operators moving along the line according to the requirements of the different components within the line. If the layout should consist of more than one line it could then well be that operators move from line to line and must therefore be familiar with the machining and operating requirements of more than one line. This is further emphasised during periods of labour shortage or a fall-off in order quantities, when the lines become sparsely populated with both operators and components.

Setters also must be accustomed to a variety of machines and it may well be the case for them to be responsible for machine setting on a number of lines. It is a possibility that if the number of lines and machines merits it then a setter could be responsible for certain machines in each line. This however is not to be recommended since the setter is no longer responsible for the end products coming from a line but only for individual operations within each line - this could weaken a vital link in the chain, abrogate responsibility and seriously impede the flow of work in all the lines with which the setter is connected.

It must also be remembered that flowlines can lead to frustration on the part of the operators. They can become isolated, they can become numbers in a line. All this leading to fairly high labour turnover, absences and poor quality work.

This is not so endemic in the cell type layout and therefore operator requirements should appear high on the list of priorities when considering changing to Group Flowline Layouts.

Careful consideration should also be given to the scheduling of work to each flowline. Firstly to ensure that the setters know the order of work and thus the order to set-up the machines. Secondly to ensure that bottle-necks do not occur to impede the flow of work resulting in the temporary storage along the flowline of batches of part-finished components.

CHAPTER NINE

MOBILITY, FLEXIBILITY, VERSATILITY

MOBILITY, FLEXIBILITY, VERSATILITY

INTRODUCTION

It used to be common practice for a boy to be indentured to a Master in the particular craft or art that he wished to follow. The Masters invariably belonged to a Guild or Society whose express purpose was not only to protect the craft or industry but also to do all in its power to forward its cause and image. Thus we had institutions such as 'The Worshipful Company of Clockmakers', 'The Worshipful Company of Coach Body Builders', etc., each looking after their own particular interests and seeing that the secrets and traditions of the craft were properly guarded and passed down. Such an apprenticeship, usually of eight or more years duration, was of such a nature that on successful completion the apprentice could make a clock or carriage in its entirety. Could not only lay out the gear train, cut the wheels and pinions, harden and temper springs, engrave the dial, etc., assemble all the parts, but also design and manufacture a suitable case.

A similar type of training still exists for a clock or watchmaker in Switzerland today.

The training of a 'Toolmaker' even today should be such that he is quite capable of designing relatively complex tools, carrying out all the necessary machining operations, heat treatment, fitting and final tryout. The same is also true of an 'Instrument Maker'.

These facts are also confirmed by the training that such craft apprentices receive in training schools, colleges of technology, etc. With the increasing needs of the population together with the growth in the population and the opening up of new markets, such luxuries as satisfaction in initiating work, carrying out all the operations necessary for its completion are things we can no longer afford and the Liveried Companies are now a shadow of their former positions in the life and commerce of the country. So too are the craftsmen that went with them.

The division of labour, the complexities of the finished product, the differing requirements of the processes, etc. have just as assuredly killed off the toolmaker and instrument maker as have similar developments seen the demise of the clockmaker and blacksmith.

Even though training schools, technical colleges, still give instruction and practice in a wide variety of operations, for many of those attending such training schemes the situation on the shop floor is vastly different. The division of labour ensures that the majority become turners, milling machine operators, fitters, etc.

Lucky is the individual who can still practise a variety of skills - he is by all standards a much happier man!

Functional type layout also ensures a continuation of this division of labour.

Invariably the foreman on each section came up from the ranks - a good highly-skilled man. The foreman is visible evidence that hourly paid men can get promoted. This itself can be an incentive for the operator in a section to be conscientious, give of his best and completely master all aspects of his craft and machine that he operates. In doing so, he can become, along with all his colleagues, jealous and hold very passionate views of the importance of his task. With Group Technology must all this be swept aside?

The operators must be able to operate a variety of machines and display equal skill abilities on all of them. The setters too must be capable of setting all types of machines within a Cell or Line, even though the operating principles and tolerance capabilities are different.

The foreman too must be responsible for a variety of processes. Must have an intimate knowledge of all their operating principles, be able to discuss problems with operators, setters and chargehands yet must at the same time represent all aspects of his Cell or Line when dealing with middle and upper levels of management.

All this in spite of the fact that a study of what a foreman does reveals that in a functional layout, the foreman spends about one third of his time with his products, one eighth with the machines, and the rest of his time with his men.

Now the Technology has altered, the human factor must change likewise!

9.1.1 MOBILITY

In the test of human involvement means that the person is free to move. In Group Technology this means anywhere within the Cell or Line or indeed from Cell to Cell or Flowline to Flowline. In certain environments in Group Technology, especially where a Company has twenty or thirty cells, mobility could mean moving from a Cell in one part of the factory to another Cell in a totally unfamiliar part of the same factory.

9.1.2 VERSATILITY

Invariably flexibility and versatility mean one and the same thing. With Group Technology it is advisable to treat them separately. Versatility is the capability of turning readily from one occupation to another and capable of dealing effectively with the many occupations.

This indeed is a prime requirement of Human Involvement with Group Technology.

The Line or Cell deals with a family of components. Not all components within the family have identical machining requirements, some machines will be idle. For success, operators must move as and when one operation ceases and another starts. It could be milling to drilling to grinding to de-burring, etc.

A variety of skills are required. All must be learned. Many can only be taught by careful instruction and patience on the part of the cell foreman, chargehand or cell leader.

Fortunately the human mind and body is, given the correct atmosphere and attitude, able to adapt fairly quickly and become accustomed to a variety of simple tasks and operating procedures.

Versatility is not the problem it is often made out to be. The problem of versatility usually resolves into one of creating the right type of environment, such that the worker can readily appreciate and accept what is required of him.

9.1.3 FLEXIBILITY

In the previous chapter it is seen that we require operators within a Cell to be versatile. Case Study No.1 makes particular reference to this fact and records that previous to G.T. many operators were engaged on mundane jobs requiring little initiative, found to be boring and lacking in inspiration.

It is also required that workers should be flexible in their approach in using this versatility.

Flexibility should, in the Group Technology context, refer to the attitude of the operators and how they are conditioned to accept the need for change. Versatile they may be, but if the approach is not right, if the change does not appeal to the inner man, the exact opposite can result, namely, inflexibility.

The fruits of Group Technology can just as surely be destroyed by the man in the Cell who feels frustrated and neglected as by the man at the top who has not taken the time or trouble to understand the basic principles and falls back only too eagerly and readily on any difficulties that may arise, be they of a human or technical cature, especially during the critical period of changing from what has been to Group Technology.

CHAPTER TEN

PSYCHOLOGICAL ASPECTS OF GROUP TECHNOLOGY

PSYCHOLOGICAL ASPECTS OF GROUP TECHNOLOGY

People at work are motivated in different ways. They have ideas, sentiments, emotions and feelings. They have goals towards which they strive, these goals may or may not be compatible with those of the firm that employs them. They may have interests more important to them than their work. Whilst at work, a worker's attention may at any given moment be divided between the work before him and on interests that may be completely divorced from the work. Another important facet is that in most kinds of employment people do not work in isolation and there is therefore a constant interaction with other human beings. Certain people no doubt lead a Jeckyl and Hyde existence having one personality at work and another external to the work place. Most people surely must react at work as they do elsewhere - with interest, affection, good humour, indifference, contempt, anger, and ridicule. And just the same in leisure pursuits people surround themselves with satisfying human relationships, the same must also be true of the vast majority that engage in daily toil.

Human personality is non-existent unless it can be compared with another and our personality traits come from rubbing shoulders with our fellow human beings, and social interaction is thus the normal consequence of personal contact. When personal contacts are repeated the relationship may become a group.

The term Group Technology means different things to different people and is thus perhaps an unfortunate choice. As stated in Chapter V the generally accepted definitions of the term reflect more on the technology and not on the people involved and therefore a more apt definition involving all aspects of Group Technology is:-

"The replacing of the more traditional batch production methods of manufacture by re-arranging work, machines, equipment involving operators and management at all levels to form an effective system, the object of which is to minimise planning, setting, tooling, control, etc., coupled with maximization of output.

With the emphasis on EFFECTIVE SYSTEM."

It is a well-known fact that in times of crisis or catastrophe the British people cast aside their inhibitions, prejudices, class distinctions and work exceptionally hard and with dedication until the crisis is over.

Witness the voluntary help that comes automatically at the scene of a flood disaster or climbers or walkers lost during severe winter conditions. These volunteers risk life and limb without thought of tomorrow.

The formation of fire-fighting teams during the last war saw the Chairman and workers of the same company sharing such duties with a good bonhomie between them. People from different social backgrounds combined quite happily to fight bombs, incendiaries and to give help to the afflicted irrespective of class, creed or rank. From this, these two examples, it is seen that effective team work is possible involving all stratas of society.

But must it always be dependent on a catastrophe or crisis? Are such things the only necessary incentive before people will combine and work together toward a common goal?

It is often said that good team work or effective working in groups depends upon the individual leader, the man at the top. It may seem strange to speak of the 'efficiency' of human relationships, on examination it is strictly correct. Unhappy human relationships are sure to be inefficient because they cannot produce the best results in any situation.

How can efficient human relationships be achieved?

First of all, by everyone concerned in a job believing that they are a team - whether they are managers, technicians, supervisors, or operators.

Of course the work of each differs. In all situations, some must be 'tellers' and others 'told'; the important thing is that each should know how it fits into the pattern as a whole.

Although a firm may be fully convinced that changing to Group Technology methods of manufacture will bring overwhelming benefits and is prepared to go ahead with the exercise, this may well prove worthless unless the spirit and enthusiasm is communicated all the way down to the lowliest worker on the shop floor.

It is a leader that one must look for first.

The capacity for leadership, if used correctly, is a man's chief asset to his firm.

In all situations men always look for a leader, and when they find him they will follow. Men look ahead to a leader, they look back to a driver.

Companies need only men who look ahead, because that is the way of progress.

Remember that for many firms the change to Group Technology will be the first upheaval of plant and equipment, the questioning of proved and tried methods of planning and control etc. in the whole history of the firm. Many will stand on the side lines observing each move with critical eyes, waiting for the first opportunity, waiting with 'I told you so' attitude. (Note the attitude of one of the managers referred to in Case Study No.9.)

The true leader will carry the majority with him, will sweep away all but the most stubborn opposition, and even in the end convince these to accept, perhaps grudgingly, the philosophy of Group Technology.

Generally people like associating in groups. Most sports are team efforts, football, rugby, cricket, depend on the combined and co-ordinated effort of the whole team. True, individual players stand out, this is understandable, but the efforts of these 'few' would be of little avail unless supported wholeheartedly by the rest of the team.

PSYCHOLOGY:- SCIENCE OF NATURE, FUNCTIONS AND PHENOMENA OF HUMAN SOUND OR MIND.

With such sporting activities there is always a team leader, or a manager who takes an intimate interest in all members of the team. A person who is continually spurring the team on to still greater achievements, who can quickly see when things are not as they should be and takes the appropriate steps to put things right. A person who has the confidence of all members of the team and is respected because he does not shirk from castigating a member who falls out of line or is not pulling his weight.

What is the incentive for such team work in sporting activities? For the professional, obviously money and the glorification and adulation of an enthusiastic following.

For the non-professional? Probably the enjoyment of the sport or game, being with like-minded colleagues and the satisfaction of having given on one's best.

Perhaps it is advantageous to consider some of the reasons for people not wanting to work in a team.

1. Many people are highly individualistic, prefer to be on their own and prefer to ignore those around them. This attitude is not confined to any one social strata.

2. Some think they know their limitations and have no wish for these to be exposed, where they think that they might then be subject to ridicule.

3. Identification with the work that they do is of prime importance particularly where effort is rewarded by acclaim from those in authority.

These firmly believe that in a team effort this facet of contact with authority would be lost.

4. To certain people the work that they do is the most important thing in their lives. They can identify with the work, even though the operations they perform are simple and perfunctory.

5. Certain people quickly form an opinion of their colleagues. Invariably this is a biased opinion since it is based upon perhaps one or two small incidences, and these might be quite unconnected with the place of work. Once formed these opinions are not easily displaced and lead to isolationism and the feeling of wanting to prove one's superiority over the individual and this can, in their view, only be achieved by individual effort.

6. If an incentive scheme is in operation frustration is avoided if this relates to the individual and his or her effort; whereas with a group incentive scheme it is very difficult to convince all that the reward is shared accordingly to the individual's contribution. The feeling that certain lazy workers are being carried by the group, and that these are being unfairly rewarded, is endemic unless the necessary safeguards are incorporated in the scheme which will allay this attitude.

7. An attitude that there is a much better prospect of promotion, assuming that this is based strictly on merit, when working alone. Unfortunately little is done to right this attitude. Whilst candidates for promotion should be selected on what is considered to be superior all-round ability and knowledge for the immediate vacancy, it is as well to be remembered that the selected individual should give every appearance that he is capable of fitting into the organisation still higher should an opportunity present itself and that this can only be achieved if he displays those characteristics that are of extreme importance in getting the best out of everyone he is responsible for and that individualism is

not a pre-requisite for this.

In equipping a factory it is not sufficient to select machines giving the highest output of the required quality, to consider reliability and likely useful life, to know the number of operatives and provide intelligent arrangements of plant to give uninterrupted and trouble-free transition from intake of raw materials to despatch of finished goods. It is necessary to study the overall mechanism of production. To integrate all the separate manufacturing requirements into a single, comprehensive problem - how to obtain the best possible product and the best rate of return on investment. That this involves dealing with money matters is immediately obvious. Rather less obvious is the fact that it also involves dealing with human beings (Case Study No.4).

Early industrialists found it easy to believe that production problems could be solved by installing suitable machinery or by devising improved systems of work. But times have changed.

Today, if people cannot be found to co-operate, if they object to the introduction of new tools and methods, then the best laid schemes may prove more hindrance than help.

Production now is dependent not only on the skilled deployment of machines, materials and money, but it is dependent on the willing performance of men and women, and it is absolutely necessary to take into account the way in which they respond to their working environment.

Wild (Wi/73) distinguishes two types of work groups in industry (Fig.XI):-

1. Formal work groups that are created by industry;
2. Informal groups which will always exist.

The principal distinctions being as follows:-

1. FORMAL GROUPS, created to achieve specific goals and to carry out specified tasks which are clearly related to the total organizational

mission. They may be either permanent or temporary groups depending upon the purpose of their formation.

2. INFORMAL GROUPS. Relationships will develop between members of the organisation which extend beyond functional objectives. If the arrangement of the work area, the work schedule and the nature of the work permit, these informal relationships may lead to the development of 'informal groups'. Such groups arise out of a particular combination of 'formal' factors and human needs and are affected by, among other factors, the degree of interaction between individuals, personal characteristics, interests and external influences.

Sayles (Sa/58) subdivides these two basic types of groups as follows:-

1. FORMAL:

   (a) Subordinate group - members share a common supervisor.

   (b) Functional group - members must collaborate in order to accomplish the task.

2. INFORMAL:

   (a) Friendship clique - members gain satisfaction from their interactions.

   (b) Interest group - employees who share a common economic interest and who are held together by their desire to gain common objectives.

Taking the division a little further, formal functional groups can be classified by the type of dependence between members, i.e.

1. OPERATIONAL INTERDEPENDENCE, in which members are dependent for completion of their task upon other members. Groups working in progressive manufacturing systems such as assembly lines are operationally interdependent. Earnings often depend upon the collective performance of the group, in which case pressures are often exerted by the group upon those

deviating from group norms. When these groups are found at the shop-floor level there is usually status homogeneity among members.

2. FUNCTIONAL INTERDEPENDENCE, in which members are dependent upon others with complementary skills in order to achieve completion of the group's objectives. This category includes such groups as those manning process equipment and maintenance teams. Individual earnings may be related to the group productivity, and the different skills possessed by group members may lead to status differentials.

3. STRUCTURAL INTERDEPENDENCE resulting from organisational design, giving members common supervision and normally common territory. Payment may relate to group or individual effort, and members may be heterogenous in respect of skills and responsibilities. Dubin (Du/58) identifies:

(i) TEAM GROUP, in which members designate the positions to be filled and the people to fill them, changing allocation of members to positions as required. Such groups are fairly autonomous, receiving very little supervision, and often work within broad terms of reference established by supervision.

(ii) TASK GROUP, in which the jobs are clearly defined and each individual is assigned to one and only one job. The group will have some flexibility over the method of work adopted and also the rate of work, but little other discretion.

(iii) TECHNOLOGICAL GROUP, in which work content and method are specified and individuals are assigned to the jobs. Speed of working is also controlled. The individual has little scope for the use of discretion. He has, however, in most cases, the opportunity for some degree of social interaction. The overriding importance of the technology allows the group members little autonomy or varying the operating activities.

Fig XI indicates the approximate relationship of the two-part structure of group working in industry, with it will be noticed the emphasis placed in formal groups (Wi/73).

From analysis of the above types of group it would seem that according to Wild, Group Technology should produce Formal Groups and this would be Sayles' interpretation with subdivision into a Functional Group with Operational Interdependence. Dubin on the other hand would classify Group Technology as a Team Group. Perhaps the most important and overriding factor is not what type of work group evolves, but how each and every individual in the work group accepts the situation and reacts to the various input factors to the group, such that in all and every situation the group works in concert to achieve the common objective.

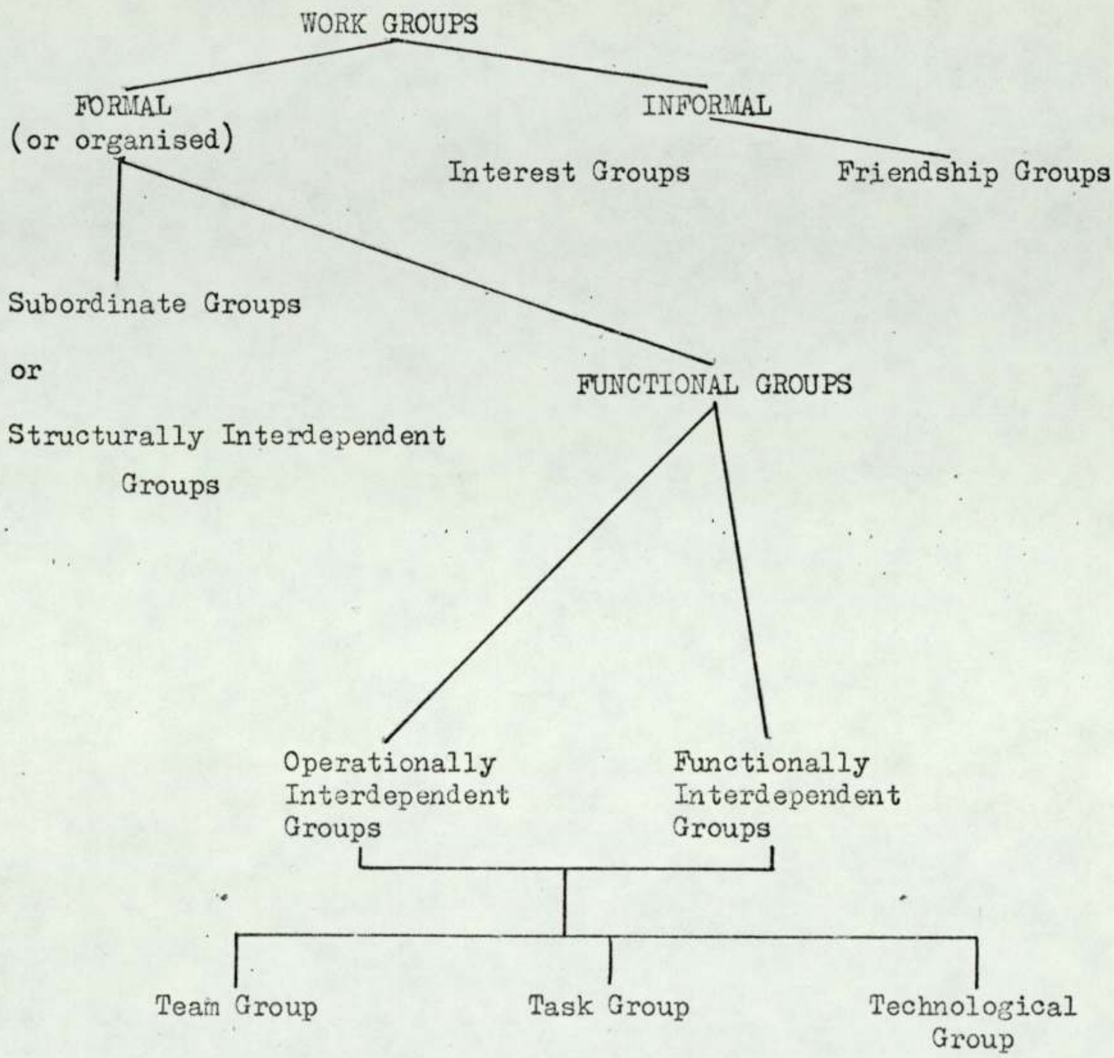
In certain spheres of activity it is possible to devise procedures that will indicate the reaction under certain conditions before actually subjecting the individuals to the expected parameters that they are likely to encounter. For example, astronauts have to undergo through selecting and testing procedures, to see not only how they can stand the physical environment but how they react toward their colleagues.

Of course the best test of how a man or woman will react is to try them out on the job. This is an impractical proposition. Psychologists have done a great deal of work developing off-the-job tests to find out what a man can do and try to determine how well he will do it in the future.

Some tests try to get at the man's characteristics: does he have mechanical aptitude? Does he dislike monotonous work, etc.?

Tests are far from perfect. They are probably better at predicting failure than success. Most of the tests so far developed are a type of 'trade test'.

It now seems that what is wanted is for psychologists to develop tests based upon group working. To see if it is possible to predict how



SUMMARY OF TYPES OF WORK GROUP (emphasis being placed on formal groups)

(after Wild)

<u>FIG. XI</u>

each member will react and from it be able to select those persons with particular characteristics for working in a group.

But whatever testing procedure is developed for such an investigation it will never completely solve the validation problem: will men with high marks or displaying the required characteristics succeed under working conditions. Such tests might again be better for predicting failure than success. If the test indicates that the man does not have it in him to work amicably in a group or team, he probably will not. But if they show that he does have all the necessary attributes, you cannot be very sure that he will succeed. Other reasons not indicated by the test and perhaps quite unconnected with the working environment could be the cause for failure.

The following is a letter published in the Sunday Telegraph from Ian Gordon-Brown, Director Industrial Participation Association, in reply to articles in the same paper by Graham Turner on worker participation, and whilst the comments are not specific to Group Technology or Group Working they do have a certain amount of relevance.

"Three comments for anyone who contemplates going down the participation road.

First, if the top management of a company does not actively support the participation plan, it will almost certainly fail. This finding holds good for enterprises in several of the Socialist economies of Eastern Europe, as well as in the West, according to a recent study of worker participation in management by the International Institute of Labour Studies.

Secondly, most of those who have introduced employee participation say: 'We wish we had spent more time both in preparing for our scheme, and in educating, and training, people to work it'.

Thirdly, successful participation normally calls for joint planning and discussion between management and the whole workforce, not just between management and the shop stewards, before a scheme is introduced. This is often as vital as the suitability of the scheme itself."

Case Study No.1 indicates the benefits that can flow from complete involvement of the whole work force. Conversely, Case Study No.2 shows the reverse and Case Study No.10 refers to a Company in which Group Technology was considered only in upper ranks of management resulting in some sort of 'scheme' that is 'on ice'.

If Group Technology produces self-contained Cells or Units or a 'Factory-within-a-Factory' then it is seen how relevant the above points are.

CHAPTER ELEVEN

INCENTIVES

INCENTIVES

INTRODUCTION

Incentives are intended to stimulate the will to work. They are external factors or conditions brought to bear on the individual to induce in him the right attitude to his work.

How effective are pay incentives?

Do men really work harder if their take-home pay is related to their output?

Is money the most important factor in the life of a worker?

Answers to these and similar questions are extremely difficult to establish with any degree of certainty.

Many incentive plans such as the Halsey, Gantt, Taylor, Rowan, and Emmerson were developed in the early 1900's. The author found that where a company was using an incentive plan invariably it was a straightforward piece rate system and highly individualistic. The Chairman of the company referred to in Case Study Nos. 1 and 2 thought that incentives of any shape or form that were linked to a man's performance were not only out-dated but also degrading to the workers. His company paid an hourly rate and whilst management seemed happy at the level of productivity it was felt that certain workers would have made more effort if their wages had been related to output. See also Case Study No.2.

Many of the more elderly in our management teams still believe that financial incentives save money, resulting in less costly products. Others, perhaps more enlightened, believe that there are other non-financial incentives that will produce the same result, providing that a fair wage is paid to all according to their worth to the organisation and that the right climate, environment and relationships have first of all been established.

(Bu/75) states that one change which is desirable with Group

Technology is the wages and accounting system.

'It is desirable to substitute a fixed wage, or group bonus, for individual incentives. With group layout the emphasis must be on the team spirit and group co-operation. Individual incentive schemes tend to destroy this type of co-operation, due to jealousies about such things as who should get the best-paying jobs.'

Individual incentive schemes are concerned mainly with the minimisation of operation times. We now realise that throughput time is equally important to profitability. The traditional individual incentive schemes provide a disincentive to the achievement of this second aim, because they make it more difficult to split batches, to move men from one machine to another, and to arrange continuous flow between machines for critical components.

With functional layout and stock control, machine operators have the opportunity to increase their output and earnings by doing extra work for the future. With group layout and flow control on the other hand, they have no such opportunity. The amount of work assigned to the group is fixed when the programme is adopted. Because there are no large banks of material in the group, the speed of the operator even if he is 'tied' to one machine, is controlled by the speed of other operators who feed him with part-finished work. Under these circumstances an individual incentive scheme has very little to offer, and only provides a costly bureaucratic source of irritation.

If it is believed that a financial incentive must be paid when changing to Group Technology, then what Burbidge says is correct and it is more sensible to base the method of payment on the work of the whole G.T. cell of G.T. flowline.

Case Study No.8 is, however, concerned with a plant having a large number of cells, and before re-organisation paid incentives based upon individual performance, but decided, on the change to G.T. all financial incentive schemes would be scrapped. Fairly close study of worker performance in the various cells revealed no deficiency of application or indeed worker dissatisfaction with his take-home pay. One or two instances were noted of operators who had left and joined a firm having a piece-work system and had returned expressing a general feeling that whilst the money was marginally better, it had to be earned and that other things, namely the environment, was more important.

It must be mentioned that the firm in Case Study No.8, whilst not having a financial incentive scheme, did operate non-financial incentives which took a variety of forms.

People are employed to do work and they expect something for their effort. They are paid for their productivity. Generally people are likely to work for one firm in preference to another because they believe that one firm pays better than another.

In industry there are a variety of methods of linking wages and productivity, but generally they can be classified into one of two general types:

1. You pay a man for the time he is at work (without directly measuring his output or performance;
2. You pay him a wage based upon his output or performance.

Paying straight hourly rates is the most common method of paying wages, and in many industries is the only method used. Even in factories using incentive schemes of one form or another there are many jobs which are not suited and indeed can be extremely difficult to link productivity and wages.

A common distinction is that made between financial and non-financial incentives.

It is necessary to examine both types in a dispassionate way, since if a change in the manufacturing layout and methods envisaged in Group Technology is being contemplated, it may not be deemed necessary to carry over the old methods of payment, and if the forward planning for G.T. should indicate increased output, savings in throughput time, reduction in finished and part finished stock, etc., factors which result in decreased expenditure, it may be unwise in these circumstances to link wages with productivity and non-financial incentives may be more important in keeping workers, as well as keeping them productive while working.

11.1.1 FINANCIAL INCENTIVES

This includes any scheme in which effort or productivity is linked directly or indirectly to money.

Wages and salaries are the main financial incentives. Bonuses, profit sharing, pension schemes, medical schemes such as B.U.P.A., holiday plans, etc. are company housing extensions of financial incentives that either pay directly in money, or provide services that might otherwise not be used by the worker or would require personal expenditures.

11.1.2 NON-FINANCIAL INCENTIVES:

These are forms of payment for working where the inducement is not a financial one.

These incentives can take a variety of forms, and are based on the fact that people respond to a wide variety of inducements that are not all necessarily expressed in monetary terms.

One such incentive is increased span of control, or greater responsibility; more authority, greater say in decision making. A number of companies let their senior workmen show visitors round the plant. Even belonging to the '21 club' (employees with twenty-one years continuous service) is a worthwhile incentive to many people, as is the annual 'night-out' for all those with unbroken service of say ten years or more.

Of course some incentives have both a financial and non-financial side. For example, promotion can be looked upon as a non-financial incentive in which the reward is greater authority and status. Promotion invariably carries increased pay. Promotions reward doubly'. Seniority can also mean preference for promotion, taken off 'the clock', and retention during slack periods is again an example of mixing the two types of incentive.

11.1.3 GROUP INCENTIVES

Any incentive scheme should be one that both employer and employee are in favour of.

The workers want a scheme that allows them to earn good money when they work hard, and invariably one that pays weekly; a scheme that is simple so that each employee can quickly determine what his earnings should be and finally a scheme that will pay a good basic minimum wage during work shortages, machine down time, etc.

Management want a scheme that will keep workers producing at a high level, with high machine utilisation and thus keeping costs down. It also wants a flexible scheme that pays more to the top producers, is easy to operate, makes costing easy and finally a scheme that will not endanger production by leading to disputes.

Probably no incentive scheme yet devised completely satisfies all of the above.

Is it possible to embody most of the above into an incentive plan suitable for Group Technology layouts?

Incentive schemes for people who work in groups or crews is not new. Many car workers work in groups of six or seven and are paid accordingly to the number of car bodies or final assemblies they produce. Radios and television sets are invariably finally assembled on flow-assembly lines and each line is paid according to the number of completed sets coming off the end of the line. Oil well drilling crews are paid a bonus according to the number of days saved from the estimated time before striking oil. Workers in a tool-room have been known to be paid a bonus dependent on the monthly total sales of the Company.

With Group Technology the situation is a little different.

Invariably G.T. is concerned with machining, it involves flexibility and versatility. It also involves a variety of components passing through the cell each having different throughput times and not all requiring the same operations, batch numbers differ and the production schedule can also be very flexible. But these are one or two factors that are very relevant for payment schemes relating to people who work in groups and not applicable to Group Technology, namely:

1. Increased output is not possible by increasing the number of workers in a designed Cell assuming that it has the correct number of workers for which it has been designed; whereas on an assembly line this is possible and has led in the past to industrial unrest.

2. Additional workers, sometimes called relief men, who step into positions temporarily vacated to keep all work positions manned, are not required in a G.T. layout.

3. New workers in a conventional group, even though they may not delay throughput time very much, do lower the average output per man. In a G.T. cell the newcomer can be given the easiest and simplest task to perform and gradually be introduced to all the other tasks accommodated in the cell. Thus there is very little if any reduction in productivity in the cell.

With G.T. cells or G.T. flowlines it would appear that the ideal situation has been arrived at if payment is to be linked to productivity of the cell or flowline. This statement is based upon the following:-

1. The Cells or Flowlines are invariably small and it is a known fact that group incentives work very well with small groups.
2. If the take-home pay of everyone in the Cell depends on joint effort, the slacker or shirker will not be tolerated.
3. New and also slow-workers will be helped because all lose if one gets held up.
4. All workers get the same take-home pay, therefore there should be no disputes relating to pay.
5. The burden on supervision is reduced, because the group becomes self-policing.
6. There will be a reduction in administrative overheads.
7. If it is considered that worker morale is an important ingredient of of productivity, then morale in a G.T. situation can be at a high level.

In spite of the above seven points, experience is to the contrary. Many managers have expressed the opinion that the question of method of payment in changing to G.T. methods of manufacture is the most difficult problem and the one that they seem to fight shy of. This fact is substantiated by a recent survey carried out by Ho Kong Chan, student of University of Aston, Production Engineering Department, relating to payment systems used in Group Technology Manufacturing Systems (Fig.XII). As can be seen not one Company has gone over to a payment system based upon output from a Cell or Flowline.

This fact is probably indicative of the general attitude that the remuneration level is one of the most difficult problems with which a manager has to contend. This is basically because the problem is one of reconciling conflicting interests.

The manager's principal interest lies in ensuring the minimum cost for maximum production.

To the worker, the content of his wage packet determines his standard of life and therefore aims at maximum remuneration without undue exertion.

The manager can readily appreciate the advantages to be gained from the change to Group Technology methods of production and probably pushes to the back of his mind the problem of workers remuneration. Does not want to risk the possibility of a confrontation or dispute, and therefore continues to use the same method of payment. In doing so is not making full use of all advantages of G.T. Methods of payment for Cell workers need not result in less take-home pay - it can indeed mean increased pay. To the manager it can mean not only increased productivity and all the other technological advantages so often quoted, but also reductions in overheads, less supervision, improved quality and less scrap and indeed less abuse of machine tools, jigs and fixtures. All this seems to hinge on adequate preparation, educating not only the operators but also all levels of management and suitable training for all those who will be intimately connected with any aspect of G.T.

11.1.4 MEASURED DAY WORK

The author's investigations revealed not one single company engaged in Cellular Manufacture adopting this form of incentive. Nevertheless it is worth stating what is involved.

Under this plan the workers work at a day rate or hour rate. The work they produce is carefully measured and controlled. Individual or group performance indexes are determined in much the same way as they are under a piece-work scheme.

The basic difference is that the workers are paid a fixed rate for the day regardless of whether their performance is above or below 100%

Name of Company	Ferranti Ltd.	Ferodo Ltd.	Whittaker Hall Ltd.
Payment used before G.T.	Premium bonus scheme	P.B.R.	(Sale + stock variation) x 6-month average
Payment used after G.T.	as above	as above	actual sales
Thomas Mercer	Royal Small Arms Factory	International Engineering	Platt International
piecework	piecework	measured daywork	piecework
as above	as above	merit-rating	piecework (modified)
Hyster Ltd.	Hoover Ltd.	H.J. Godwin Ltd.	Herbert Ltd.
measured daywork	piecework	standard dayrate	measured daywork
as above	as above	as above	as above

FIG. XII. Payment systems used before and after G.T. in the firms.

Variations, e.g. workers performing at a rate below 90%, may receive the lowest rate for the job. Workers performing between 90% to 100% receive the next highest rate, those between 100% and 110% the third highest rate and so on.

A more common application of the plan does not provide for differential base rates keyed to performance. Under this version of the plan, the worker has no financial incentive to produce at a rate higher than 100%.

Since satisfactory performance is usually one of the conditions of employment, the worker has an incentive to maintain production at a satisfactory level to ensure continuance of employment. In many cases where the plan is used there is no strict definition of 'satisfactory performance'.

In other cases, satisfactory performance is clearly defined as 100% of standard plus or minus 5%, i.e. the minimum acceptable performance is 95% of the established standard.

Measured day work appears to be best suited to progressive assembly line operations where the speed of the line is mechanically controlled. The experience of the motor car manufacturers in this country would seem otherwise and it is suggested that such a plan must be adequately supported by an improved management system that takes into account all aspects of the plan particularly support facilities to ensure that at all times the 100% target is reached.

An added management difficulty is how to satisfactorily resolve the problem of changing from an incentive system to measured day work and still maintain a high level of productivity.

The chief virtue of measured day work is that it does provide management with a measure and control over the standard hours of work produced without tying this control to an incentive wage payment plan. In this way, management can obtain the advantages of work measurement and control without the disadvantages of wage inequities which incentive plans frequently produce.

Given adequate time for experimentation with G.T. it should be possible to introduce measured day work to ensure satisfactory productivity with adequate reward for the cell workers. Success would no doubt depend on adequate management systems as mentioned above.

CHAPTER TWELVE

JOB EVALUATION AND APPRAISAL

12.1.1 JOB EVALUATION AND APPRAISAL

The most common method of payment of wages is by time rate, that is, according to the number of hours worked.

The main difficulty is determining the rates appropriate to the different types of work that have to be done.

Job evaluation attempts to do just this. It does not set production bonuses, merit pay increases, extra pay for shift duties, or overtime rates.

The intention of job evaluation is to assess the worth or value of each job by consideration of the demands it makes upon the man employed in it. It is 'job-centred' and does not take into account at any stage the characteristics of one worker against another worker doing exactly the same job.

Job evaluation is a method by which a series of jobs can be put in some rational order according to their productive contribution. Once the jobs are ranked in this order, then it is possible to project the rates of pay on to the various classes of job to determine the pay they will carry.

Fig. XIII shows the essential structure of any job evaluation plan. The principle of job evaluation is the description and assessment of the relative value of all jobs in a company in terms of a number of factors. The job factors chosen for comparison should be those commonly found in all the work undertaken, but the important feature on which the scheme depends is that their relative importance varies from job to job.

The factors should also be comprehensible to all concerned and they should be such as to be capable of grading in relation to all the jobs likely to be considered.

Many formal methods exist for ranking work assignments. For example a schedule of job factors may be set up to include the following:

FACTOR GROUP	SUB-FACTORS
Requirements to perform the job competently:	
Mental:	Reasoning ability; Co-operation with others; Initiative and observation.
Physical:	Muscular strength; Dexterity and motor accuracy; Stamina and agility.
Acquired skills and knowledge:	Education; Training periods required; Experience required.
Working conditions:	Physical and mental disagreeableness; Hazard and risks (temperature, fumes, etc.); Responsibility for equipment and materials; Responsibility for safety and work of others.

FIG. XIII. Essential Structure of Job Evaluation.

Job Fatigue

Physical Effort

Manual Dexterity

Intellectual Effort

Training Required

Supervision Needed

A long list of jobs may be used, and for each job, all the factors are evaluated on a points scale and the total score or sum then becomes the evaluation of the work assignment.

All jobs having the same score, or within a prescribed range, are paid alike. The jobs can then be placed in rank order according to their job evaluation scores, and the step-like arrangement of jobs as shown in Fig.XIV results.

Some job evaluation schemes are much more complex and will include as many as five sub-divisions together with the allocation of points for each factor. For example:-

PHYSICAL EFFORT

This factor appraises the amount and continuity of physical effort required. Consider the effort expended handling material (the weight and frequency of handling), operating a machine or handling tools, and the periods of unoccupied time.

Sub-division 1

Light work requiring little physical effort. POINTS: 10.

Sub-division 2

Light physical effort working regularly with light-weight material or occasionally with average weight materials. Operate machine tools where machine time exceeds the handling time. POINTS: 20.

Sub-division 3

Sustained physical effort, requiring continuity of effort with light or average weight materials. Usually short cycle work requiring continuous activity, the operation of several machines where the handling time is equivalent to the total machine time. POINTS: 30.

Sub-division 4

Considerable physical effort working with average or heavy-weight material, or continuous strain of difficult work position.

POINTS: 40.

Sub-division 5

Continuous physical exertion working with heavy-weight material. Hard work with constant physical strain or intermittent severe strain.

POINTS: 50.

From the above it can be seen that if the Job Evaluation exercise is to be successful then a pre-requisite for each task is:

1. a job description: this is a statement of the task, i.e. exactly what it entails and the duties to be performed;
2. a job specification: this is in part a re-write of the job description, and lists the requirements of each of the factors rather than listing the duties.

Without the use of both the job description and job specification there can be too many unanswered questions concerning how much of each factor is required.

The specification needs the support of the job description to justify the claims. Together they constitute a much better basis for job evaluation than either would alone.

The evaluation exercise is best carried out by a committee representative of both the employer and employee and perhaps with the aid of a specialist in job evaluation.

If the job evaluation exercise is performed with care and thoroughness it is possible to make a list of the characteristics that workers need for each particular job. This information could then be used by the personnel department when selecting workers for particular jobs. For example, job evaluation exercise may say that an inspector must inspect small items carefully and that considerable visual effort is required, but it does not say that the inspector should have good eyesight. Interpreted in the light of an inspection vacancy, one characteristic to look for in applicants is good eyesight.

Of course Job Evaluation will not solve all problems connected with the determination of job rates. It gives no consideration to the supply and demand, to the bargaining power of labour, nor to the ability of the company to pay. It does not consider the relation of wages to such things as to whether the factory is located in a high cost or low cost area, nor the cost of transportation of the workers. Neither does it attempt to consider human factors such as how well the worker gets on with the foreman.

It is concerned with the job to be done, not the man on the job. A company contemplating Job Evaluation would do well to contemplate very seriously these factors and if possible take the necessary steps to write into the scheme safeguards such that, if any of the factors mentioned above, or others do arise, the necessary steps can be implemented automatically without recourse to argument, worker dissatisfaction or industrial unrest.

12.1.2 MERIT RATING OR APPRAISAL

One aid to ensuring a stable and satisfied labour force is to see that the 'rate for the job' is an equitable and fair one; this is what Job Evaluation does.

Job evaluation is, as has already been stated, concerned with the job to be done. It does not take into account the individual worker, it does not differentiate between the good worker and the poor worker, it does not distinguish between the experienced and the 'new-hand'.

A good chargehand or foreman knows the occasions when the judicious use of praise for a job well done will be an adequate reward for the retention of job satisfaction in the worker's mind. That satisfaction may be strengthened by a more continuous recognition of the quality of the worker by some form of supplementary remuneration.

One of the ways of providing this supplement is by a merit payment which has the purpose of recognising and distinguishing those workers who are better at their jobs than others employed in the same work. Reference to Fig. XIV indicates that for the particular exercise in Job Evaluation, each job has a minimum and maximum rate, or a range of pay is established, applying to the jobs in a given step. This then could be the necessary framework for paying supplementary remuneration.

The new worker would start at the bottom of the base rate and within the zone of payment for the particular job, one or more steps could be established, before reaching the maximum rate for the job. The main difficulty lies in establishing how individual workers are to be appraised and indeed who is actually going to do the appraisal. With appraisal or merit rating you are looking at the man and how well he does his job.

Satisfactory performance is partly subjective so you cannot measure it wholly by objective methods.

Perhaps another important reason for reviewing a man's progress ought to be to find out his weaknesses so that you can help him improve and to furnish a basis for giving pay increases to deserving men.

Generally the assessment results in terms of a grading from 'unsatisfactory' through 'satisfactory' to 'good' to 'excellent', on a number of qualities that may be present or absent from a worker, but the presence of which contribute to greater effectiveness in his job. Such qualities could be:

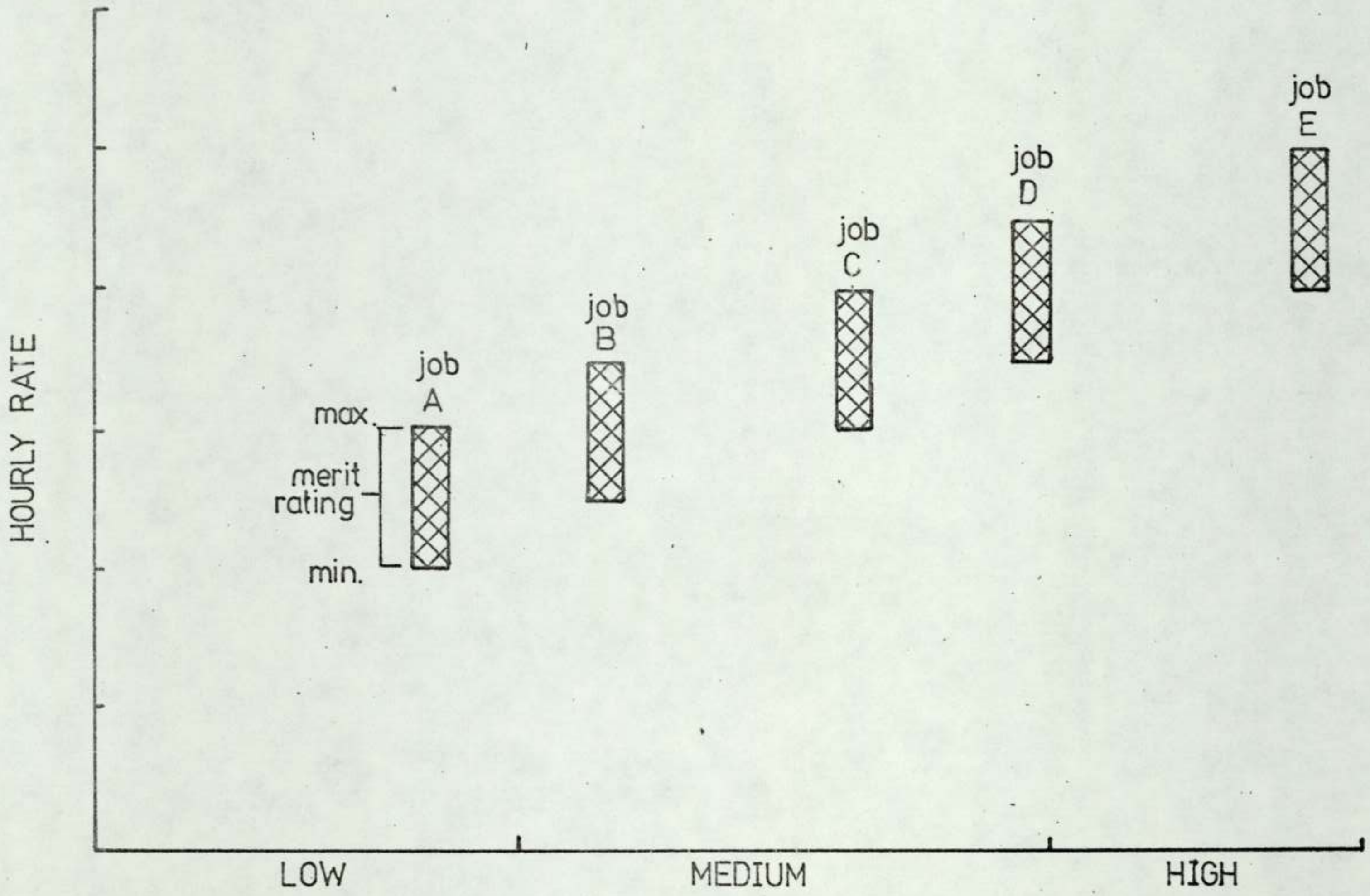

HOURLY RATE
max.
merit
rating
min.
job
A
job
B
job
C
job
D
job
E
LOW
MEDIUM
HIGH
PRODUCTION CONTRIBUTION
(after dubin)

FIG. XIV

Quantity of work - production average

Quality of work - scrap and salvage

Co-operation with other workers and with supervisor - attitude and actions regarding his job

Conscientious application to the work assigned - disciplinary action, verbal or written

Technical ability, care of equipment - job status, record of damage

Safety - number of accidents

Timekeeping and punctuality - number of latenesses.

From this appraisal a combined assessment is arrived at which is capable of expression in monetary terms, so that a supplementary award can be added to the base rate of workers of sufficient merit to justify additional payments.

The size of the merit pay is small compared to the base rate but it does provide some recognition of the outstanding worker. Usually once determined, a merit award will continue to be paid but should be subject to periodic review at say six or twelve monthly intervals.

Problems can arise in merit rating assessment. Firstly, it is to do with the worker, not his job. The only people who really understand his job and can do the rating are the man's foreman and assistant foremen or chargehand, neither of whom have had any training in rating or assessment methods. This could mean that the foreman and assistant foreman are likely to look at the whole man, not his separate parts. In all probability they will judge him as 'unsatisfactory' or 'satisfactory' etc. on all factors. It would, of course, be quite possible for a worker to be consistently good or poor on all factors, but it is quite likely that he will be better on some factors than on others.

Secondly, among amateur appraisers there might be a tendency to rate all factors, and hence all workers, as 'average'.

Thirdly, employees often feel that management uses merit rating exercises as excuses for not giving pay increases.

Merit rating done by the worker's immediate superior could lead to all workers developing into 'yes-men' and stifling all initiative. And finally, in most people there is an inherent dislike of hurting other people's feelings and therefore the wrong reasons are often advanced to a man for a poor showing or performance.

12.3.1 JOB EVALUATION AND MERIT RATING IN A GROUP TECHNOLOGY ENVIRONMENT

In a G.T. situation, the ideal is reached when complete worker flexibility and versatility is achieved. That is, when each and every member of the team of workers in the Cell or on the flowline is capable of, and does, when the production schedule demands, operate any machine or perform any operation required of him. Such a condition would mean that the basic remuneration of all G.T.workers would be the same and the job evaluation exercise would resolve itself into determining the differentials, if any, to be established between different Cells or flowlines within the factory.

Once this condition had been established, more emphasis would have to be placed on appraisal or merit rating. Since depending upon the variety and complexity of operations and machines within the Cell the learning period could be quite lengthy before achieving the expected and scheduled output with little thought given to achieving the optimum or ideal.

In practice it is much more complicated. Invariably in a G.T. situation one finds a 'key' machine, a machine which generates work for the rest of the Cell. This could be an N.C. lathe requiring considerable skill in setting and adjusting and quite incapable of operation by other Cell members, unless given lengthy and costly training.

Or it might be a very expensive machine such as a Thread Grinder positioned in the middle of a G.T. flowline; a machine again requiring a skilled man not only to set the machine but also to operate. Under these conditions management would not, and quite rightly in spite of the benefits, allow such machines as these to be operated by more than one man.

Alternatively a situation could arise where the highly skilled operators of such machines as mentioned in the previous paragraph, whilst being quite capable of operating all the other machines within the Cell or flowline, refuse to do so, since they consider such work an affront to their dignity and calling.

With such situations the ideal can never be achieved.

A possible solution could be the establishment of a special category of Cell worker who operates a key machine or one that is very expensive and therefore better operated by one man, paying such individuals a special rate on the understanding that when the work load in the Cell or flowline demands their services other than on the aforementioned machines they make themselves readily available.

Another problem frequently encountered is that of the worker who prefers a highly repetitive job requiring little or no skill. Such workers are quite happy and content, require little out of life, and in many instances are themselves 'key' workers in so far as they give little if any cause for anxiety. Such workers, if asked to do other tasks, would find all sorts of excuses for not doing so and in extreme cases leading to absenteeism or leaving. Obviously such workers require special treatment when it comes to determining their rate of pay.

It might well be that such workers should be paid considerably less than other workers in the Cell. The problem is not so easily solved because such workers may revolt at such treatment and finding a replacement may be much more difficult than a replacement for a skilled man. Depending upon circumstances, the solution may be found from deliberations of the Cell workers themselves. These are the people more intimately concerned with life in the Cell or on the flowline, and perhaps are much more able to appreciate the nature and importance of these so-called unskilled, trivial tasks, that at the same time are important for the completion of the work and the smooth operation and flow of work.

CHAPTER THIRTEEN

DEMARCATION

13.1.1 DEMARCATION

'From time to time when new materials are introduced (e.g. plastics in place of wood) or when methods of construction are changed (e.g. prefabrication of sections of ships), conflicting claims arise as to which class of employee should do particular work. A procedure for dealing with this type of dispute is provided by a National Demarcation Agreement, which was signed in 1912 by the Shipbuilding Employers' Federation and most of the trade unions concerned.' (M.O.L./61)

As has been stated earlier in this Thesis, G.T. involves considerable re-organisation, the people involved must be prepared to be flexible and versatile, to co-operate with the 'system' and operate not only a variety of machines and processes of the more conventional nature but also those that have been developed by tooling engineers and planning engineers who realise the potential of the new system. If the full potential of G.T. is to be obtained then all barriers that could obstruct the smooth flow of work must be put to one side.

The skilled man must be prepared to do unskilled or semi-skilled tasks, the unskilled must be prepared to try and improve their skill level by accepting advice and help from workers in the Cell. A turner must be prepared to operate a mill, a grinder, a drill as and when the need arises. The planning engineer must devolve some of his functions to the Cell Supervisor, or Cell Leader. Tooling engineers must work very closely with the planning engineers, and cell leaders, to develop tooling modules etc. as a joint effort and not in isolation, etc.

Similar parallel considerations arise, of course, at managerial level. In the G.T. environment no one should work in isolation. The personnel department should be just as much involved as the sales department as production engineering, etc. G.T. is a complete system, the sharp edges must be rounded off, there is no place for inter-union disputes, for departmental clashes, for personality difficulties. Everyone must be informed as to what their particular function is and how their function contributes to the success of the exercise.

In times of organisational, technical and market stability the virtues of everyone knowing his own job are stressed. It is in times of change that the virtues, so to speak, become a liability, since the particular rights and duties which occupational groups have come to regard as theirs are questioned. Occupational prerogatives are not lightly given up since they represent the group's concept of work and, as has frequently been observed, a threat to work is a threat to personal and family security.

The following is an example of the situation that can happen when groups of workers maintain an inflexible approach; it concerns the re-lining of the clay gun used to plug the tapping hole in a blast furnace:

2 men, members of the T.G.W.U. operate the lifting tackle;

2 men, members of the B.M.S. burn off the bolts;

2 men, members of the B.I.S.A.K.T.A. remove the nozzle;

2 men, members of the N.U.B. line the nozzle.

A similar operation performed on an identical blast furnace in France is carried out by two men!

In 1965 a Royal Commission on Trade Unions and Employers Associations was initiated by the Government and the following is an extract from the resulting report (Report Cmnd 3623) "The Donovan Report":-

PRINCIPAL CAUSE	Number of Strikes in all industries
1. Wages	1052
2. Working arrangements, rules and discipline	646
3. Redundancy, dismissal, supervision, etc.	326
4. DEMARCATION	57
5. House of work	30
6. Closed shop	29
7. Trade Union recognition	18
Sympathetic strike	18
8. Alleged victimisation for trade union membership and other disputes about trade union status	16

PRINCIPAL CAUSES OF UNOFFICIAL STRIKES
(Royal Commission on Trade Unions and Employers Associations 1965. Report Cmnd 3623.)

Examination of the above table indicates that Demarcation Issues do not cause very many stoppages of work, but when they do they can cause serious disruption and the outcome is not always in the best interests of either side, leading to over-manning as in the example given above, or machinery, plant and equipment purchased for particular work remaining idle and deteriorating, or souring relations between management and men.

Fortunately demarcation disputes occur very infrequently in the manufacturing industries concerned with small batch type production. Demarcation problems seem to be the forte of the older established industries such as the Iron and Steel Industry, the Railways, Shipbuilding etc.

The author found only one instance of circumstances which could have declined into a demarcation dispute and this involved a modified machine tool and was temporarily resolved by the chargehand operating the machine.

It is also well worth remembering that certain productivity agreements provide numerous examples featuring flexibility of labour, e.g. erosion of demarcation and of traditional working practices taken from an oil company productivity agreement.

1. INTER CRAFT FLEXIBILITIES

   "Boilermakers and Fitters will carry out tack welding for structural work ...."

   CRAFT/NON-CRAFT FLEXIBILITIES

   "Suitably trained members of the T.G.W.U. will carry out bolting and unbolting (for example manhole covers, heat-exchangers, etc....) when craftsmen are unavailable.

2. The next example taken from an early productivity agreement in a major service industry:

   "... the following general principles shall apply where such arrangements would assist in the proper progress of the job."
   "Craftsmen on related work should be interchangeable as far as is practicable ..."

3. The next example shows 'greater flexibility':

   "Glazing and associated work to be done by:

   Plumbers
   Joiners
   Painters.

(To/72)

The basic requirement for industry is for co-operation rather than division. Business undertakings are co-operative systems composed of people who work in concert to pursue a definite objective. Group activity is therefore a characteristic of virtually all industrial work. Individuals do not work in isolation, they are employed as members of a group and their efforts have to be combined to achieve the appropriate harmonising of all their activities. This is equally true throughout the structure of management, as it is among the workers on the shop floor.

If when change takes place the efforts of managers is co-ordinated by frequent consultation and interaction of ideas, a necessary part of industrial life, then the possibility of disputes, official or unofficial, demarcation or who does what, recedes.

The concept of Group Technology is involved with EFFECTIVE TEAM WORK. This involves among other things education and training, consultation and dissemination of information, this applying to all stratas in the industry from the highest levels in the management echelon to the lowliest worker on the shop floor. When people know what is going on and why, even though some of the information might not effect them they are then in a much better position to accept the situation or question its validity, leaving room for manoeuvre, adjustment or alteration, further explanations, etc., than they are when confronted with a fait accompli, with the corresponding and attendant attitude to reject as totally unacceptable leading to, among other things, the 'who does what' kind of dispute.

CHAPTER FOURTEEN

WORKS ORGANISATION

14.1.1 WORKS ORGANISATION

Organisation has been described as:

"The process of dividing the work of an undertaking into groups consistent with the talent of individuals, and the arrangement of such jobs into the most appropriate framework for the achievement of the aims and objectives laid down."

An organisation is also people and therefore the whole organisation works only as well as the limitations of its men permit. It should also be remembered that the policy of a company should have a unifying effect upon the work of those employed in the activities of the enterprise and an ideal feature of the organisation structure should permit the maximum co-ordination of activities by encouraging harmony.

The policy of a company is the foundation of its management activity. Managers can instigate and supervise work only when they have definite knowledge of the aims of their undertaking and a good general idea of the methods to be used to achieve their purpose. Policy should not normally be regarded as a secret! It is imperative that it be made known to everyone in the undertaking who will be affected by its implementation.

From the above description of what an organisation is, it follows that each and every organisation will be different, even those that do like things will be different because the limitations of the men will be different.

What should be the same is the dissemination of information relating to the policy of each company and this to each and everyone within the company.

Returning to Chapter 5, Technological Advantages Claimed for Group Technology, it can be seen that this is not like putting in a new machine tool, which will only affect say the manager, his assistants and operators in the machine shop, or the introduction of a new Sales

Forecasting Technique which only affects the sales department and to a lesser extent production control.

Group Technology affects each and every department and all workers within all departments: Drawing and Design Departments, Production Planning and Scheduling, Personnel; Stores and Stock Control; Purchasing, etc., etc.

14.1.2 THE POSITION OF THE GROUP TECHNOLOGY SECTION

Group Technology will be a new method for ALL organisations and if it is to be successfully introduced and implemented then, initially, the team of people responsible for the initial investigation must report high enough up in the organisation to ensure that their findings and recommendations have the full authority of the most senior member of the organisation. Fig. XV (Ga/Kn 73) shows just such a position.

If the Company already has an organisation chart it is probably an easy matter to create and insert a section to be concerned with Group Technology.

A Company without such a chart would be well advised to construct such a chart, even if it is only a bare skeleton it will be better than nothing. The Company structure is important, neglecting the structure will invariably lead to problems. The 'who does what?' questions arise, responsibilities are not accepted or evaded, consultative management is difficult to achieve, etc. In this country G.T. applications are generally applied and will be generally applied to the small to medium companies, companies as has already been stated are engaged in batch manufacture. In these companies, the departmental arrangements in use is not too logical, being largely the result of the way the departments happened to be set up originally.

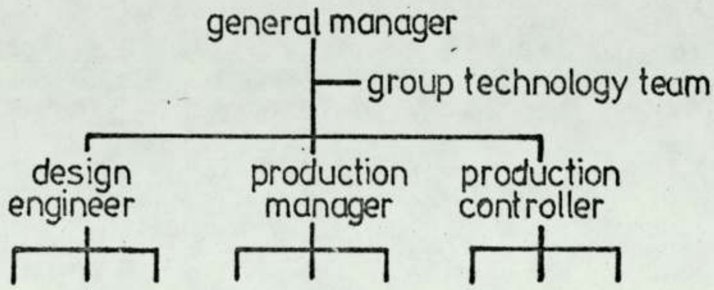
Since all companies pass through critical stages of growth and even though the managers do not always recognise these stages. These stages or milestones are important, because the old management methods are no longer suitable. Failure to note these stages, or failure to make the necessary changes, can and does lead to stagnation or decline.

Group Technology is something new. It is a complete rethink on manufacturing policy. It cuts across all areas in the organisation. Failure to recognise this will ultimately lead to failure or mediocre performance and the non-realisation of all the benefits that ultimately stem from a whole-heartedly committed Company.

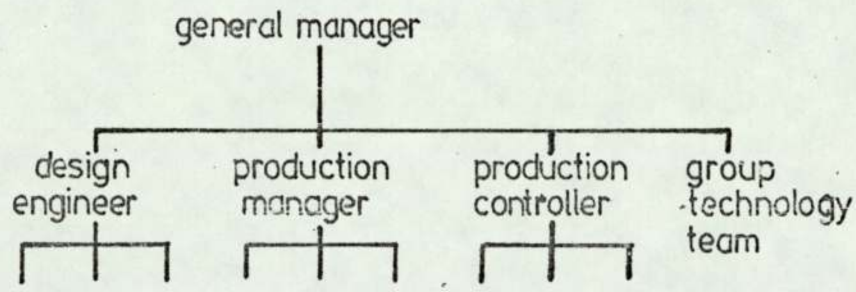
After the first analysis and projection by a Company into the benefits, the advantages, the merits of Group Technology, the next logical step should be the existing company organisation and structure, and if no structure exists then this should be given the first priority with, in all instances, the inclusion of the Group Technology Team at an appropriately high level, as suggested by Fig. XV.

Organisation charts are useful management tools. They show departments and lines of direct authority. They are not perfect tools, and as has been stated above, an organisation is people and therefore smooth operation of the company depends on the co-operation between departments on the same level and between the different lines of command in the organisation. Charts cannot show the necessary co-operation and informal inter-relationships, or to show the bonhomies which are so important to smooth operation and high morale.

It is also necessary to indicate, preferably in writing and perhaps not too precisely, the function and responsibility of each department; what they can and cannot do. This is of extreme importance for the newly formed G.T. department, even though in the overall scheme of things it is a temporary department and will go out of existence when Group Technology is working smoothly.



(a) advisable



(b) unsuitable

THE RANKING OF THE IMPLEMENTATION TEAM
(after gallagher & knight)

FIG. XV

CHAPTER FIFTEEN

HOUSEKEEPING

15.1.1 HOUSEKEEPING

In Chapter 10 reference was made to 'efficient human relationships'. A corollary to this is that they are also a function of order, neatness and cleanliness in the plant itself. Again it is difficult to measure the effect that the working environment has on productivity, but it is generally agreed that good workmanship, high productivity, quality workmanship and sound personnel relations are more likely to be an adjunct of a neat and orderly layout than when the reverse is the case. As has been stated earlier, many plants and organisations in the United Kingdom have grown in a haphazard fashion and the old order has in many instances not made way for the new. It is quite usual to find numerically controlled machine tools placed in the most easily available space with little thought for its servicing, its attachments, or the fact that certain parts of its ancillary equipment will perform trouble free for longer periods if sited in dust-free atmospheres. Similarly the operators of such machines are quite often allowed to continue in the same old way dressed in scruffy overalls, sitting on an 'orange box' with all the impediments of production scattered around or stuffed into odd holes and corners.

The Production Engineer should be at the forefront in insisting on good housekeeping.

What better place to start than when re-organising plant and equipment to form G.T. Cells or Flowlines?

I wonder how often this aspect of production is considered?

Certain firms in laying out Cells have painted the machines in the different Cells distinctive colours. This is part of good housekeeping - it gives the Cell workers a sense of belonging to a particular part of the plant.

Another aspect is painting white lines on floors as demarcation for gangways etc. and including adequate areas for maintenance swarf removal as well as suitable areas for the operator to perform his task in comfort and without the need for being a contortionist.

The whole field of housekeeping requires attention immediately the re-arrangement of plant and equipment that conforms to G.T. principles has been agreed, bearing in mind that if each Cell or Flowline can be made self-contained so much the better.

The following are among the important advantages of good housekeeping:

1. Production rate increased because of the orderly, business-like condition of departments, removal of obstacles to production, etc.
2. Production control made easier. Materials and parts do not get lost or mixed. Speed of removal of work and less banking of rough or processed materials are corollaries of good order. It is easier and quicker to check operations and obtain data.
3. Inspection work takes on a high character. Quality control of work follows order and cleanliness control of conditions.
4. Materials and parts conserved and salvaged. All unused materials or parts, spoiled work, scrap, etc., are removed to proper places.
5. Time saved. Search for tools, work, etc., eliminated. Workers have more room to operate freely. No time lost in clean-ups to get space in which to work.
6. Floor areas are cleared for production instead of being littered with rubbish or crowded with unnecessary banks of work.
7. Maintenance and repair work facilitated. Maintenance men can get at machines, do not have to clean them of dirt and grease, have room in which to work.
8. Safety protection made more certain. Elimination of crowded quarters makes machine operation safer. Clear, clean floors reduce stumbling and tripping, and slipping on greasy or oily spots. Clear traffic aisles reduce collision of trucks, running into workers, knocking over

stacked materials, etc.

9. Fire protection improved. Fire hazards and spontaneous combustion are removed. Areas are cleared for quick exit, and for room to get at and fight any fires. Carelessness with matches is avoided.
10. Cleaning costs reduced. Cleaners can do their work faster and better. It is cheaper to keep dirt down than to remove long time accumulations.
11. Morale is heightened. Workers used to decent conditions at home become more interested in the plant when cleanliness and order are enforced.

THERE ARE NO DISADVANTAGES IN CLEANLINESS AND ORDERLINESS.

Neither merit nor profit attaches to being dirty or disorderly and no excuse exists for the tolerance of such conditions. If they exist, they are a direct reflection on the character of the plant management (Al/Ba.67).

Group Technology is the starting point for re-organising the methods and techniques of production. It should also be the starting point for the so often neglected asset to production, namely good housekeeping.

The author has knowledge of an American concern in this country who designed a factory as a plain shell. The machines are located permanently and of a distinctive colour. There are no fixed benches for dumping things on to or underneath, each operator being supplied with a small bench mounted on wheels so that it is completely mobile and kitted out with a standard kit of tools. In essence this means a unit completely free of encumbrances and much more important is that it entails minimum effort on the part of cleaning staff to keep it so!

CHAPTER SIXTEEN

CASE STUDIES

CASE STUDIES

INTRODUCTION

Group Technology has been practised in various companies in Great Britain for the last ten or fifteen years and considerable expertise exists relating to the technology itself; figures and facts are available relating to the advantages, the savings, the improvements. Many engineers can expound the virtues of this or that classification system and the reduction in the number of redundant components, or modifications to existing components making them suitable for more than one application - a spin-off from component analysis performed in a systematic manner.

The author considers that presenting such findings in a quantitative manner is more than dangerous. To quote 'the reduction in level of work in progress as 50%' is meaningless and misleading unless all other peripheral facts are given. Undoubtedly there are organisations where the application and implementation of G.T. has been performed in a most scientific way and the performance before and after has been carefully monitored, the results analysed and presented mathematically.

If production engineering management was just facts and figures, formulae and numbers, factories would no doubt run much more smoothly and efficiently, life would become dull and monotonous and boredom would be a much greater social problem than it is under present conditions. The utopian dream of little or no human work is pure fantasy with little hope of ever being even remotely achieved.

To obtain facts and figures relating to reduced costs, improved production, reduced lead times etc. is fairly easy. All that is required is a form of questionnaire that can be addressed to the Production Engineering Manager, he in turn in all probability delegates the responsibility for filling in the form to a junior who, anxious to succeed, obtains all the information from the different sources: production control, stores, wages, sales, etc. The success rate (of returned questionnaires) may be of the order of 25%. Thus are the facts and figures marshalled to suit whatever the original intention.

The implementation of group technology is not a 'packaged arrangement'. Each factory and application is different (Ga/73). This fact alone means that in the field of human involvement a questionnaire would be impossible to devise and equally impossible to collate the results, furthermore only qualitative statements with a very wide tolerance would be possible.

The following Case Studies are based on fact finding, face-to-face meetings with a variety of people in organisations allegedly engaged in group technology methods of manufacture.

These people ranged from Managing Directors to quite junior staff of a production team and this fact alone meant that the same question posed to the General Manager of one firm evoked a totally different response when put to a junior engineer of another plant. This is quite understandable since the same problem is invariably looked at from different directions, the objective whilst being common, the ways of achieving the objective very often differ.

Another problem frequently encountered during visits to industry was the attitude that the implementation of G.T. was very much a personal thing and the responsibility of one man and even if others had been involved steps were taken to see that the 'others' did not become involved during the visit.

The Human Factor is a difficult and contentious situation in many environments and frequently the author was asked not to talk to operators and not to make any notes on the shop floor. Only twice was he permitted to speak freely to Shop Stewards.

In spite of these incidences it must be recorded that the people the author encountered spoke quite freely and openly and in most instances they were as pleased to talk to him as he was to question and listen to the answers, and he is extremely grateful for the time these people gave.

16.1.1 CASE STUDY No. 1

The following information relates to one factory of a privately-owned company that has a total work force of about 400 both male and female, producing components, sub-assemblies and complete assemblies, with batch quantities ranging from less than about 50to as many as 3000. Many of the individual components are very small with a correspondingly small tolerance and the Company operates as a mainly service industry in a highly competitive area facing increasing competition in certain product areas not only from other U.K. competitors, but also from Japan and Eastern Europe together with the attendant developments and applications that is involved with this type of environment. The management are the first to acknowledge that Group Technology has played no small part in meeting this challenge, and quote reductions in delivery time for certain items of only ten days where previously a norm was of the order of fourteen weeks; this and other aspects of G.T. have enabled the products of this company to remain in the forefront and for the company to be acknowledged world leaders in their particular sphere.

The roots of G.T. can be traced back to about 1977 when a memorandum to the Production Engineering Section instructed them to analyse the manufacture of particular types of components, since the prevailing output was poor and throughput times were very long. The outcome of the resulting exercise was a re-organisation of the method of manufacture according to G.T. principles, but this fact was not known at the time. What was established was the fact that by looking closely at certain components and their overall machining and associated operations, re-organising the layout of plant, improvements in performance could be achieved with little additional capital outlay.

Initially middle management were not interested in G.T. This attitude probably reflected the cautious approach being adopted to the implementation and as with many other new innovations there are always those who resent change particularly when it affects their own life-style and ingrained methods. It also seems that management itself were cautious, treading warily, not understanding themselves the full implications and therefore tending to confine their activities to a fairly close circle.

Suffice to say that the Managing Director is now firmly convinced that G.T. is the answer to many production problems and does result in reduced costs, improved delivery, better management/labour relations, and job satisfaction. All of these helping to meet competition successfully and keep product ahead of competitors, open up new markets particularly in the Middle and Far East.

The author also gained the impression that management were continually looking at each Cell rather critically to see if the layout could be improved, whether the families could be increased and whether further alterations to tooling were desirable and indeed if modifications to components would bring beneficial results. The management of this company acknowledge that whilst they know a very great deal about Group Technology, their Cells, System and practices are far from perfect and that they tend to be in a continuous learning situation, realising of course that too fluid a situation can negate efforts completely.

Previous to the introduction of G.T. and also during the early years the Company operated various payment by results schemes; all such schemes have now been completely abandoned. This exercise was not completed overnight but was the result of careful and patient negotiations with the unions extending over quite a long period, finally resulting in a Job

Evaluation scheme that followed the normally accepted pattern. Cell operators now find that if they are prepared to learn new skills, to set or operate different machines, this flexibility will be recognised in financial terms.

It should be noted that not all operators were in favour of the Job Evaluation exercise and the end result. A minority thought that it was a retrograde step and that without some form of incentive scheme, motivation suffers with a resulting fall in operator performance and productivity. On the other hand many workers expressed a totally different viewpoint and were quite adamant that their take-home pay compared very favourably with that in the rest of the district and further they were not harrassed into meeting deadlines. An important aspect having a distinct bearing on this particular viewpoint is the fact that the Cell Leader or chargehand has been given considerable autonomy within his Cell and this was observed to influence not only the attitude of the Cell workers but also resulted in a very harmonious atmosphere.

Pre-G.T. methods of production involved a considerable amount of paper work, including the raising of orders, stores requisitions, progress recording, time accounting, etc., now only the barest minimum consistent with good accounting methods is required, thus there is the feeling by the Cell workers that their efforts are not supporting a large number of ancillaries 'chasing' pieces of paper and filling in forms. There is no doubt in the author's mind that this is an important factor contributing to the genuine enthusiasm and morale in this particular factory.

No attempt was made by management to select the workers for each Cell; individual temperaments, likes or dislikes, general attitudes, etc. were not considered, and it appears that Cell workers were brought together by accident although the author has a suspicion that the tasks they now perform in the Cell are very closely related to what they were doing in isolation previous to rearrangement. Only one instance was detected where a Cell worker was not completely happy with her companions, but this fact in no way impeded her performance -in fact her productivity might have been in advance or superior to that of her colleagues.

Since no selection methods were adopted for the workers, each Cell seems to have developed its own personality. With all groups of people who lack an elected leader, one individual for a variety of reasons tends to assume the role of leader. In the case of Cell workers it could be that the worker with the longest service finds himself in this position. It might be the one with most knowledge of the work; or the worker who speaks up for his fellow-men; it could be the union man or woman; or the person operating the key machine. In whichever way the leader emerged it is his or her personality that tends to formulate and then dominate the character of the Cell. Within the Cells in this company it is possible to isolate each type of Cell leader. The author got the impression that management welcomed these differences, probably using it as a means of cross-fertilisation and development of existing and future Cells.

Certain machines used in some cells were quite portable and thus when the operation sequence changed, due to a different member of the family being machined, then the machines could be moved to suit the operation sequence, thus in one particular Cell it was noticed that one moment the workers tended to be in a box type formation, then a criss-cross formation and finally the machines and hence the workers could be in a straight line flow situation. These movements and rearrangements being performed with the minimum of delay, and were accepted by the Cell workers as a necessary part of the exercise, being in part performed for their benefit and this appeared to be accepted without question.

This company has quite a number of Cells; machines and equipment have not been painted a distinguishing colour neither are the boundaries well defined or indeed the overall shape, some conforming to a rectangular shape, others straight line and still others conforming to a haphazard layout. This no doubt has its advantages, probably the main one being that under such circumstances there can be no hierarchical attitude on the part of either the Cell workers, the Cell leaders or Cell chargehands; all have equal importance. The following sub-sections of this Case Study relate to certain individual cells:

CELL 'A'

This cell contentrates on cutting small gears and pinions, burnishing of the pivots on pinions and simple sub-assembly work. This Cell is adjacent to the area in which single spindle automatic sliding head lathes are positioned; the machines that produce the pinion blanks. Hence the pinion blanks are fed directly into this Cell without need for temporary storage.

The workers in the Cell are all women with two chargehands both male. To a very large extent the accuracy and resulting quality of the end product is largely dependent on the performance and quality of work coming from this Cell. Because of this, one chargehand concentrates on the cutting of gears and associated work; the other on pinion burnishing, polishing and sub-assembly work. It was noticed that the operators move around within the Cell dependent upon component requirements and also the fact that the time for the different operations varies. This movement by the operators was quite spontaneous and did not involve instructions from the chargehand.

Both chargehands operate as setters and one is also the shop steward for the factory; both are firmly committed to the Group Technology methods of manufacture adopted by the Company. It is relevant to record the attitude of one of these chargehands: 'Now I am much more involved - before Group Technology I never knew what was going on; now I can plan the work myself, I am much more of a chargehand'. This attitude can largely be explained by considering the functioning of this Cell.

The numbers of components in each batch are determined from an assembly programme. This monthly requisition in the form of a computer print-out is issued to the chargehand and he then decides the order of work. This decision is based upon:

(a) a knowledge of work already in the Cell;

(b) a good understanding of his workers' performance and capabilities;

(c) knowledge of the machines and equipment in his Cell;

(d) innate confidence by management in his ability.

Because of the type of work and the fact that most components are small turned parts or pressed blanks, these components both before and after processing are stored in a cabinet in the Cell. There is a very good reason for this.

If an order is placed with the automatic lathe section for say 1000 pinion blanks, the auto-section will comply, tool up the appropriate machine but the machine will be allowed to operate until the bar is finished. This results in excess blanks being turned which are stored in the Cell. The same applies to blanks from the Press Cell.

For this particular chargehand in this Cell it means that after receiving his monthly programme of work he checks what he has in his temporary store and passes this information to the Production Control Department who then modify the order requirements to the Press Cell and the Auto-Cell.

At first sight this may seem an unnecessary and cumbersome way to operate. This is JOB ENRICHMENT and gives to this particular chargehand a feeling of importance, of being part, if only minor, of the management team. This is reflected in his attitude to all of his work. He is a dedicated worker, readily sees the advantages of G.T. to his own duties and responsibilities. It is largely due to his enthusiasm that ensures that workers in the Cell are kept happy and fully occupied. Also of importance is the fact that this chargehand operates as a setter and schedules the work through the Cell. The author observed that invariably he was busy altering, adjusting and re-setting machines ahead of the flow of components, thus ensuring the minimum of delay for the operators after the completion of one operation and the commencement of the next. When not involved with such duties he was checking work in progress, liaisoning with other departments as well as doing work on small batches of components that come to the Cell from time to time and require a particular skill and patience in their execution. Whilst there is considerable flexibility among the workers in this Cell it was noticed that certain workers excel in and seem to prefer only one type of operation to perform, although this does involve operating different machines of the same type within the Cell. When the necessity arises, such workers do move around within the Cell.

The workers have a compulsory break of ten minutes in the morning. Vending machines for the dispensation of solid and liquid refreshment are available all the time and yet this in no way affected machine utilisation which was observed to be high at all times. The Cell is relatively small in terms of distances between the machines and inter-communication is both easy and probably desirable when considering the nature of the work, the size of the components and the small tolerance zones and also the fact that all of the workers are female, many of them weighting companionship of more importance than financial reward. Further most of the work within the Cell is demanding, components are usually very small requiring a certain skill and deftness in loading and unloading as well as operating the machines and with the almost continuous noise from the remainder of the factory the opportunity to communicate easily with one's fellow workers contributes greatly to productivity. For many operations within this Cell operators are provided with gauging equipment. This is either of the 'GO' 'NOT GO' type gauge or indicating type instruments equipped with tolerance pointers. This in itself contributes to job satisfaction for the operators, ensures that deviations are quickly brought to the attention of the chargehand, reduces the need for a separate inspection department or inspector within the Cell, thus contributing to the reduction of overheads.

Surprisingly the chargehands intimated they were given few details relating to Group Technology. The author suspects that there is possibly some truth in this, reflecting the different levels of knowledge and communication necessary for the different stratas in an organisation and in this case the information imparted to the chargehands used terminology, facts and figures alien to their sphere of activity and their attitude is therefore understandable.

CELL 'B'

The components processed in this Cell have all the same general slender cylindrical shape. Each type has the same distinguishing feature, namely, gear teeth of basically involute form cut at right angles to the main axis of the component and conforming to a rack. Other operations performed in this Cell include surface grinding, drilling and tapping, super-finishing and ultra-sonic cleaning.

The family for this Cell contains approximately thirty components, the main variations being in the overall length, length and position of the rack teeth.

This Cell appears to be a little disjointed due to the lack of suitable floor space and the layout contributes to an uneven flow of work and a certain amount of back-tracking.

This is a Cell with a key machine, the thread grinding machine.

Special fixtures for this machine enable thirty identical components to be accommodated, but the operation time is fairly lengthy. Much more important is that the time for setting this particular machine can be as much as five hours. Setting can involve a complete wheel change together with the attendant balancing operation, followed by wheel truing and finally with the correct change wheels and dressing device,dressing the wheel with the correct contour. The first batch of components must then be carefully checked; the tooth shape by using a cabinet projector and then the pitch on a special pitch measuring machine, if either the shape or pitch are not within tolerance then the wheel must be re-dressed and machine re-set. Batch quantities can also be quite small and the setter/operator of the thread grinding machine thinks that more thought should be given to the scheduling of work in this Cell to ensure that:

1. small batches are not sandwiched between large quantities necessitating machine re-setting after a fairly short interval with consequent loss of production time and reduction in wheel life;
2. scheduling should also ensure that where rack details are identical these batches should be scheduled to follow each other wherever possible.

Attention to the above two points would remove the frustration detected in the attitude of this setter/operator who also acts as Cell leader. This man appreciates the difficulty of scheduling work into his Cell and hopes that the people doing the necessary programming are fully aware of this problem.

Note: The author has the conviction that management are fully aware of this particular problem and probably a close look at the channel of, and method of communication would produce an amicable solution.

Alternatively it might be advantageous to look at all the particular tasks that this operator performs with the possible enlargement of his work to include participation in the scheduling.

One particular operator in this Cell expressed considerable concern at the apparent lack of information. He had heard of Group Technology, 'working in groups', how was this going to ultimately affect him and his work? Such attitudes are difficult to elucidate. Does he genuinely know very little of what is going on? He went to great lengths to explain that he had a son at a University and was quite proud of this. This seems to indicate a higher level of intelligence compared with operators several decades ago. They are much more aware that the avenues open to them are no longer as restricted, that there is more to life than an eight-to-five job with a pay packet at the end of the week. They question the motives of those who create their different environments.

This man was quite prepared to accept that innovation and change is a necessary part of modern life both within the home and at his place of work. He wanted to know where he stood at the end of the day.

Adequate communication would seem to be the key to this problem.

CELL 'C'

This is primarily a press Cell equipped with hand operated, hydraulic and mechanical power presses, surprisingly it includes small drilling and tapping machines, this not only bringing variety of work to the operators enabling small sub-assemblies to be produced within the Cell but tends to smooth out the flow of work between a high-speed hydraulic press, operating at perhaps 150 strokes per minute to a hand-operated press at 15 strokes per minute.

The operators in this Cell consist of one setter, who is also Cell leader, together with three female operators.

The number of components in a batch varies from a minimum of 50 to a maximum of the order of 10,000; considering this range one appreciates the need for additional, slower operations to keep the Cell operators busy.

Whilst no attempt was made to evaluate machine utilisation it was noticed that this was of quite a high order.

The setter has a certain knowledge of G.T. and that it involves forming families of parts. He did not appear to know and therefore appreciate the full implication in so far as it affects his own work. He likes the new arrangement mentioning two specific points, namely, it has reduced the amount of effort required in moving trays of components around; and he finds it much easier to keep a check on work that is being processed, that which is to be processed and that which has been completed.

He does not schedule work in the Cell but works in close collaboration with Production Control. This arrangement can sometimes lead to difficulties particularly when work is scheduled that can only be processed on one particular press, the setter finding that that press is already in operation. He sometimes feels a little frustrated when press tools are sent from the toolroom for a proving run with the proviso that this be done immediately, resulting in stopping a press, breaking down, setting the new tool, trial run, followed by removing, and finally re-setting the original tool. Within this Cell the setter is provided with the necessary checking equipment. The arrangements for seeing that the tool is still functioning correctly at the end of the run, thus ensuring that it is returned to the store in good and serviceable condition for when it is next required, is a little obscure. This could lead to frustrations within this Cell.

Invariably the setter obtains the materials required for his cell from the store and seems quite happy with this arrangement. The Cell is approximately square shaped, the space available being severely restricted, and it is not an ideal layout, but it should be stressed that the presses are adequately guarded. The housekeeping in the Cell is not very good and management should look carefully to see whether it is possible to make conditions more pleasant and desirable.

The author noted that the small work force in this Cell work as an extremely happy and harmonious team but whether the noise from the high-speed hydraulic presses plus that from machines in the near vicinity could have a cumulative deleterious effect on Cell productivity is questionable. It would seem an area worthy of investigation.

It is interesting to note the attitude of one of the operators in this Cell, a mature woman whose manner and appearance would seem to suggest aspirations to better things than operating power presses and similar machines. This particular woman has about seven years employment with the company, not continuous and not all of that operating power presses. It must be admitted that perhaps the over-riding factor of why she works for this particular company is the accessability from her home. She is completely happy with the company, and feels that management do consider the workers and that the personal contact that is maintained between management and workers is extremely important. Probably she rates the conditions of work more important than the level of pay. Difficulties that arise with her work from time to time are quickly attended to and help is always at hand.

She knows a little about Group Technology methods of manufacture and whilst liking variety would prefer to concentrate only on press work.

CELL 'D'

This Cell is looked upon by management as their main Cell, and is involved with drilling, counter-sinking, counter-boring and tapping with a certain amount of sub-assembly work. Hole sizes produced in components in this Cell vary from somewhat less than 0·5 mm to 6·00 mm with corresponding tap sizes and the operations are performed on single or multi-spindle drills; also included in the equipment are two small toggle type presses and one hydraulic press. The work force within this Cell comprises a chargehand and eight female operators.

The Cell layout is approximately rectangular, but it was noticed that for certain types of components, the machines could be rearranged (some machines are light and not permanently fixed to bench) to form a flowline. This rearrangement was carried out very speedily being assisted by the fact that all drilling jigs and other necessary fittings were stored in racks within the Cell area. Within the Cell it was noticed that good relationships existed between the various operators and the chargehand no doubt due to the interdependence of the operators and their overall dependence on the chargehand. The chargehand during rearrangement of the Cell was obviously the key figure with an intimate knowledge of the requirements of the next component batch within the family and thereafter was engaged in sharpening and re-setting tools and generally attending to other duties to ensure a smooth flow of work with the minimum of interruptions.

The women in this Cell help each other. This appeared to vary from mutual selection for the various tasks and operations to be performed to forbearance with a slow worker or one whose operation was giving some difficulty.

One other important factor noted was that the last operator in the sequence carefully stacked the components in a tray, and because there was no intermediate storage during processing, the rejection rate due to bruising and similar forms of damage was minimal and furthermore it was quickly brought to the notice of the chargehand that one particular storage rack required attention to ensure that components would not be damaged. The author is in some doubt as to whether this attitude is partly due to job satisfaction, or female operators, or the Company fortunate with this group of operators or a 'spin-off' from Group

Technology. What is known is that when productivity is measured by the number of rejects due to bad handling, group technology as practised within this Cell ensures that productivity verges on 100%!

A technological/socialogical factor noted in this Cell was the lack of abuse of the equipment - machines, drilling jigs, etc. When some workers work in isolation boredom can occur at fairly frequent intervals. The effect of this boredom can be seen in a variety of ways. It can mean periods of sitting doing nothing, frequent temporary absences from the work-place, deliberate misuse or even abuse of the machines or equipment, mental aberrations resulting in turning control wheels in the wrong direction or confusion in the operational sequence. Relating this to the operations performed in this Cell could mean frequent and unnecessary drill and tap breakages, misalignment of drill with drill guides, drilling into the drilling jigs (the author has known holes to be drilled around the drill bushes such that their position and fixing becomes tenuous). None of these factors was noted, the condition of the relevant pieces of equipment being of a very high order and any real or apparent discrepancies quickly brought to the attention of the chargehand. Such an attitude of course contributes to the quality and reliability of the end product as well as ensuring as far as possible that when jigs, fixtures, etc. are stored, they are stored with the knowledge that when required again they are in a fit condition.

CELL 'E'

This is a Cell composed of almost identical machines, namely eight single-spindle sliding-head type automatic lathes, and is an exceptionally good example of G.T. applied to this type of work and confounds those critics who imply that G.T. is only applicable where there is considerable operator involvement on fairly large components. In this set-up the human involvement is confined to four men who act as setter/operators. Component sizes vary from approximately 1·5 mm to 10·0 mm diameter by 1·5 mm to 130 mm long.

The setter/operators are also responsible for the quality of the product produced in the Cell and are equipped with the necessary measuring and gauging equipment. This fact has enabled the company to dispense with patrol inspectors at considerable financial saving; the setter/operators being quite happy to assume this additional responsibility.

Since this Cell produces a very large proportion of the parts required in the final product and the work of other cells is dependent on the output of this Cell; quite often a second shift is worked until the sales forecast indicates that the position is tending to stabilisation, the second shift then being discontinued. When this happens the company is left with what amounts to surplus labour, natural wastage eases this problem but of greater importance is that associated with two chargehands in one Cell. This it was noticed resulted in lax and inadequate attention being given to the machines. Single-spindle automatic lathes stop when the bar has been used, the machines then require attention for removal of the end of the old bar and replacement with a new bar. This is followed by checking of the first two or three components from the new bar. Machines remained idle for an undue length of time. Similarly when one batch of components was completed there seemed to be a lack of direction within the Cell to ensure that the re-tooling and re-setting was accomplished with the minimum of delay. Various solutions seem to surface any one of which, if adopted, might either solve or go a long way to providing a solution. These solutions can be briefly summarised as:

(a) Disposing of one chargehand.

(b) Sub-dividing the Cell, giving each chargehand responsibility for one division, and when a second shift is required then they can be easily re-combined.

(c) Looking at the possibility of placing some if not all of these machines in other Cells. The components produced in the Cell provide the raw material for other Cells.

(d) Creating a senior chargehand.

(e) Equipping each machine with a visible or distinctly audible warning signal to indicate when it requires another bar of material.

(f) Introducing some form of payment by result to ensure machines get prompt attention. (This would be a retrograde step fraught with danger and complications, the ramifications of which could penetrate every aspect of the Company's operations.)

One thing is sure, that if attention is not given to this particular problem with a genuine and sincere effort by management to solve it, it could prove endemic and affect the good management/employee relationships that already exist in this factory.

CELL 'F'

This Cell is an attempt to apply G.T. principles to assembly work and as such it is difficult to establish the success of the operation. If the only criteria was smooth flow of completed assemblies, then it is highly successful, if it was based upon the number of different completed products within a family then the answer might be very different. But as stated earlier, this company sees very little of its efforts as the ultimate and no doubt modifications to this Cell if G.T. principles are to apply, will have already been contemplated.

Nevertheless it is important to record certain relevant facts. The assembly workers in this Cell are all women with the exception of two men, one who is a chargehand and the other the final inspector. One woman also acts as a viewer just to check the final product prior to placing in a storage compartment for shipment.

The environment in this Cell is particularly good, being light and airy with a continuous outside window down one side and is sufficiently isolated from the rest of the factory to exclude all noise from the machine shops.

The workers sit round three sides of a large wooden bench which is positioned in the centre of the room, the viewer and inspector being located at the fourth end.

Certain sub-assemblies are delivered from the stores, these having been completed in Cells A or C; other sub-assemblies are produced within this Cell and therefore provision is made for simple machines to be accommodated along one side of the assembly bench.

Batch type methods of assembly tend to be used in this Cell and small power operated screw-drivers are provided to relieve operator fatigue and ensure constant tightening torque.

One Cell worker, an elderly woman with fourteen years service, seems to act as Cell leader, and she unfortunately refused to co-operate (for reasons best known to herself) and nothing the author said or did could convince her otherwise.

The latest recruit to this Cell had been working three weeks previously in Cell 'A' and had then expressed a wish to eventually work in the assembly Cell (living proof to other workers, particularly those in the machining Cells that management does not pass them over and that they are seriously considered when vacancies occur in other parts of the plant, assuming of course that they have expressed a wish to move). Other Cell workers had been employees of the Company for periods varying from about two years to seven years.

As stated earlier the assembly workers including the viewer and inspector are positioned around the assembly bench all facing inwards, the bench itself being about 6 metres by 3 metres. Essentially the work consists of fitting together small wheels and pinions into a framework, which is then placed and fixed into a brass case, dials and pointers being then attached with completion by attaching a bezel at the front and a back plate.

These varying operations require the use generally of both hands, eyes, and for certain operations the ears to listen to the noise emitted from engaging wheels and pinions, and all these must be applied with varying degrees of concentration depending upon the actual assembly operation. It was noticed that because of the close proximity of the assemblers to each other, communication between neighbours was good and also with all other workers in this Cell. Unfortunately this produces a very important drawback, namely that when one of the workers makes a comment practically all the other workers in the Cell look toward where the comment came from and in doing so concentration is lost and in certain instances all work ceases. A Time/Activity study would reveal some startling results comparable with figures recently published by Birmingham University into machine utilisation. Of interest is to compare the comparative activity within the machining Cells in this factory. In many instances distances between operators was short, either because of the Cell arrangement or because of the small nature of the machines and equipment. Under these conditions operators could converse quite freely with each other, the work generally continuing to progress since in many instances only the hands were required for the various operations, tool movements, work alignment and clamping being performed automatically or by means of fixed stops. Contrast the operation of a manually operated capstan lathe with a normal centre lathe, in the one the operator is required to move handles and levers in a sequence that is soon learned and is then done almost by instinct and in the other lengths, diameters, surface finish and sequence is wholly under operator control and deviations are almost wholly operator orientated. In the assembly Cell it would seem that productivity could then be improved by looking at the disposition of the workers and probably locating them round the periphery of the room, with all the workers facing outwards.

It is a credit to the management of this Company that the methods of manufacture they have involved, the integrated inspection coupled with the development of families of components and associated Cells results in very few rejects in the final assembly Cell, this fact results in the end product being eminently suited to female labour; women being usually adept at such work but only if problems are virtually non-existent and the work can progress smoothly. Such conditions apply in this Cell, this being substantiated if only by the stable nature of the Cell workers.

With the exception of the viewer all the other operators have the opportunity to move around within the Cell, and of course with the existing layout they quickly become acquainted with all the tasks performed in the Cell, and little difficulty is experienced with such movement.

Understandably new workers to the Cell go through a period of familiarisation performing the more simple tasks before progressing to the more intricate and delicate tasks of final assembly. Providing the new worker is accepted, and the simple tasks would seem to be an ideal probationary period for management to assess the potential of the new worker and for the other Cell workers to decide whether she will make a suitable colleague, she receives all possible help, since unlike workers in other Cells, the next person to handle the end product of this Cell is the customer, it therefore being extremely easy to determine the number of complete units produced per month, and customer feedback information soon indicates falling off in quality or reliability which in turn reflects on the quality of work emanating from this Cell. This then is a built-in incentive for this Cell to work as a harmonious team and for new members to be integrated as quickly as possible.

One rather mundane task which is common to all the end products from this Cell is the assembling of dials and bezels. Fortunately one woman prefers to specialise in this task and has no desire to move around. Job enrichment means nothing to her, she probably realises the limits of her ability, or lacks strength of character to put it to the test. The other Cell workers are quite happy that she should always be called upon to perform this task and no doubt management sees particular virtues in letting her continue to specialise.

An attempt was made in this Cell to discover if there were any common factors that either singly or in combination appeared to be important to these women assembly workers.

All without exception liked the fixed wage and considered that the wage at the end of the week was a fair one comparing very favourably with that paid in other local industries for doing similar work. An important factor was the two men employed in this Cell, one the chargehand, the other the inspector, and the general impression was that they liked these two men. It was difficult to establish the reasons for this and was probably a combination of appearance, general manner and attitude, knowledge of the work and, related specifically to the chargehand, helpful supervision, i.e. difficulties experienced with the work were soon attended to in an extremely friendly manner. All without exception enjoyed the work they were doing and this was mainly due to the fact as stated earlier that the quality of component produced in the other cells contributed very substantially to the reduction of snags in the final assembly. They also found the work interesting and obtained considerable pleasure from seeing the result of their work in the final product both in the factory and in various other ways such as in occasional shop windows, photographs in the technical press, etc.

Before the rearrangement of their work several found the work rather uninteresting, now with the increased variety things are much better with improved security and perhaps more interesting prospects. The conditions they accepted were very good, colleagues pleasant, and all in all it was considered to be a very comfortable situation.

The only things disliked about the work, and this was by no means universal, was the waiting time, i.e. when one batch of work had been completed and the next batch or task to be performed had not arrived or been decided; and one worker thought there were too many alterations. For domestic reasons one woman expressed a dislike for the early start. The author thinks that there is a possibility of considering flexi-time working for such Cells as this one, particularly when they tend to be self-contained. The final point to arise related to the method of working as part of a group and not in isolation and the personal difficulties that can arise because of this and would lead in one particular instance of this worker leaving. Within this Cell no acts of favouritism or individualism could be detected and hence any personnel difficulties arising would probably arise from personal difficulties!

16.1.2 GENERAL COMMENTS RELATING TO CASE STUDY No.1

Overall the application of Group Technology principles to the Production Engineering activities within this Company are without doubt highly satisfactory and figures can be quoted of improved delivery dates, reduction in stock, reduced manufacturing times, reduced costs, improved machine utilisation to name but a few. Whether by change or deliberation other factors of a socialogical nature have played no small part in the success story; these vary from such things as the social nourishment of work friendships, the acquiring of responsibility to good channels of communications, and the inspiration of top management.

Much work has been written about the right size of working groups, and in the context of G.T. the size of Cells. This Company has an average of six workers per Cell, these are mainly women and work in close proximity to each other. This in no way implies that at all times relationships within the Cells were completely harmonious, but it does mean that with such small numbers the possibilities of cliques arising as a result of personal abrasiveness is fairly remote.

The hourly rate paid within the Cells is consistent with other rates in the locality although this might be difficult to establish since no other factory in the district operates a G.T. system. It was hinted that the rates paid in this factory were the highest in the district, but again proof was not forthcoming. Usually the rate is the same within the Cell, with one or two exceptions, such as the operator of the thread grinding machine is paid at a higher rate.

Whilst no bonus system of any kind operates within the factory a target rate of so many components per day is fixed by work study methods. It was not noticed that slack working in any Cell could be directly attributed to the absence of an incentive scheme. In fact the reverse tended to occur. With such small numbers of workers in the Cells, it is highly unlikely that all will be slackers and the odd one or two who perhaps show this tendency soon find themselves in disfavour with their colleagues and no doubt would soon be asked to leave. The Cells, because of the small numbers of operators, tend to become self-disciplining, thus leaving the chargehand to concentrate on his other duties. Usually when a new worker is engaged he or she is paid at a rate which is 90% of the top rate. After a suitable probationary period of about one month's duration and if work is considered to be up to standard and Cell requirements, the top rate is paid. From conversation with the general foreman, new workers, providing they are acceptable by the Cell workers, receive considerable help from within the Cell to bring them up to the necessary level of performance. Any training thought necessary is considered to be within the sphere of activity of the foreman or chargehand. The company do employ a training officer who can be called upon to help with specific in-Cell requirements should this be considered necessary, to date this facility has not been utilised.

It was also noted that good rather slow workers receive all possible encouragement even to the extent of suggestions from other Cell workers that he or she should engage only in operations that are of a less exacting nature, be less versatile but thereby contributing to the output from the Cell.

Communication between Cell workers and all levels of management is good, being invariably by personal contact. The Managing Director often tours the shop floor, with his knowledge and interest in Group Technology can take more than a passing interest in both the work in progress and the operators. This company's efforts have been recognised nationally and internationally resulting in many requests for visits from other industrialists as well as technical writers. Published articles relating to the G.T. activities of the company are always displayed prominently inside the works. Invariably the chargehands or Cell leaders are brought in to explain the activities within their particular Cell to outside visitors. As was explained by management 'we created the conditions but these key workers tend to know more about the day-to-day activities within the Cells'. Having chargehands and others perform this duty is part communication, part job satisfaction, part job enlargement. The most important part is the effect that it has on the individual's ego. He is acknowledged by management as an important personage, he is part of the management team, it is part of the social nourishment of work friendships, the acquiring of responsibility. Whilst the several people the author has in mind would understand very little of the previous sentences, the effect of explaining their particular tasks and duties more than showed in the enthusiasm and relish with which they answered subsequent questions.

Another facet of communication noted in this company was the use of three-dimensional model layouts. The never-ending struggle to keep the productive capacity of operations in balance means constantly adding machines in some places and taking them out in others. Good layouts do not just happen. Only by constant attention can you have and keep on having a good layout. Three-dimensional replicas or models of machines and equipment were used in this factory for new layouts; the completed model layout being left in a prominent position in the factory thus giving a much better picture to people who are not accustomed to reading drawings and asking for comments from those who will be accommodated in the new layout.

Communication is also enhanced by having fairly frequent meetings involving Production Engineering Management, Shop Floor Managers and Cell Workers. At these meetings broad outlines of the objective of any proposed changes in Cell layout are explained together with any other relevant information such as design changes in the product or components which will affect the method of working or Cell layout. Cell workers also have the opportunity to voice their opinions relating to proposed changes, existing arrangements or on any other matter that has a direct or indirect bearing on conditions appertaining to the Cell. Such things have included the disposal of waste material that in the opinion of the Cell workers was causing difficulty and a possible dangerous hazard. The quality of certain material has also been questioned, relating this to the poor quality products produced in the Cell. Requests for pre-production runs of tools used for the first time or those with considerable alterations, thus reducing waiting time in the Cells have been requested.

Since the minutes of these meetings are recorded and posted on the works notice board, management find that this type of face-to-face confrontation is an extremely useful exercise but has resulted in a fair amount of additional effort on their part to attend to and produce a satisfactory solution to such problems as those mentioned above.

Probably with job enrichment in mind and also the possibility of reducing overheads, the re-structuring that has taken place in this company has thrown the onus of maintaining quality of product, so far as it can be controlled in the Cell, on the Cell itself. Certain Cells and workers are equipped with indicating type gauges, 'GO' and 'NOT-GO' type gauges or receiver gauges of one form or another with the chargehand setters or the General Foreman carrying out spot checks. No other inspection personnel are employed. The company does have a quality control department; this department only operating within the Cells when defects arise that cannot be corrected by personnel within the Cell or by the foremen. As was stated in CELL 'F' where the final assembly is performed, the non-existence of inspection procedures in no way affected the assembly operations and most certainly has no deleterious effect on the quality of the completed product.

Surprisingly the housekeeping within the Cells was not of a very high standard. There are no disadvantages to good housekeeping, all efforts to improve housekeeping score in one way or another. Housekeeping affects the attitude of workers to their work, affecting in turn the quality and productivity; it also affects the equipment, machines and other apparatus that they use. Perhaps this is a contradictory to the previous paragraph which emphasises the quality of the end product. It is the author's firm belief that this is something that should be attended to particularly when alterations are contemplated to existing Cells or new Cells are to be developed. Attention should be given to the storage and proper racking of auxiliary equipment for the various machines (it was noted that drilling jigs, press tools were carefully stored and suitably protected), spanners, tools, etc. come more easily to hand if placed on a 'shadow board' and suffer less damage than when thrown carelessly into a wooden box. Measuring and gauging equipment when not being used is less likely to suffer damage if stored carefully. More attention too could be given to lighting in the various Cells and to the general overall cleanliness. With many women workers it should be easy, once having established a high standard of housekeeping, to ensure that it is kept that way, workers generally like working in good wholesome surrounds. Of course good housekeeping can be given its rightful attention when considering the layout of a completely new plant and it is admitted that it becomes more difficult when suffering such constraints as an existing building with existing plant and the necessity to maintain production or disrupt it as little as possible when carrying out even minor changes. Under such conditions it is easy to forget or confine it to a minor place in the re-structuring strategy. It is also admitted that it would be difficult to measure the improvement in productivity resulting from a 'good housekeeping' exercise.

This company has a small personnel department and apart from fulfilling the normal personnel department requirements such as finding and engaging the right type of labour, registering National Agreements, acting as a recording and filing section, etc., the department has a minimal activity in the Group Technology set-up. Usually little, if any, information is given to new employees relating to Group Technology methods of working. This means that such employees are not aware of the possible need for them to be moved from task to task to meet the differing and changing requirements of the Cell. It is true that on the shop floor, certain foremen and chargehands attempt to interest new employees in the methods that the company have adopted in rearranging machines and equipment and how the workers slot into the methods and practices. In spite of this lack of initial information there was no difficulty experienced by the operators. It is thought that a valuable contributing factor is the rather small, compact and therefore personal nature of the Cell, where the new worker was either quickly accepted and became part of the Cell, or was rejected, and this could be for a variety of reasons, and therefore would leave fairly quickly.

Perhaps because it is a relatively small company and relies more on the overall atmosphere created by reasonable working conditions; the feeling of belonging because of the 'family' contact; the number of long-serving employees than confusing a new employee with relevations relating to G.T. and the personal benefits to be enjoyed. The personnel department endeavour to obtain the reason for an employee leaving the company. At the present time the information is sparse and does not include reference to Cell working methods or conditions. Once a new employee is engaged there is little follow up and therefore no feed back of information that could be helpful on the technical side. Newly engaged employees start at 90% of the flat rate and are on a one month's probationary period. This period is flexible and really depends on the worker's ability to reach an acceptable level of performance.

No doubt this company along with many others looks upon its apprentices as a future source of skilled labour, some of it suitable for promotion to chargehand, foreman, etc., yet the company do not provide any special formal or informal induction or other relevant information appertaining to Group Technology. This seems to be a failure in the chain of communication within the company. Since the company is overwhelmingly committed to G.T.its continuing success depends on how well people do their work. All the non-human things in G.T. must be run by people and the earlier people are encouraged to understand and recognise the pattern of activity the better chance there is of continuing success and the possibility of improved methods being developed within the company.

The personnel manager does not see the various Industrial Training Board schemes as a possible avenue to be explored to further the interests of G.T. within the company. Must training stop when a man has become proficient at performing particular tasks? Does he not become a better worker if he knows what system he is to be part of?

The key personnel in this company are the foremen and chargehands. It was noticed that they were the people ensuring efficient Cell operation. Yet the company does not make any special concessions to this grade of worker to ensure that they are fully conversant with all aspects of G.T. They are not sent on suitable courses where they can meet others engaged in G.T. and possibly bring about a cross-fertilisation of ideas. Neither does management within the company expound their views on the complete philosophy of G.T. Finally the personnel manager does not participate in the meetings of production management with the Cell workers and is therefore not aware of the effect that Cell working might have on any human problems that arise.

16.2.2 CASE STUDY No.2

These observations relate to another establishment of the company to which Case Study No.1 refers. It is important to separate the findings if only for the following reasons:

1. The plants are physically separated by some 8 km.
2. The products produced are vastly different.
3. The batch size quantities vary from 1 to about a maximum of 40.
4. Much of the labour force is highly skilled and mainly male.
5. It has its own management team although personnel responsible for G.T. operate in both plants.

Basically this plant has three Cells and the layout is an extremely good example of the application of G.T. principles to one-off non-repetitive manufacture for the manufacture of special purpose equipment and jigs and fixtures and is a rebuff to those who maintain that G.T. is only applicable when batch quantities are in double figures and a variety of different operations and therefore different machines are required.

CELL No. 1

This is a Cell in which the components are all of a similar shape but varying in size. Basically the shape is cylindrical, knurled on the outside, a centre hole and usually incorporating several radial holes. The sizes vary from about 25 mm diameter to 100 mm diameter, the material a high-grade alloy steel, batch quantities rarely exceeding single figures, the customer requiring the end product with the minimum of delay. It is encouraging to note that because of the application of G.T. delivery times for these products have been reduced from 56 to 21 days!

Generally the pattern of work movement is as follows:
Adjacent to the stores are two short bed, cam operated turning machines. These machines are not part of the Cell since they produce products for other sections of the plant. The operations these machines perform are to turn and knurl the outside, rough the bore and part-off.

The components for Cell No.1 are then taken and placed on shelves together with a routing sheet and component drawing. They are then ready to be processed through the Cell.

Invariably the first operation is a duplication of the operation above, but with this important exception, here the machine finishes the bore, faces the ends and produces the appropriate chamfers. All tool movements being controlled by cams with the setter operating the machine.

After this operation they move down the line for drilling and marking operations.

Another line of machines in this Cell is given over to special types of rotational components, invariably very much smaller than the sizes quoted above. In this line, the first operation is performed by a highly skilled turner, usually operating from an appropriate length of bar material; from this man the components progress to cross-drilling and small milling operations.

The company have stated that the steady introduction of G.T. has resulted in a reduction of manpower over the years, with no less productivity, and in spite of an increasing order book. This reduction in operators was certainly noted by the author, since only three operators were involved with the operations in this Cell and there did not appear to be any great build-up of components waiting to be processed.

It was also noted that the skilled turner referred to above could be called upon to perform other operations within the Cell should the necessity arise.

General supervision within the Cell was the responsibility of a chargehand, a man, who was keen and enthusiastic and could already expound the virtues and additional advantages that have and could accrue to both himself and the operators in the Cells.

CELL No. 2

This is a Cell composed of practically all the same type of machine, namely centre lathes of between 8 and 14 inches centre height. All skilled turners are employed in this section and perform the normal operations associated with centre lathes, i.e. turning in a chuck, between centres, screw-cutting internal and external. A chargehand operator is employed in this Cell.

Sometimes the raw material is in the form of rough turned rings, in other instances bar material of the appropriate diameter and length. As initially laid out by the Group Technology section of the company, the work from these lathes would feed were necessary to milling machines and a modified lathe for the rapid production of radial holes and that these latter machines would be incorporated in this Cell.

In practice this does not happen and the turners employed in this Cell do not, and when one studies the route and sequence of operations performed, comply with basic G.T. principles.

CELL No. 3

This is a Cell composed of six milling machines - plain horizontal, plain vertical, and universal; together with several single spindle drilling machines.

Basically the parts produced in this Cell are flat with a series of stepped square or angular faces, of high grade alloy steel, the parts being subsequently heat-treated and finished on surface-grinding machines.

A key figure in this Cell is the chargehand who is also the chargehand for Cell No.1. As stated earlier this man is a keen and enthusiastic advocate of Group Technology, and like all good supervisors, this man thinks about his job, tries to improve methods, and control costs.

Apparently it was at his suggestion that a simple fixture was devised, that is permanently fitted to the table of a horizontal milling machine, the machine being equipped with a face mill on the spindle nose. Invariably the first operation with flat or non-rotational components is the production of two surfaces that are at right angles. This fixture has a series of accurately ground and positioned pins for locating the work, such that these faces can be quickly produced. All other settings on subsequent milling machines are then taken from these datum surfaces, thus not only is the machining speeded up but also the measurement and alignment operations. It does mean that for a large part of the time, maybe as much as 70%, this machine is idle, but the savings in operator time far outweigh this disadvantage.

Again all the operators in this Cell are skilled setter/operators, tending to operate just the one machine, and this is understandable since in many many instances the component can be produced on the one machine.

One operator in this Cell does operate the modified lathe used for the production of radial holes which should be operated by an operator from Cell No.2.

GENERAL COMMENTS RELATING TO CASE STUDY No. 2

The scheduling of work to the three Cells is not very well defined. Routing sheets and component drawings are placed on a series of shelves adjacent to the Cells and there appears to be no formal method of scheduling and the various workers including the chargehands remove the work pieces from the shelves as and when required. This rather loose method does cause a certain amount of consternation and difficulty on the part of the setter-operator in Cell No.1 whose main task is making the tool and cam changes on a special turning machine. If there was a static display of the work schedule such that this operator could see the work that lies ahead then, he could plan his own work accordingly, resulting in the minimum number of tool changes consistent with maximum machine utilisation. Remembering that the machine this man operates requires more or less continuous setting because the batch quantities vary from about 2 to 15 with an average of 8, with an average machining time per component of 12 minutes.

Within Cell number one complete flexibility on the part of the operators is almost an impossibility. At one end of the Cell or line the turning machine mentioned above is positioned and further down the line small holes of the order of 0.02 mm are required to be drilled, this operation calling for a particular type of expertise and patience. Operator flexibility is made all the more difficult by the fact that labour of above average intelligence for the task in hand is hard to attract in this area.

Coupled with this lack of flexibility is another parameter, namely the disparity in rates of pay within the Cell; this varies from 83p per hour for the skilled turner to 72·5p per hour for the man who stamps the components and prepares the small jets. One employee was convinced that because of the unfairness of this disparity in wage rates that he is not working in a G.T. Cell!

As in the other plant a Job Evaluation exercise was performed, but there appeared to be considerable dissention among employees regarding the outcome. The shop steward was quite emphatic that rates of pay compare very unfavourably with other industries located in an industrial town about 13 km away. It is appreciated that care must be taken in comparing wage rates because they do not necessarily reflect in all instances additional benefits such as pension schemes, sick pay, etc. What is equally important is that any dissention, however fractious, does affect the full implementation and operator participation of G.T.

Cell No.2, the turning Cell, is the Cell where there has been the minimum involvement with G.T., and it was ascertained that there was a number of reasons for this, namely:

1. The clumsy way in which management tried to 'sell' and project G.T. to the operators, emphasising that G.T. would improve productivity by as much as 40%. This to the workers meant 40% more work from them and this fact alone merited additional payment. When it was revealed to them that any additional financial reward was non-existent, the lathe operators refused to co-operate.

2. The militant nature of the chargehand in this section. He is a skilled man, can see the benefits of G.T., has also many ideas of his own which could be incorporated into the Cell; unfortunately for management, this man has also the power of persuasion to convince the other turners that it would be disastrous for them to accept and co-operate in any G.T. exercise, and that this was a management exercise in which the benefits were all one-sided.

   This man is also fairly independent in so far as interests away from his work make him financially independent, this fact no doubt influencing his attitude and the stand he takes.

3. The difficulty of obtaining experienced and skilled turners of the right calibre capable of producing the quality of work.

4. The unco-operative attitude of the shop steward, who intimated that any benefits accruing from G.T. should be shared equally by workers and management.

5. The rather weak overall management of the plant. Whilst this was difficult to establish with any degree of certainty, certain factors support this observation.

   The works manager, bye-passes shop floor chargehands and issues instructions direct to operators, thus usurping any authority the chargehands might have.

   The low esteem that certain workers have for a particular foreman. Whilst this foreman is not directly connected with the turning section, the compact nature of the plant is such that a malpractice in one area can have almost instant repercussions throughout the whole plant.

   The rare appearance of the works manager on the shop floor, this fact alone is of vital importance if good channels of communication are to be established and maintained.

6. The cramped area into which the turning-section was located.

   Studies have shown that the environment does have an effect on worker attitudes. The Hawthorne investigations showed that a cash reward for extra effort is not the only, or the most effective, factor in encouraging motivation of the individual. The findings showed that the usefulness of a monetary incentive is so dependent on other things that it cannot be considered as a separate factor, having an individual effect on the worker.

Consistent with good G.T. practice the management intention for the turning Cell was that the rearrangement should incorporate a modified lathe to perform radial drilling and light milling operation, thus the Cell would be complete and for a large majority of components further operations in the 'as soft' condition would be unnecessary. Examination of this modified lathe indicates that a very considerable saving in setting time is achieved compared with performing the same operations on a conventional machine, and thus there is a very large saving in costs.

These facts were very apparent to the employees in the turning Cell, and since there was to be no financial reward, they refused to operate this machine. Stating that it was not a lathe since the headstock did not revolve and as turners they could only produce axial holes whereas this machine produced radial holes and that they did not want to know anything about milling operations that could be performed on this machine.

Thus were management's efforts in this direction frustrated. This machine was not operated successfully until the company engaged a milling machine operator who is actually located in Cell No.3. This man was informed on engagement that he would be required to operate this machine and prior to this job had been made redundant with difficulties in finding suitable employment, willingly acquiesced.

Cell No.3 works quite efficiently and effectively, this being in no large part due to the enthusiasm of the chargehand, who not only sees the advantages of G.T. to the company but also benefits accruing to his own job and position.. On the other hand he is not completely happy with the way management project G.T. and feels that shop floor management should be consulted at a very early stage, be given all the facts, not only technological but economic as well. Thus he would be in a much better position not only to explain to operators but channels would have been opened for him to communicate upwards. Management often forget that communications is a two-way business, and that shop floor personnel not only have good knowledge of the processes and operations but also the ability to think in a constructive way. This fact is borne out by the many companies who operate suggestions schemes and the benefits that have accrued to the company from suggestions that have emanated from the shop floor.

Finally, as mentioned in Case Study No.1, this company hold meetings between the management and Cell operators where problems of mutual interest occurring in the day-to-day operation of the Cells can be discussed.

In this plant, such meetings are not held, and management were not prepared to give a definite answer as to why such meetings do not take place.

On reflection several reasons, either one or all, may account for this lack of communication.

1. The G.T. team are relatively young, nevertheless ardent enthusiasts of G.T. and with a good understanding of the principles, but their enthusiasm for the technology may have 'blinded' them for the need to get people to co-operate if their plans were to be successful.
2. Failure to produce a well-structured and thought-out plan of action to sell G.T. to the operatives, and thus avoid any misunderstanding.
3. Inexperience on the part of the G.T. team in communication and

consultation and the need to create understanding with little knowledge of the main elements necessary in creating a proper understanding between management and managed.

4. Friction between management of the plant and the G.T. team. This in part may be due to some of the points mentioned above.
5. The belligerent nature of the shop steward and one of the chargehands, that could lead to a confrontation and an industrial dispute.
6. The attitude that it is better to leave things as they are since any pressurising of the operators could lead to them leaving and the subsequent difficulty of replacement and consequent loss of production.

CASE STUDY No. 3

This company is rather unique in many ways from a normal manufacturing organisation and this uniqueness results initially from its original conception in a country town remote from other large industrial areas or activities. The original site which was then sufficient for its then needs now covers some hundreds of acres and has encompassed residential areas in the resulting growth.

The company is still the largest in the town and immediate area and employs some 5 - 7,000 and this fact alone presents problems both in attracting suitable labour and retaining present staff, made particularly more difficult with the present fiscal limits relating to wages.

The products produced by the company range over a wide area and embrace the manufacture of power and mechanical signalling equipment, compressed air and vacuum brakes, semi-conductors and semi-conductor equipment, power-operated tub handling plants for the mining industry, brakes for road transport, supervisory and automation equipment and pneumatic equipment.

Its markets are world wide, with an annual turnover within the range

£10,000,000 to £25,000,000.

The organisation of the company is on a 'line and staff' basis with each product range in separate division, i.e. power and mechanical signalling equipment, one division; supervisory and automation equipment and pneumatic equipment another division, etc. Each division is autonomous with the company.

One very different and important deviation from the usual line and staff organisation is the provision of a basic machining division within the company.

This division is responsible for all the major machining for all of the product ranges within each division. This means that this machining division must be equipped with machines capable of coping with components from, say, 1 metre by 1 metre by 1 metre to components produced on single spindle automatic lathes.

The variety of operations varying from those performed on tape controlled horizontal boring machines, through gear cutting to grinding and lapping.

Most of the products processed for the various divisions are in small batches and this is an ideal situation for efficient Group Technology methods of manufacture.

The main objectives in the re-organisation of the machining division on a Cell basis was to reduce throughput time and to increase planning efficiency such that the company would be in a better position to cope with, and resolve more successfully, difficulties associated with the supply and demand of labour.

About six years ago the manager of the machining division decided to investigate the potential and suitability of G.T. to the product range passing through his various machine shops. This initial investigation was followed by a consideration of the various classification systems.

With the many thousands of different components involved some requiring upwards of 50 operations coupled with the range of sizes it was decided that classification would involve many thousands of man-hours and the usefulness of the end result would be extremely doubtful and precarious because of the attitude of the other divisions of the company. Apparently there is even non-uniformity in the drawing offices in the different divisions, and to ask them to add a code number was one thing, to get them to do it quite another. This omission of a classification system does lead to a certain amount of frustration which is increased by the lack of coherence between the various divisions. For example, it is possible for a division to raise an order on the machining division for parts which are obsolete in so far as the tools etc. for producing them have been destroyed; or for simple parts which are standard items and could be obtained much more quickly and at a lower cost from an outside supplier.

Another area of frustration is the fact that management of the machining division have no control over the material stores and therefore lack up-to-date information regarding stocks, sources of supply and suppliers.

Having decided that a classification system would be too complex with very doubtful co-operation from all the divisions, the planning department turned their attention to a fairly comprehensive range of components and divided them into six groups, each group requiring different operations.

Within each of these groups was established a 'key' machine and with an over-riding desire to improve machine utilisation other machines and equipment were selected for producing the product mix. From this exercise the existing machine shop was rearranged and divided into six Cells, each Cell for the production of a particular range of products.

The machines in each Cell, of which there are approximately thirty, have been painted a distinctive colour, the Cells separated by areas for the temporary storage of components that cannot be completely machines in a specific Cell.

Basically, each Cell is divided as follows:-

1. Mills, drill, broaches, planers.
2. Jig borers, grinders, centimatics, mills.
3. Lathes, grinders, mills, drills, gear cutters.
4. Semi-automatics, capstans, turrets, fine borers.
5. Single spindle autos, capstans, small drills, centreless grinders.
6. Small capstan lathes.

Of particular interest is the fact that the manager of the machining division looked very carefully at the necessary Planning and Jig and Tool requirements for the newly-arranged machine shop. His deliberations culminated in a complete re-organisation of these facilities on a G.T. basis. Accordingly project groups were formed consisting of existing personnel from the planning and jig and tool departments. Each project group was allocated to one of the manufacturing Cells and given responsibility for providing the necessary service to that Cell.

This re-structuring has resulted in increasing liaison with shop floor personnel and an awareness of the problems encountered in operating machines and equipment and a corresponding reduction in delay of feedback of relevant information affecting the operating efficiency of each Cell. The Cell operators too, seem happy with this arrangement, now being able to put names to faces with a less tenuous link in the chain of communication.

The Chief Planning Engineer has started monitoring each group of machines and has found that as much as 70 - 75% of the component families are machined completely within the Cell. He has also investigated the usefulness of pre-setting equipment and is convinced that further savings and increased machine utilisation within each Cell will result from greater investment in this area. One or two bottle-necks have occurred. These have occurred mainly with de-burring operations and cleaning of the machined components. De-burring is largely operator orientated and difficulty is experienced in obtaining sufficient labour. Cleaning consists mainly of immersing components in baths of cleaning fluids followed by drying, here the problem is lack of these facilities sufficient to service each Cell.

The company operates a piece-work system and this tends to work against company interests now that the machining division is structured on a cellular basis. Cell manufacture implies versatility of labour within each Cell. A worker is no longer a milling machine operator, or a turner or a grinder. He must, if the Cell is to be efficient, be prepared to move from one machine to a totally different machine depending on the machining requirements of the particular batch of components. There are of course certain reservations, the most important of which is the operator's own capability and ability and management recognising this ability of being able to operate the different machines adequately, i.e. safely, quickly and with due care and attention to the different machines and the different component requirements.

Invariably it has been the experience of cellular manufacture that it is the operators of machines other than the key machine that are required to move and therefore the required capability of such operators is relatively small and easily acquired. When you operate a piece-work system of payment within a Cell as this company does, then the problem of versatility is not one of the operator's capability of being able to operate the different machines but it resolves itself into the speeds at which different machines can be operated and the effect this variation has on the operator's earnings. Even within a Cell, two machines performing identical operations have different performance characteristics and rates and therefore different rates of productivity. This means that an operator resists having to operate a machine with a low productivity and consequent loss of earning capacity.

As mentioned earlier this company is located in an area where competition for labour is non-existent. Nevertheless labour turnover is fairly high, this being exacerbated by the fiscal policy of Government limiting wage increases. Even highly skilled workers leave the engineering industry to seek employment in less attractive jobs but where the rate of pay is much higher, or as has happened with this company leave, go to another company to do the same task, but where it has been designated differently and a much higher rate of pay is awarded. This company would very much like to make a pay award considerably in excess of that allowed by statute, but would almost certainly be penalised for breaking the law. This shortage and uncertainty of labour makes planning and scheduling of the work difficult. The Chief Planning Engineer stated quite categorically that, with the machining division now in six Cells, with each having its own team of associated planning and jig and tool engineers, it is easier to control the flow and production than it was under the old system.

Management of the machining division have held meetings with the union officials and explained why they were rearranging production facilities and also the broad implications of Group Technology methods of manufacture. From these meetings it would appear that the unions have more or less accepted the need for these changes. No doubt with the usual reservations relating to redundancies and any reduction in take-home pay.

From observation it seemed that the operators have accepted the changes and seemed busily engaged in their various tasks within the Cells.

Information from the Chief Planning Engineer intimated that the operators did not want additional responsibilities and any improvements by management relating to job improvement or job satisfaction unless related to more financial reward was a waste of time. This attitude is to a large extent substantiated by the continuing payment of piece rates within each Cell and the resulting lack of flexibility as mentioned above.

Of interest is the changed role of the foremen in the rearranged system.

They are no longer looked upon as just foremen, but as managers of sub-contract machine shops. No longer responsible for a batch of identical machines or processes, but now responsible for an area encompassing different machines and with a variety of product mixes involving the production of the complete workpiece.

As far as the foremen are concerned there has been considerable job enlargement and the foremen now take their rightful place as part of the management team.

Some foremen have risen to the occasion, welcomed and accepted these new functions and new roles for them to play. In others, inadequacies have shown up and the company seems to have accepted this situation. With the increasing involvement by the planning department such foremen can be given assistance until such time they can be left on their own or alternatively are moved or leave.

It should be pointed out that the company met a certain amount of opposition from operators and foremen when the changes were initially announced and certain instances of non-co-operation were noted. Fortunately the machine shop manager came up from the ranks, could therefore appreciate the anxieties experienced on the shop floor and spent quite a large amount of time explaining what they were trying to do and allaying any fears or suspicions expressed by the work force.

The company does have a personnel department and in common with all personnel departments is responsible for general policy as it affects all employees namely in the areas of conditions of employment, honouring of wages agreements, etc. It plays little, if any, part in the day-to-day personnel problems of the various divisions and is therefore only remotely aware that the manufacturing division has re-organised on a G.T. basis.

In the area of training for G.T. the local College of Further Education has put on suitable courses for planners, etc. A shrewd move on the part of the Chief Planning Engineer - the man mainly responsible for the G.T. systems - has resulted in him being employed as a part-time lecturer at the College to conduct a City and Guilds Engineering Planning, Estimating and Costing Course, No. 259. Since the bulk of the students on this course are employees of the company he has been able to explain in considerable detail the philosophy of G.T. thus influencing the attitude of employees and helping considerably in the application and efficiency of the system. This seems to be a good example of playing the educational system to one's own exclusive advantage.

Company policy is such that key personnel are sent on different courses and are thus able to converse and discuss with others their experiences in implementing and running G.T. systems. Little is done in the way of educating shop floor personnel.

GENERAL COMMENTS RELATING TO CASE STUDY No. 3

The machining division of the company has now had several years experience of operating a G.T. system. Management have looked at the way G.T. has been structured and implemented in other firms and industries and after due deliberation decided that without the help of external consultants they would introduce Group Technology manufacturing methods, tailored to suit their own particular circumstances.

Academically it could be argued that had they followed the generally recommended procedures the benefits and improvements would have been much more dramatic.

The original objectives have been achieved, namely to reduce throughput time and give better deliveries.

Other benefits have accrued by the very nature of the re-organisation such as rationalisation of hole sizes and job enlargement for certain employees.

With the experience so far gained, the management of the machining division should now take a dispassionate look at what they have achieved and seek further improvements by involving other divisions within the company.

The Machining Division have facts relating to such things as preferred batch sizes, machine utilisation, reduction in setting times, increased operator productivity. All this as a result of their G.T. experiment. Such information properly analysed and presented should then be used as a basis for persuading the other divisions to design and plan the development of components such that they are compatible with the existing G.T. arrangement or for planned developments in this area. It might also be possible to adapt an existing classification system to make design retrieval a distinct advantage and to indicate the group of machines in which particular components should be produced; and certainly, even without a classification system, it could be argued that G.T. experience indicates quite conclusively that the stores area should come under the direct jurisdiction of the machining division, if only from the fact that the value and quantity of stock and materials can be substantially reduced.

As was stated in the report, from the labour supply angle, the company is uniquely situated. It does not have to seriously compete for labour, nevertheless it suffers acutely from a labour shortage. From this fact it would seem that since operator productivity has increased after G.T. methods were introduced, operator involvement should be studied more closely to see if further gains are not possible, particularly in the following areas:

1. the reluctance of operators to move from machine to machine as circumstances demand;
2. devising a payment scheme that is based on the total output from each cell, yet still retaining an element of piece-rate payment and skill differential.

Both of the above stem from a general lack of understanding and a breakdown in communication.

This company in common with many others gives only the minimum information to shop floor employees such that they have only a vague concept of the philosophy of Group Technology.

It is rather ironic that whilst many companies encourage their senior staff to present papers and attend lectures and conferences which are attended by like staff from, in many instances, competitor companies, they pay little attention to informing their own shop floor personnel. It is a well-known fact that the success or otherwise of a G.T. system initially depends upon the man at the top but finally depends on the people who actually work in the Cells and invariably the better informed the greater will be the effort by Cell workers and the company better placed to realise its objectives.

Management should accept that any proposed organisational or technical change should be disclosed fully to all employees and that this is an essential ingredient to good industrial relations and successful negotiations.

Since the operators apparently are not interested in job improvement or job enlargement but only in 'take-home pay' the company should initiate, in conjunction with all the employees from one Cell, a 'book-work' exercise into methods of payment based upon the monthly output from the Cell. The results of such an exercise could then be used as a basis for discussion with the operators concerned. In this connection it would be advisable to make the Cell as self-contained as possible and include not only operators but inspection personnel together with those associated with the planning and tooling work.

CASE STUDY No. 4

The following is the record of a meeting with the General Manager of the Company. A company which is part of an international group, other companies within the group are engaged in G.T. operations and Case Study No. 12 relates to one such company. This particular company produces among other things instruments for measuring lengths, surface texture and component geometry to an exceptionally high standard and is a world leader in these particular spheres. The total work force is approximately 104 and since the tolerances, both on length and position, are extremely small, in certain instances non-existent, i.e. fit-for-fit, many of the work force are highly skilled machinists and fitters. At the present time this company is not operating G.T. but nevertheless has conducted pilot studies in the toolroom and model shop on five components and a report on these studies is in the process of being compiled.

Probably the next step will be to embark on a G.T. exercise for the production of the smaller components used in the manufacture of the companies' instruments, and from this progress to a completely G.T. orientated production system.

Various exercises are also being conducted into machine selection for the various families of components that are to be tackled, since the General Manager believes that with the implementation of G.T. investment in new plant and equipment could very well be justified.

The general manager sees little difficulty relating to the technological side of G.T. and fully realises that for it to be 100% effective then he must have the full co-operation of all the personnel involved. To this end he believes that his present set-up for communication at all levels is perfectly adequate to ensure a two-way flow of information, such that when the company do go ahead with G.T. all levels in the company will be fully informed. The existing company structure is indicated in Fig. XVI.

The present method of communicating information is as follows: once a month the General Manager meets the Works Manager, Works Engineer, Materials Manager and Production Manager. At this meeting the financial accounts are discussed together with other matters which will affect the future operations.

The last three mentioned managers then pass on some but not all of this information to the eighteen supervisors, this being done during normally pre-arranged meetings.

The supervisors are then at liberty to pass on such information to the operators concerned. Since the number of supervisors is large compared with the number of operators, it literally becomes a face-to-face meeting.

It is also the practice of the General Manager to pass important information direct to the shop stewards, and the shop stewards always have access to the General Manager.

These then are the channels of communication and the links between the various levels of management that the General Manager believes will successfully overcome personnel problems that are likely to be associated with the introduction of G.T.

Already the managers and supervisors have been briefed on G.T. and supervisors have been sent to conferences and seminars and also to companies engaged in G.T. thus gradually expanding their knowledge and confidence when it comes to discussing G.T. with operators. A Job Evaluation exercise has been carried out and whilst no incentive scheme is in operation at the present time the virtues of some form of group incentive if and when the company do decide to implement G.T. has been seriously considered.

The Personnel Department had not been consulted.

GENERAL COMMENTS RELATING TO CASE STUDY NO. 4

The General Manager of this company was a mature man with many years experience of the engineering industry. He gave the impression of considering each problem very carefully, investigating all aspects and being fully aware that any decision taken by him could have serious consequences for the company and for the employees. Management/employee relations at the factory appeared to be good and this was evidenced by the fact that in the past a number of employees had left the company, for what they at the time thought were better pay and conditions only to return after a short time after finding that 'the grass was not greener on the other side'. As stated in the report the technical advantages of G.T. were very apparent and it would seem that the rather cautious approach to G.T. was due in part to the General Manager being very conscious of the effect that it could have on his employees. Also in recent years the group chairman has been ruthless in dealing with members at board level and whether this philosophy makes individual company managers wary and cautious in introducing new methods and processes, is difficult to establish, but it must always be at the back of the manager's mind. Protecting the status quo also protects oneself!

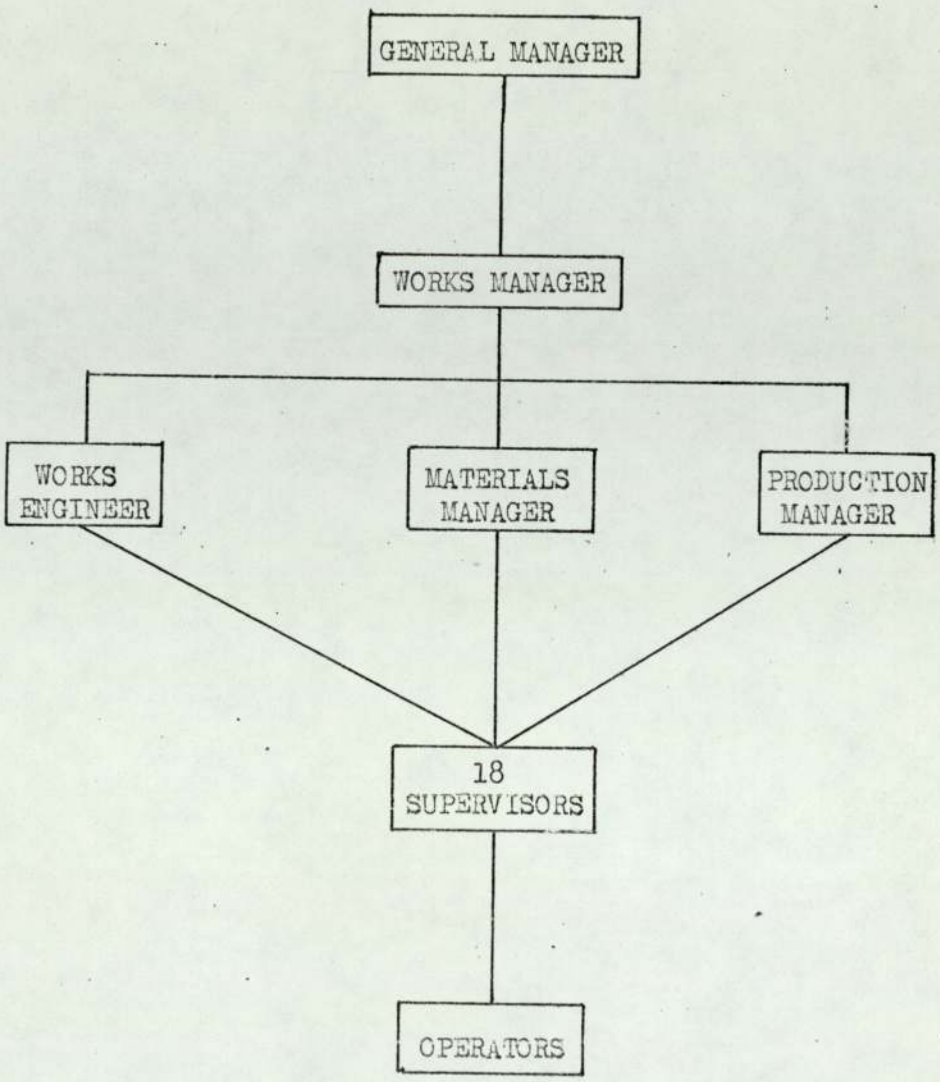


FIG. XVI. Levels of Communication

CASE STUDY No. 5

The Cell system of manufacture is almost always thought of as being applicable to normal production engineering practices where components are machined from the solid material consisting of bar, plate, strip, casting, forging, etc., and indeed the limited number of well-publicized applications related to this type of industry.

This study relates to the Foundry Industry where the raw material initially is solid, being then transformed to the liquid state before solidification into the various shapes and sizes required. This company has 325 shop floor employees and 110 staff and is engaged in the production of quality steel castings from a few pounds to 8 tons in weight.

Before proceeding to enumerate this company's efforts with G.T. is is necessary for the reader to be fully aware of the situation in a foundry devoted exclusively to the production of steel castings.

Basically it consists of large electric arc melting furnaces of Bessemer Converters capable of melting up to the maximum weight of casting, in this case 8 tons. These furnaces have associated scrap yards, storage areas for alloying additives, etc., areas for the disposal of slag, re-lining of furnace and ladle and associated lifting tackle.

A foundry area for the making of the very large moulds required for invariably the 'one-off' casting, with its associated sand-slinging equipment. Smaller areas in which are located the machine moulding process, for smaller repetitive type components. Core moulding machines and associated drying ovens. Sand recovery plant and a fettling department capable of fettling large quantities of small components as well as the largest produced.

With the exception of the machine moulding, core making and drying ovens most of the other equipment is fixed and therefore any rearrangement must start with the fixed location of most of the equipment. Also because of the hazardous nature of foundry work all re-location of plant and equipment takes place during the annual shut-down for the yearly holiday or at other holiday periods. The fixed plant and periods during which any rearrangement can take place imposes certain restrictions on what the foundry manager would like to do and what he can actually do in implementing any G.T. methods or principles and this, coupled with the fact that all components produced, whether large or small, use, apart from the methods of moulding, the same equipment and services. In spite of this, this company has attempted to apply G.T. if only in ensuring that castings with the same material specification are moulded at the same time thereby ensuring economies in the melting process.

To date any contemplated rearrangement is immediately conveyed to the shop floor personnel by way of a meeting between management and shop floor workers. Should it be thought necessary, a three-dimensional model, using simple rectangular-shaped blocks, is made and used as a focal point in the discussion. The layout is finalised, after adequate consultation, and then carried out during a shut-down period.

In the past difficulties have arisen with a new layout when this has resulted in increased take-home pay for the workers involved, the objections coming from those not engaged in the new layout. These difficulties have largely been overcome by the institution of a 'Procedural Agreement' for the settlement of disputes, grievances, disciplinary incidents, and other matters arising concerned with Industrial Relations' - details of this is given in Chapter XX. This company do have good communications and consultative machinery. Every month a joint-consultative meeting takes place. This meeting involves the personnel manager, work study officer, shop stewards, and is chaired by the foundry manager. Items discussed at these meetings can range over a wide area and include such things as load on the shop floor; production efficiencies, personnel problems. Minutes of these meetings are circulated and posted on notice boards.

Each shop also has a shop committee and this meets every week for approximately half an hour. These shop committees are composed of a shop representative, two foremen and one superintendent or line manager. Sub-committees are also set up and these consider such things as training, labour shortages, etc., and the findings of these fed to the works committees.

Of interest is the fact that even dismissals are carried out by the works committees.

The company feel that whilst their system of communication is good it is not perfect and the Personnel Manager is continuously looking at possible ways of improvement. With a strike record of about three days duration in as many years any improvement would seem to be miniscule.

What is important is that these channels of communication and discussion are those which would be used should the company decide to extend G.T. operations and thus all levels would be immediately informed of the proposed changes and thus in a position to find out and discuss what effect such changes are likely to have and of course be able to propose modifications and alterations.

A discussion with the Personnel Manager revealed that the question of worker versatility or mobility would be extremely difficult to resolve and that one would have to understand the entrenched union views and the skill levels before contemplating such a move. He exampled the case of moulding. This could be classified into machine moulding, where skill levels were minimal, to floor moulding calling for the highest level of skill. In floor moulding, the quality of the finished casting is largely due to the skill of the man who produces the mould and unlike machine moulding, where extra moulds are easily produced to take care of bad castings, no such opportunity applies to floor moulding, where it is a ONE-OFF situation.

Similar conditions apply to pattern making. Even the most highly skilled cabinet maker would have difficulty in coping with certain types of pattern, with their loose pieces, draft, fillets, core prints, etc. He might even find difficulty with the pattern makers rule!

With such differences in skill levels versatility is a non-starter. Foundry work is inherently a hazardous and dirty job and where skill levels might be of the same order, the personnel manager thought that environmental conditions would preclude the movement of labour. He instanced machine moulding, core making and fettling. In these three instances skill levels could easily and quickly be achieved. Fettling was however the most arduous, dirty and noisy job and he could see untold difficulties in getting the man who was a machine moulder to carry out even a minor fettling operation. The foundry manager could see the usefulness of G.T. and would like to apply it much more than he has been able to at present, and whilst one had to agree that his difficulties were not insurmountable, compared with a company engaged in normal production engineering activities foundry work seems to be in a very stark position when it comes to advice and help, and one could not help but admire this man and his unaided efforts.

GENERAL COMMENTS RELATING TO CASE STUDY No. 5

In many of the publicized applications of G.T. many refer to the compositions of families of components consisting of castings of one form or another. Castings are a form of supply, hundreds of thousands are produced each week, finding application in practically every industry, light to medium to heavy engineering. One of the very first applications of G.T. in this country related to the production of valves used in pipe lines for conveying fluids of one form or another. Valves, the bodies of which were castings! The company referred to in the above Case Study finds itself in isolation.

It is located in one of the so-called Garden Cities. Hence it has no pool of labour on which to draw; there are no other foundries in the vicinity.

It has excellent management/labour relations with a forward-looking management, willing and ready to look at existing methods of production, alter and re-structure if necessary, if such would improve productivity. Group Technology appeared to be such a method.

Ironically, the company on the next site with which it was once very closely associated, and is involved with the manufacture of cranes, appears to have gone through the motions of investigating G.T. and has since rejected it. This company was involved with the normal production engineering machining activities, with products ideally suited to a G.T. system.

The author knows of no other foundry or allied industry that has applied G.T. and it would seem to be a fruitful area for investigation either by the D.E.S. or a University Department in association with the D.E.S., and the company referred to in the Case Study could be an appropriate starting point.

CASE STUDY No. 6

This relates to a company producing injection and compression moulding machines, most of which are conventional type machines with an occasional modified or special machine to the customer's specification. Some of the machines are vertical, others horizontal, varying in size with die closing forces of several hundreds of pounds to perhaps 200 tons. All machines apart from the basic structure carry mechanical, hydraulic and electrical controls in varying degrees of complexity.

The engineering division, employing some 400, is divided into three machine shops catering for light, medium and heavy components, and an assembly and testing bay.

Group Technology methods have been used in a rather limited form for the past two years and initiation for G.T. came from the Divisional Works Manager.

The company has the machining Cells indicated above together with four assembly Cells; one devoted to small machines; one to mechanical assembly; one to hydraulic, and the fourth one to electrical assembly, with the testing area in the near vicinity. It is of interest that in the rearrangement of the assembly areas, note was taken of their individual material requirements and the stores so arranged that these material requirements were adjacent, thus ensuring minimum delay in transporting or obtaining the relevant material from the stores.

G.T. was introduced by the provision of one machining Cell and one assembly Cell and the number of workers per Cell is approximately 25. Initially the decision to implement G.T. was not discussed with the shop floor workers and only with the foremen to decide who were to be the chargehands. Information from the Assembly Shop Manager intimated that the company enjoyed extremely good industrial relations and that they had suffered no inconvenience from the Unions when the decision to operate along G.T. lines was taken.

The Assembly Shop Manager was of the opinion that a little knowledge of G.T. was a bad thing for shop floor operatives and therefore only the minimum detail was given to them and only explained to them what he thought was necessary. Apparently there was a small amount of operator resistance particularly from operators who discovered that after re-organisation they would be working under a different foreman. All workers in the engineering division have been subjected to a Job Evaluation, or rather their jobs have and after G.T. a modified bonus system was introduced in the assembly Cells and this seems to have met with approval from the Cell operators.

The company does produce a company newspaper that appears at infrequent intervals, but nothing was published about G.T. The Personnel Department was not directly involved and the problem of operator mobility, flexibility or versatility did not arise.

Middle management appear to be quite happy with the re-structuring and have offered only constructive criticism; and in the process of re-organising for G.T. job enrichment or job enlargement was never considered.

Given the same task of setting up a G.T. system this company would progress along almost identical lines with one exception, and that would be to analyse all components and set up a classification system. From the personnel angle it would still be to provide them with the minimum amount of information and it is only when the take-home pay is not satisfactory does a worker start complaining and questioning what he is doing and the way he is doing it!

GENERAL COMMENTS RELATING TO CASE STUDY No. 6

The general impression was that this company have not really understood what is involved when G.T. methods are to be used. Looking at the products produced by this company and the fact that the machine shops were conveniently sub-divided for the production of small, medium and large size components seemed to be an almost ideal situation. Unfortunately only a passing view was obtained of the machine shop devoted to the manufacture of large components, and this brief view showed some very large machines, many of which were obviously old, and they did not appear to have been moved into any logical sequence, and the layout appeared to be haphazard. The company representative seemed reluctant to reveal any further information relating to the machine shops and the suspicion arises that either G.T. is not being practised in these areas or management demarcation is applied very rigidly.

The philosophy of imparting minimum information to employees is highly questionnable; unfortunately it was not possible to question an operator on the shop floor, but this attitude is contrary to the almost popularly held belief, on both sides of industry, that the more information imparted, and that when people know what they are doing and why, a more harmonious working situation arises. In the assembly areas, these had obviously been altered and rearranged and the assembly of the various types of machines appeared to be progressing smoothly. But was it really G.T.? Probably in part yes. More than likely Group Technology was being confused with Group Working, a totally different concept!

CASE STUDY No. 7

With a total work force of some 1200 and producing a single product which can have many attachments and variations this company embarked upon G.T. in the early 1960's, but the term Group Technology had not then been used.

Initiation for the change to Group Technology came from the Production Engineering Management and was introduced into the machine shop and six Cells are now in operation.

Middle management was involved very early on in the discussions and many were sent to other organisations and conferences to assess the experience of others and the potential for their own product. The Production Engineering Manager had initial talks with the Cell workers and used simple line diagrams to explain what the re-organisation would mean. His deputy has now established extremely good communications with all the

Cell workers, is a keen and dedicated enthusiast for the technique and plays a major part in ensuring smooth operation in the different Cells, explaining in detail where necessary and of course providing a channel of communication in both directions.

G.T. was also carefully explained to the shop stewards and apparently this body of people were very co-operative and offered no objections. Strangely the Personnel Department has never been involved, neither has the training department.

With a full order book and an apparently almost insatiable world demand for the company's products there has been no redundancies. Management anticipated that Cell workers would probably ask the question "What's in it for us?" and successfully overcame this problem by not only increasing the bonus but at the same time changing to a Cell bonus system, where the bonus is related to the output from each Cell.

The Production Engineering Manager readily admitted that they had not yet achieved the objectives and goals originally set, which was to increase output and reduce parts stock and be in a much better position to give firm delivery dates. But they realised that since the G.T. re-organisation savings had been made in different directions and that a much smoother output has been achieved. Mistakes that have been made have been on the technological side and have been mainly due to work scheduling.

Production management of this company appreciate that G.T. can involve versatility of labour, this apparently has not been a problem, but believe that there are special exceptions to this especially when it involves highly skilled work, operating expensive plant or equipment, and under these circumstances would be very reluctant to move a less skilled man to such work.

The Production Engineering Manager said that his greatest asset was having the full support of top management of the company and this, if not for spending money on new plant and equipment, for providing the necessary facility for re-organisation. To obtain this support then it was important to produce a full comprehensive survey with if possible comparative figures to substantiate the change to G.T. He also thought that one should consult with as many people as possible who had experience of G.T. and thus learn from their mistakes.

Job enrichment or job enlargement was not taken into account when designing the Cells, but certain supervisors and foremen have been impressed with the results. The P.E.M.'s last remark is very pertinent; when asked, "What do you consider to have been the main problems, human or technical?" he answered "Human - machines don't answer back!"

The view was also expressed that the more knowledge a line or Cell worker has relating to the work that he is doing the better it is. In this company's experience this knowledge was best imparted by a combination of talking and written graphical descriptions.

GENERAL COMMENTS RELATING TO CASE STUDY No. 7

The general impression was that here is a company that has done a great deal in the G.T. area. It was possible to see for instance special tools and attachments to make the equipment more versatile; one could also see the flow of components through the various Cells. One Cell even incorporated induction hardening followed by quenching as well as the normal turning and grinding machines, thus indicating that in looking at component families, not only the machining operations should be considered but the ancillary ones as well, all this being achieved without the use of any formal classification procedure.

Operators seemed quite happy and contented as they pursued their various tasks and one when questioned seemed to know a little about Group Technology, what it was, why the company had re-organised and how he fitted into the scheme of things.

The management of the company have been impressed with results to date, and envisage that in future all work where possible will be organised on a G.T. basis.

The author came away from this company feeling that with a certain amount of outside consultancy help, G.T. developments could be quite dramatic, since the Production Engineering Management team were themselves keen that this should be so.

CASE STUDY No. 8

Much has been written about 'The Right Time to Install Group Technology'. In all instances it is the technological advantages that are stressed as being the main reasons for re-organising from functional to cellular layouts and the end results are quoted as percentage reductions in throughput times, work in progress or percentage increases in productivity, machine utilisation, etc.

This case study relates to an organisation which a few years ago, because of the general economic situation, found that the number of new orders for its products was falling off rapidly, competition from overseas competitors for the few orders that were available was very intense; it also had very severe financial problems with several millions of pounds outstanding as loans from financial houses etc., and with a very large labour force of several thousands of skilled and semi-skilled machine tool operators and fitters. In spite of these and other difficulties, or perhaps because of them, the management of the company decided to embark on a policy of re-structuring and now have some twenty-six Cells in one factory and eighteen in another, and involved the re-siting of some 1050 machine tools and either directly or indirectly every department in the organisation was affected by this change.

This change was greatly facilitated by the support of top management and the G.T. team being led by the Planning and Development Director of the company, a man fully dedicated to G.T. as the answer to most of the problems of Batch Production. This man seemed to have the right type of personality, to inspire confidence in his speech and actions, to readily appreciate the feelings and attitude of the men on the shop floor, to be able to speak to workers on the shop floor in terms which they readily understood, and to accept the fact that not all industries' ills were due to shop floor militancy; poor and irresponsible management were also partly to blame.

This company, faced with having to make several thousand workers redundant and knowing full well that cellular manufacture could lead to further redundancies, pressed ahead with its plans.

From the very beginning the Personnel Department were involved and has since these early days been kept fully informed of the progress of G.T., participating in the meetings and discussions when this was thought desirable. Selling G.T. to workers on the shop floor was, because of the plight of the company, which incidentally was fully reported in the National Press, relatively easy. This is understood, most shop floor workers are sensible and responsible people and fully realise that if communicated in a correct and proper fashion, most management decisions are for the good of the whole company and that faced with a falling order book, G.T. as projected by the company appeared to offer a sensible and tangible solution.

Initially the company decided to set up an experimental Cell for producing certain families of components. In this Cell difficulties were experienced with certain operators. Many of these difficulties stemmed from the fact that the operators were now having to work in an unfamiliar part of the plant, with different colleagues. If the technological advantages were to be achieved then management realised that this first experimental Cell must be a success. Whilst the G.T. team leader believes that certain aspects of job enlargement and job enrichment are important, the take-home pay is the over-riding factor affecting how an operator works. Accordingly all the workers in this first experimental Cell were paid an additional one pound per week. This additional incentive paid dividends. The experience and results from this one Cell fulfilled the expectations of the G.T. team. From this small beginning the company were able to embark on a full scale implementation including the coding of some 70 000 components, selection of family groups and construction of the necessary Cells.

At all stages in this development frequent meetings were held with shop floor representatives. Not all the problems arising at these meetings were personal ones. Many of the Cell representatives had given considerable thought to G.T. and were concerned in the interaction of interdependent operations, both within Cells and when components were required to be completed in a second or third Cell. Such attitudes on the part of the shop floor enabled common problems to be solved not only quickly but also amicably as well.

In this company the size of the Cells varies. The largest contains some 32 operators and the smallest perhaps less than eight. These discrepancies in Cell size are largely due to two factors. One, the difficulty in obtaining the right type of foreman. In the normal layout, the foreman and chargehands are usually highly skilled in a relatively limited field. The requirements of the supervisor in G.T. are somewhat different and people with a far wider experience are required not only in the practical sense but also in having far wider horizons and being able to run a 'mini' factory. Secondly, it was necessary to ensure that as far as possible load balancing in the Cells was reasonably even, giving uniform utilisation of machines and equipment. This last problem was one to be solved in the early stages of designing the Cells. The first problem was not capable of easy solution and the company admit that mistakes were made when it came to selecting the supervisors for each Cell. Furthermore the Planning and Development Director stated quite categorically that such problems can be solved, but there is no ready-made general-purpose solution, and that from all angles a man might seem to measure up to the situation and have all the necessary and desirable qualities; in practice he might fail miserably. Management must be aware of this problem and in this company help and advice were readily available in such cases.

Flexibility, versatility and mobility of labour were considered by the G.T. team. In fact this facet was looked at very carefully. They found that mobility was not a problem. A machine operator would be quite prepared, should the occasion arise, to operate a machine in one Cell and then a similar machine in another Cell in a different part of the factory. Flexibility and versatility was another matter because this depended on the operators. Their ability and capability to master the operation of more than one type of machine and their willingness to do so. Careful investigation revealed that this possibility was only likely to arise in very remote instances and for the time being the company because of this were leaving the solution to if and when the problem arose.

It was interesting to learn that the operators in the largest Cell in the plant had continued their 'Group' activities into the social sphere, external to their work, and had organised coach trips and darts matches. Management were hoping that this type of activity would spread to other Cells, but wisely were keeping a low profile in this direction.

During the introduction of G.T. the Planning and Tooling Departments felt that they were being left out of the re-organisation; whether this attitude was genuine or partly due to the economic climate of the company was impossible to establish. Consequently the managers of these departments sought a meeting with the G.T. leader and this resulted in these two departments playing a much more effective part in the running of this 'cellular' plant and at the same time went a long way in allaying the fears of workers in these departments that G.T. would lead to redundancies.

Finally, management took the opportunity to pay considerable attention to the housekeeping function during the re-organisation. The factory buildings were some 60 or 70 years old and had grown in the typical British way with a considerable accumulation of 'bits and pieces'. Now the environment is very much better, machines have been cleaned, general lighting improved and gangways between the different Cells wide and well defined and these improvements seemed somehow to be reflected in the attitude of the operators to their different tasks.

GENERAL COMMENTS RELATING TO CASE STUDY No. 8

The writer got the impression that everyone in the various Cells within this factory were determined to make a go of G.T. and the place seemed to hum with a contented activity of purpose. Whether this was due to the difficulties of the company and the ever-present fear of redundancy was impossible to establish. What is known is the massive management support and enthusiasm for G.T. and the way this enthusiasm has been conveyed to the shop floor.

The company does have good industrial relations and does everything possible to ensure that all are fully informed - this is achieved by way of meetings at management levels, with shop floor representatives and with various 'in-house' publications.

The company has also opened up its activities in the G.T. field for all to see and receives many visits from other industrialists. Seeing a more or less continuous stress of people viewing their activities must surely be another perhaps indirect factor contributing to the high morale of the workers in this plant.

The Planning and Development Director takes every opportunity to publicise his company's efforts in G.T. by presenting papers at conferences and contributing articles for the Technical Press and uses these to publicise company products. This attitude on the part of this Director to take every opportunity to push company products must be reflected in some way in favourable worker attitudes.

The company has acquired considerable knowledge and expertise in the field of Group Technology and now has a special department offering a comprehensive advisory service to customers and will recommend the best course of action to improve their present production techniques or offer a complete 'package' based upon G.T. for any completely new project.

Ironically re-organisation has not materially affected the economic fortunes of this company. The Chief Executive, who fully supported the re-organisation of the factory utilising G.T. principles, has now been replaced and considerable government money has been injected into the company in an effort to stave off further economic ills. The company are still convinced that what they did was in the best interests of the company then and for the future when it is sincerely hoped that its fortunes will show considerable improvement.

CASE STUDY No. 9

This company is often quoted in the technical press and at conferences as one of the prime examples of the application of G.T. in this country. This is understandable when it is considered that the specification for its products number some 20,000 and that new specifications are generated at the rate of some 150 per week. Within one week approximately 500 specifications are required in approximately 1200 batches with an average batch size of about 500. Such information must be put in perspective.

The raw materials of which there can be ten or more in various combinations and proportions are mixed together using a variety of methods and then extruded in to a variety of basic shapes. These shapes are then machined to customer requirements, the physical dimensions varying as well as the number, position and shape of holes, etc. Hence it can be seen that these various combinations of raw materials, methods of production and final physical form can produce so many specifications. Having said this, it is necessary to state that over fifteen years ago this particular company had accepted the concept of an industrial organisation as a socio-technical system in which for the technologies to be successful due account must be taken of all the employees and attention given to their physical and mental needs. Such an attitude on behalf of this company acknowledged the fact that if you change the method of production or the systems of production planning and control the organisation make-up of the company must be changed in line with the change in behavioural patterns.

Thus it would seem that the foundations for successful implementation of G.T. were formulated right at the very top of the company!

Only about one sixth of the turnover in this factory is produced in the G.T. Cells but this represents about 90% of the throughput. With such a heavy workload on these Cells a three-shift system is worked, with both male and female labour, the women not working on the night shift. The company performed a Job Evaluation exercise and this resulted in equal pay regardless of sex.

One of the shift managers, originally a foreman, when the company investigated the possibility of G.T., participated in the G.T. exercise and is very well briefed on its requirements. This man has become an enthusiastic advocate and one could well imagine that problems arising during his shift were very quickly solved and no doubt he was a very useful link in the chain of communication from the shop floor to the manufacturing management and vice versa. He also intimated that he was very well satisfied with the layout and found his work much more interesting and absorbing than previously. This attitude was in direct contrast to the second shift manager, who whilst not being too cynical appeared not to be very much in favour of G.T. and made a final admission that the 'company' had not done enough for the workers - by this he meant that either their rate of pay should have been increased or a larger bonus paid to them. It was not possible to discover why this should have coloured his own outlook.

Apparently the workers are paid an incentive depending on output, but because only a relatively small number of employees are actually employed in the G.T. Cells disparity over rates of pay arises with other sections employed in the plant.

After the initial setting up of the Cells, the output was considerably less than the planned output, and this was discovered to be due to a go-slow action on the part of the Cell workers, who could see that they were now more continuously employed, with very few stoppages for machine changes or re-adjustment, and this to them meant only one thing, greater output, but with the same take-home pay as before. To the management's credit this situation was soon rectified, and the bonus earnings increased, bringing them in line with the new situation. Of particular interest was the request received from the planning department, who now wanted to be more closely associated and identified with the G.T. Cells, and asked for their offices to be moved, from its position on the perimeter of the plant, to the middle of the plant. This seemed to be a genuine desire to co-operate and ensure maximum possible labour utilisation and prompt delivery to the customer. Ulterior motives cannot be suspected since this company works with material that can give rise to a very dangerous health hazard and, given the choice, most people would ask to be situated as far as possible from the area of risk.

The company has carried out detailed studies of a proposed organisation structure, where due account has been taken of the need for enriching the work of managers, and attention given to the relationships between various levels, spans of supervisory control and the ratio of managers and supervisors to operators.

Such proposals have not yet been fully implemented and it is therefore impossible to say whether they have had any serious effect on the running of the company's operations and thus to what extent they have improved or caused a deterioration in the Human Aspects.

GENERAL COMMENTS RELATING TO CASE STUDY No. 9

Generally from limited observations the work flowed smoothly in the various Cells with the work force busily engaged on their various tasks. Within the Cells there is a certain amount of flexibility but not versatility since many of the operations are almost identical, the flexibility arising from the requirement of the operators to move from a machine after the finish of one batch of components to another machine ready for the next batch of components within the family whilst the first machine is re-set, this flexibility going a long way to ensure continuity of work flow. On the other hand there were people whose main function was the supplying and despatching of material to and from the Cells and a free interchange of these duties was discernable.

One would have liked the opportunity to question the line operators regarding the work they were doing and it would have been interesting to compare the attitudes of workers on the two different shifts, each managed by different managers whose outlook on G.T. tended to be opposite. Many top managers look upon shop floor supervision as a vital link and pay close attention to their selection and training. In this particular instance, and at some later date. an alternative reason was postulated for the different attitudes of these two men. Could it be that each was in receipt of the same salary and conditions but their background, education and experience was the dominant factor accounting for the difference in outlook? Management apparently were also aware of these two distinct attitudes and it would seem that in such an important exercise engaged in by the company that one of these managers should have been moved sideways. It does indicate and emphasise the importance of such people when re-structuring for the implementation of G.T. and care should be taken with the initial selection and the need perhaps for monitoring their performance and some form of follow-up exercise where necessary.

As mentioned in the case study this company is among the foremost in the country as exponents of G.T. and as a consequence of this have shown their efforts and opened their factory to all and sundry. Do workers like being looked at like visitors to a zoo? Apparently the company enjoys good relations with the unions but it was in this plant that note-taking was forbidden on the shop floor. Were the workers rebelling against being used in some experiment with which they were not familiar? In Case Study No.1 the supervisors identified with the Cells were in many instances used to explain to visitors just what was happening in each Cell. Perhaps this is one aspect of worker participation overlooked by this company.

One final aspect worthy of note refers to the situation of this company. It is in a beautiful part of the English countryside, twenty miles or so from a very large industrial city and perhaps workers are more ready to accept, with little questioning, the conditions and the systems created for them by management. The alternatives can be very real-travelling to another town with increased costs and reduced leisure time; employment in another industry with subsequent reduction in pay; unemployment; or moving from the district. Such companies isolated in the countryside with little competition for labour seem to have a distinct advantage over those situated in an industrial complex.

CASE STUDY No. 10

The business of the company referred to in this study is the manufacture of a range of reciprocating, impeller type and centrifugal pumps used in the petro-chemical industries and plant where quantities of fluids are required to be displaced.

On the fact of it an ideal company for the full implementation of Group Technology and ideally situated to gain the most benefit particularly when it was realised that the total number of employees is about 600 and the average batch size is about three with the plant consisting of N.C. machines of various types as well as a full complement of conventional machine tools.

Alas, the situation was vastly different!

Apparently in 1967 the then-chairman was interested particularly after a BRISCH coding system had been introduced. For reasons best known to himself discussion on G.T. was at Board level only. In 1968 an attempt was made to introduce G.T. on to the shop floor. This met with very little success and the exercise was abandoned. It was not possible to discover the reason for this as the person supplying the information had only been in the employ of the company for the past year.

Recently there has been a change in the Board, with a new company chairman, and it would seem that the impetus for another look at G.T. is coming from the Chief Accountant of the company!

It would seem that the company has used the services of outside consultants who have produced information based upon fundamental routing of components and that the man giving this interview, probably his first industrial appointment had, during his undergraduate studies, been part of a team putting in a G.T. system in a firm located in the north of England. This man, the Production Controller, indicated that during his short period at the company considerable strides had been made. He has been to other plants and has given talks to others in the company, but not to shop floor workers, on the philosophy of Group Technology. It is his belief that in the next few years the company will adopt a complete G.T. approach but this will only be possible when the order book has been stabilised. (This apparently refers to the rate of new orders being balanced by the dispatch of orders.) Families of components have been compiled, machines selected for the various Cells, and the necessary rearrangements all been drawn out! But it is not the ideal time to consider G.T. Strangely for a company of this size the personnel department consists of one man and a girl, and as such would not be consulted if and when the company do decide to implement their G.T. plans. On the other hand the company consider that if and when they do implement G.T. the main problem areas will be in the field of human relations and that education and communication are vital in this area with the largest pay-off coming in the sphere of educating all levels of management as well as the work force. It is also considered that a natural spin-off from G.T. is the improvements brought about in the areas of job enrichment and job enlargement.

This firm also has only to contend with one union and enjoys good relations with this body and sees little difficulty in the area of flexibility or mobility.

Many of the workers in this company have been in its employ for a very long time and started when alternative employment was very scarce. Now things have changed somewhat, people are more mobile, and it is appreciated that if G.T. is not carefully introduced many of these workers might well leave and not therefore augur well for the success of the operation.

GENERAL COMMENTS RELATING TO CASE STUDY No. 10

Many reasons are given why a batch manufacturing system should change to the Cell system of manufacture. Almost as many reasons are given as to why an existing batch manufacturing situation should remain as it is.

And so with this company the reason offered was 'the stabilisation of the order book'.

Thus it would appear that the management of the company had either insufficient information on G.T. or did not appreciate the true relevance of G.T. as an alternative manufacturing system. One is also left doubting the authenticity of the experience of the Production Controller and in particular the competence of his studies whilst an undergraduate, particularly in the G.T. sphere.

If, as was stated, considerable and extensive studies had been performed in this area, then it is also in order to suppose that relevant studies had been made such that a comparison of the existing and proposed methods of production could be made and used as a powerful weapon to obtain the necessary consent for the change from the company at board level. No such commitment in this area was forthcoming! From this case study and other experiences relating to the gathering of information for this Thesis, the writer is becoming more and more convinced that the Department of Trade and Industry should form groups of people who are well versed in all aspects of Group Technology, not just the fundamental principles but experienced in the practical aspects. These groups of highly skilled personnel would move into industry and provide a service at minimum cost, surveying the company, make the necessary modifications, train all grades of personnel and leave when the system is functioning and achieving the necessary objectives. Then at intervals of time re-visit and monitor the system. Similar squads of people were formed during the last war and helped those industries that were experiencing a shortage of skilled labour.

The cost should not be very high but the pay-off considerable and probably a better investment than the Group Technology Centre at Blacknest. Furthermore the investment and benefits in this area would be measurable'.

CASE STUDY No. 11

This company employs approximately 750 engaged in the production of components used on Diesel engines ranging from the very smallest to those used for pumping stations, generation of electricity and the propulsion of the largest ships.

For the smaller types of engine the monthly requirement is somewhere between 20 - 25 000 per month of five or six regular types of product or about 6 000 of each type per month.

For the largest engine the requirement is about 100 per year. In between these two extremes the company caters for a variety of different sizes.

Analysis of the complete range of products revealed that size and demand falls into certain machine categories. In 1968 the factory was re-organised by component-type groupings, with two exceptions. Namely, automatic lathes were still grouped together except those identified with certain components and one machine section, comprising about 10 - 12% of the machines for producing what the company refer to as all the 'odds and ends'. This must be a fairly lucrative area since it comprises about 50 machines.

This rearrangement produced some 75% reduction in scrap with the machine setters being given responsibility for all the machines necessary for producing particular components.

The section producing the 'odds and ends' has been re-organised into a Cell formation and now comprises some six Cells with about eight machines in each Cell.

Initially the company consulted two well-known people from the academic field. This resulted in an M.Sc. student being involved in an analysis of the products when completed.

A computer-aided production schedule was also produced, this being used to call up a particular Cell, and this, coupled with a machine coding system, can also indicate a particular machine in a particular Cell. This information gives approximately equal loads in each Cell as well as steering components to the right Cell.

This exercise also resulted in the Production Engineering Department being provided with information indicating that in certain instances the wrong type of machine or capacity had been used in the past, and thus savings were being made in areas not previously considered.

Initiation for G.T. came from the Production Director and discussions were held with people on the shop floor and also with middle management. The Production Manager believes that it is better not to mention G.T. to a potential linear Cell worker as this can lead to confusion and frustration over management's intentions, but they were told about the forthcoming rearrangement and then later a formal meeting was held with the foremen who were to be involved. The Personnel Manager was also involved in the negotiations. Charts and diagrams were used to convey this information and department heads and section leaders visited organisations engaged in G.T. to study what had been done elsewhere.

The company received a fair amount of criticism from middle management and this tended to crystallise into an attitude where they questioned the advantages not being really worth the effort! Some workers asked, "What's in it for us?" and apparently were quite satisfied when told that it would mean better working conditions, improved job interest and the chance of earning more money than with the existing system.

Job Evaluation and Job Satisfaction were two areas concentrated on by management and this was in very great part responsible for an agreement with the shop floor for complete flexibility and that operators were quite willing to operate unfamiliar machines and be trained when this was thought necessary.

Difficulty was experienced with certain setters; not all were capable of setting the complete range of machines in the projected Cells and some were not even capable of being re-trained. This proved to be a major snag.

It was at this stage that the Director of Production and the Chief Production Engineer had opposing views; one wished to pursue G.T., the other abandon the project.

The problem was finally solved by laying out the Cells in such a way that those setters incapable of setting a variety of machines or incapable of being trained, would concentrate on those machines that they could set and that these machines would be placed in the Cells in such a way that they would be in close proximity to each other. In fairness to the company, mention should be made of the fact that these setters were fairly elderly and had given sterling service to the company in the past, and it was necessary to ensure continuity of employment until they retired, when this particular problem would disappear.

The Production Manager sees the difficulties of G.T. falling into three areas, and he categorises these as:

operator influenced;

setter influenced;

organisation influenced.

The Cell operator can now operate any one of eight machines and he sees that learning will improve his performance, the families he will be involved with have a smaller number of components and therefore this should lead to an improvement of operator influence.

The G.T. setter becomes familiar with the needs of the components families, Job Evaluation has secured for him an increase in pay and he becomes much more aware of the need to keep his finger on the quality of product.

Quantity is organisation influenced, and must provide the right machines and equipment, good production and planning services and adequate back-up services.

The method of payment in the Cells is a piece-work scheme based upon individual output. A Group Bonus Scheme was investigated; the resulting proposals were not looked upon very favourably by either the workers or the management group, and it has therefore been temporarily abandoned.

To date this company are well pleased with their G.T. efforts and admit quite readily that they have not been successful with all aspects as mentioned above. Monitoring of Cell performance has revealed that:

the total efficiency of the company has gone up, whereas previously a downward trend was detected;

piecework performance has improved;

labour lost hours has also improved;

reduction in the waiting time;

lead times improved;

job efficiency improved;

no change in the scrap position due to setter problems.

Unfortunately no figures were available to support these claims.

A positive spin-off from G.T. has been that it has focussed attention to particular sections and created a springboard for the Engineering

Department to study machines in the Cells and look for alternatives or ways of improving performance.

At the time of this visit the company had just acquired additional space on the factory site and was busily engaged in formulating plans to move the existing Cells to another area. Because of this the writer was able to study only one Cell in operation and it was noted that one worker in the Cell was moving from machine to machine with a small batch of components until completion.

It was also noted that some components were not completely machined in one Cell, because certain machines were not available, and therefore such components were required to be moved to other Cells for completion.

The company has a rolling five-year plan and based upon its present experience with G.T. intends to consider splitting many of the more regular types of product that are required in large numbers to form small manufacturing units. A small team will consider this and the Production Manager believes that there are good manufacturing reasons as well as sound financial reasons for doing this. This might mean destroying the present G.T. set-up, the odds-and-ends, then forming families of parts within a much larger grouping.

A joint production/consultative committee has already been established to consider the implications of these proposed changes. The company believes that one of the major changes in such a re-structuring will be to create a totally new environment and a re-think of control and payment systems and that it will then be possible to pay a group bonus based upon the output from each Cell.

GENERAL COMMENTS RELATING TO CASE STUDY No. 11

This company have successfully married mass production lines with G.T. and the writer could discover no animosity or dissention between those workers engaged in the two different environments.

Problems that have arisen have been largely on the human side and these have been successfully overcome and in the formulation of new policies relating to G.T. due account will be taken of the need to satisfy all levels of personnel involved.

Housekeeping in the plant was of a high standard and the environment was not at all depressing, the factory itself being situated on a small industrial estate.

Top management also gave the impression that future plans will have to include the re-structuring of the organisation. That what was suitable for present manufacturing policy will no longer be effective if the Cell system is to be extended. Planning and control must be more sensitive, lines of communication must be considerably shortened, and any conflict of interests, particularly in middle management, must be looked at very carefully.

Surprisingly, this company is a subsidiary of a very large organisation and yet there seems to be no overall company policy relating to G.T; unless it was at Board Level the Production Director was issued with the necessary instruction.

This would seem to be an instance where a small G.T. consultative group acting as a service department and reporting very high up in the organisation could co-ordinate the efforts of the several subsidiaries within the company and thus create a pool of knowledge and experience.

CASE STUDY No. 12

Outside consultants were used by this company to carry out a feasibility study and to give guidance to employees in the techniques and implementation of G.T.

Initiation for this came from the Manufacturing Director with the proviso that the objective was to be the production of 800 units of five different models per month.

The initial studies based upon component flow analysis resulted in the probable formation of 12 or 13 Cells.

In 1974 a pilot scheme consisting of two Cells was organised based upon a small quantity of parts that had a very long throughput time.

These two Cells ran for six to eight weeks and it was found that the throughput time was reduced. Difficulties were experienced with programming, probably due to changes in component design or components becoming obsolete. This resulted in difficulties with keeping the operators occupied in the Cell.

From this small beginning the company now has thirteen Cells operational, maintaining that the control of the Cells is the predominant feature, particularly with respect to having the correct tooling ready and waiting to accommodate different components in the family grouping, and in ensuring a smooth and continuous flow of work.

Every job in the machine shop has been graded, and it was thought that this might inhibit the movement of personnel. Operators are prepared to move if there is a reduction in the work load, the operators accepting that flexibility could be a necessary requirement of G.T.; any movement, however, would from their point of view mean a possible re-grading.

At the very beginning of G.T. the Production Manager set up a working party consisting of interested parties from Work Study, Planning, Personnel, etc.

A smaller team consisting of the foremen from each department was also instituted, this body of men still meeting at regular intervals, and they also have to produce a monthly report for the Production Engineering Manager relating to the operation and running of the various Cells (see note below).

The Production Manager also kept the unions fully informed of the company's intention and received a favourable response.

At all levels, a three-dimensional model was used for communicating the company's purpose and design in relation to G.T. and even at operator level, the talk from the production manager was followed by a question and answer session.

The company newspaper has also included articles relating to G.T. When the workers realised that G.T. was another management tool, they wanted to know what was in it for them. Reassurances that the existing method of payment would remain untouched were sufficient to allay any fears.

The company acknowledge that their greatest asset has been the full support and co-operation of top management and then qualified this by stating that all levels should be fully informed and that there was the danger of failure if insufficient information was imparted; and that in the Cells themselves foremen and key setters were the most important link in the chain, and could be the weakest link. Problems that have arisen have been mainly human ones, mainly centred around a lack of understanding of the full requirements of G.T. Technical problems seemed to be because of human defficiencies. The factory is well laid out with plenty of room between the machines and individual Cells, tools, jigs and fixtures and other ancillary equipment was kept, suitably covered and stored, in each Cell and the housekeeping was excellent.

Workers in some of the Cells have organised social events, an indication that these different groups of workers, brought together on the basis of their operating skills as machinists and with no other selection procedures, is as likely to produce an efficient coherent group as those selected by more elaborate methods!

From experience to date, the objectives and goals originally set have been achieved; the company feel that certain work, because of its intricate nature or for other reasons, will not be included in the cellular set-up and that all numerically controlled machine tools will be in a 'Cell' on their own, where the expertise and planning function for N.C. can be concentrated. With such wide gangways between the Cells this should not impede the flow of work very much, but will of course be contrary to G.T. principles. The company also intend to look at the possibility of extending G.T. into the assembly areas.

The following are unsolicited, unedited notes made during a meeting with the foremen engaged in the G.T. Cells at the plant referred to in Case Study No. 12.

Picked up G.T. from other foremen as he went along, circumstances have now changed.

All information not supplied to foremen.

G.T. 'suck it and see' situation.

Given a fairly free hand in the layout.

Foreman had previously a roving comission.

Foremen get more involved than previously, our job enlarged.

Role of foreman now requires more intimate knowledge of parts, machines and operators; he must also be technically qualified.

Operators far happier because they are more involved.

Operators have a say in what goes on; no problem with versatility.

Shop stewards love the situation.

Hold weekly meetings with shop stewards, reference to G.T. and everybody in Cell - an informal meeting.

Not enough information given to foremen, but channels of information kept open.

Use three-dimensional layouts.

Should have a group bonus scheme.

Inspectors still responsible to chief inspector, tending to do away with patrol inspection.

Request that training department should get involved with G.T.

Good idea to have a small booklet explaining G.T.

G.T. still in a state of development.

Job description and grading is important to operators, related to what they are expected to do.

Initially complete opposition to G.T. from unions and shop floor, overcome by lectures and consultation.

Foremen key figures in G.T. set-up.

Job satisfaction more important than take-home pay, but depends on foreman.

Reaction from operators not in Cells - What is going on! We want to do this.

GENERAL COMMENTS RELATING TO CASE STUDY No. 12

This company appeared to have tackled the problem of communicating their ideas and thoughts to all levels in the organisation in a thoroughly competent way and also took the necessary steps to ensure that communication was two-way. Of interest in this respect is the comment from the foremen who think that they are still given insufficient information; unfortunately it was not possible to establish exactly where there was a lack of information.

The company also had not thought it nedessary to modify its organisation structure. Again it is necessary to recall that it was thought the predominant feature in ensuring smooth running of the Cells was the embodiment of suitable controls relating to flow of material, toolings, etc.

As stated in the case study the original analysis for G.T. was based upon a throughput of 800 units per month. The recent decline in demand for the products of this company has reduced the throughput to something of the order of 400 units per month.

Just previous to the visit to this company many of its workforce, which totals some 4 000, had been on unofficial strike because of the short-time working, meaning for some workers a two or three-day working week. And a further reduction to 200 units per month was being mooted! This short-time working had posed particularly difficult problems to the Production Engineering Division which was almost totally organised on a G.T. basis; finding that certain components were in the process of being machined and in Cells that were not operational. This had repercussions all along the line, particularly in the sub-assembly and final assembly divisions.

Because of this situation, the Production Engineering Division were re-appraising the situation in an endeavour not only to keep the operating teams together, but also to overcome the above problem, and give a more complete technical capacity to the re-designed Cells, and it was thought that this re-structuring would produce much larger Cells composed of some twenty machine tools.

The uninhibited discussion with the foremen was particularly illuminating and one would have liked the opportunity for a more prolonged period with these men. It was felt at the time that, in the absence of a company official, they were being much more open and forthright with their comments and attitudes. In practice this is perhaps a function that could be successfully performed by a member of the personnel department.

Again this company was situated in a country district, with no other industries of any size or repute located within a radius of some 10 or 15 miles. Such a situation must have a direct bearing on company policy and procedures making it much easier for management to introduce changes, knowing full well that any opposition must be weakened by the fact that alternative employment is not just round the corner.

If such is the situation, then this company must be highly commended for the effort and lengths they went to, to put over to all concerned the re-structuring of production necessary for the satisfactory introduction and successful operation of Group Technology, and how such re-structuring would affect all levels within the company.

CASE STUDY No. 13

Part of a giant electronics group, this division of the company has been engaged in Group Technology for the past twelve years. It was introduced by the Chief Production Engineer who mooted the idea at a meeting with management representatives.

At the present time they have five Cells, four for machining components and one unit for assembly.

The Chief Production Engineer dislikes the term 'Cell', thinking that this might conjure up in the minds of his workers links with the penal system and the imposition of a system in which they would be considered purely as numbers, thus this company refers to its 'Production Units'.

Management consider that the operators in each production unit are part and parcel of the unit and all must work as a completely integrated team.

Each unit selects worker representatives to talk for it at the monthly meetings. At these meetings frank discussions take place relating to such things as the methods used and the reasons for not reaching the monthly production target figures.

Management also carry out activity studies within the units and the results of such studies are made known at these monthly meetings. Payment in the production units at present is based upon an individual piece-work system. The management want a situation where all the unit workers are paid the same. So far no moves have been made in this direction because the most difficult problem to overcome in paying all unit workers the same wage is that it can mean an increase for some and a decrease for others, and those most likely to face a decrease are the skilled workers. Management's last word on this problem was 'that whatever system or change in payment is made it must be accompanied by an increase in productivity'.

No problems have been encountered in the sphere of versatility or flexibility and the management believe that all a worker is interested in is his take-home pay and therefore no deliberate attention has been paid to job satisfaction or job enlargement.

In this plant the role of the production department is considered to be of vital importance and, related to G.T., any social problems arising in any of the production units is immediately passed to personnel. This is not deliberate, but appears to be company policy; matters arising in any department, which are the direct concern of another department, are immediately transferred to that department. No doubt it is felt that the best possible solution is most likely to emanate from those with specialised skills.

At this company it was not possible to see the production units in operation or to question other than the Chief Production Engineer.

GENERAL COMMENTS RELATING TO CASE STUDY No. 13

Probably at about the same time that this company considered G.T. the group of which it forms part received a considerable shake-up resulting in a rationalisation and the loss of some 68 000 jobs. Complete factories were closed down, sections closed or dispersed, and no doubt this affected the outlook of the management of those plants still remaining.

Whether this fact accounted for the reticence on the part of the Chief Production Engineer is questionable, but there was no reason not to believe that their efforts in Group Technology had been highly satisfactory or that their main problems had been of a technical nature and not human.

The company do produce a monthly newspaper, this covering the activities of the whole group, and it is the intention to use the newspaper to convey to personnel the general philosophy of G.T. and the efforts of this particular company.

They also believe that at some later date the training department can play an important part in G.T. activities.

Shortly after the completion of this study, the chairman of the group made an important announcement about his idea of worker participation and his declared intention that his company should take a big step forward in that direction. Finally saying 'The workers must be won to the cause of this country's prosperity, to the cause of strengthening its industry, its investment and its security. If they want liberty and a high standard of living, then we must all work together'. If this philosophy percolates down to local management and workers on the shop floor, what better place to start than in their production units, where the seed of worker participation has already been sown?

CASE STUDY No. 14

The following notes refer to a television programme in which several workers together with shop stewards from a company engaged in cellular manufacture were asked for their views on their experience of G.T. The notes have not been edited in any way and are included because they contain many facets relating to the thinking on the shop floor. The discussion seemed to be spontaneous with no prior priming.

Job satisfaction, four men use four different machines.

Men get more pay, improved job satisfaction.

Men enticed by increases in pay - basic and bonus.

Loyalty within Cell.

Workers move around to other Cells.

More pay, more variety.

For management - reduced stocks and work in progress.

G.T. caused only about 150 redundancies plus further ones which were really due to fall in order book.

Union's view that the first redundancies were due to G.T.

Caused problems for shop stewards, meetings with management - union view lack of consultation particularly with respect to redundancies.

Good involvement from beginning with large involvement by shop stewards.

Management sold it to workers, talked it over using three-dimensional models.

First problem to arouse interest of working people, then used the simple device of using models making deliberate mistakes such that workers suggested what was wrong and hence got workers involved, thus letting workers think that G.T. was their idea.

Production demands and requirements as well as future demand levels were made available to workers.

Workers decide what order they shall progress work.

Men therefore wee what work is available, and hence workers are more flexible and more associated with work on the shop floor; this leads to less militancy with a more reasonable attitude from workers to management problems.

For each Cell there seems to be a natural spokesman but he does not usurp the authority of the shop steward but makes contact with shop steward when necessary.

Supervisors find that they have responsibilities elsewhere since with G.T. workers assume more and more responsibility.

G.T. has improved attitude of workers to the company. Workers can talk to management, but all facets must be considered, workers are completely involved and therefore see the complete unit made.

Sickness and absenteeism tackled successfully by job enrichment.

British Industry not generally backward in job enrichment - this is a new tool for management.

Must get confidence in relationship between management and workers.

Communications, involvement, variety of work, etc., all involved with job enrichment.

Leadership is responsibility of management even on shop floor, need for joint consultation.

Efficiency equals survival.

Why do workers come to work, what do they expect? Workers demand change and the chance to participate.

Men require more identification with product to know just exactly what they do.

Meetings to involve workers more with their work.

Money not enough to motivate people.

Companies must be more competitive.

Social changes are overdue especially in factories where machines must be the guide.

Workers must relate to their work and to each other.

Workers interested in job satisfaction, need to change monotonous nature of much work.

Mutual arrangement for determining job performance.

Need to diagnose in depth the problems in industry and then get priorities in right order for solution.

Management must think ahead.

In development of future the personnel factor must be seriously considered.

Job enrichment can bring management and unions in position of looking at the job - right person for right job.

Look at what jobs machines can do, all methods must be quantifiable.

Job enrichment is not necessarily improved change in layout, should look at existing facilities first.

Too many people working together can lead to irritation among workers. What is the optimum number and in what areas should they work?

GENERAL COMMENTS RELATING TO CASE STUDY No. 14

One of the difficulties of recording such a programme by taking notes is the loss of continuity by missing certain parts and the inability to question the interviewees relative to particular remarks they have made.

From the programme the workers appeared to be quite happy with the cellular manufacturing methods introduced by this company, this in spite of the fact that it had meant the loss of employment for 150 of their colleagues.

The shop floor appreciated that communication and consultation are key factors in implementing G.T. but seemed to be vague as to the exact methods of communication apart from meetings. One would have liked information on who they thought should participate in these meetings from their side and also management's.

Some confusion seemed to exist relating to exact definitions of job satisfaction and job enrichment. It was interesting to note that they thought something additional to money was necessary to motivate people.

All in all this television programme should have evoked considerable interest from managers and workers in many other spheres. Whether the film of this programme is available for private showing is not known; if it isn't then it should be.

Of considerable interest would have been the views of upper and middle management and also the views from another company situated in a different part of the country with different reasons for going G.T.

CASE STUDY No. 15

This was an attempt by the author to obtain information relating to the Human Aspect of G.T. from companies in Holland. Three companies were visited, two in association with a member of the academic staff of Eindhoven University.

The first company, engaged mainly on sub-contract work, was producing among other things pneumatically-driven hand tools for a well-known company. Its attempt to introduce cellular manufacture had only just commenced, a student from the above University being engaged on an industrial-based project, as part of his academic studies, to produce families of components. A small machining Cell was partially in operation. The main difficulty being experienced was that posed by employing immigrant labour and the subsequent technical language problems. Because of this, the Works Manager thought that this would inhibit the introduction of G.T. particularly in those areas calling for versatility and flexibility of labour. He was also waiting information from the student before carrying out feasibility studies. Being a small privately owned company, with apparently a small number of links in the chain of communication, few problems were expected to be encountered should G.T. become a large part of the manufacturing effort. The only man on the shop floor who appeared to know what G.T. implied was the foreman of the experimental machining Cell.

The second company visited producing copying machines of several different types applied flexi-time working and all the machining area and assembly area was at a standstill because of this, having started very early in the morning, absenting themselves during the afternoons. This made it impossible to see the one Cell that the works manager claimed they had set up in operation. This Cell consisted of a number of lathes and adaptations for producing radial holes in a series of shafts differing only in physical length and diameter and disposition of the radial holes. It appeared to be the normal layout that a planning engineer would devise for producing such components and not G.T. Even an assurance from the Works Manager could not allay suspicion that here was another instance of confusing Group Working and Group Technology. An assembly line for assembling the finished machines was also given as an example of G.T. This was perhaps more in keeping with G.T. principles for it was easy to see that a variety of models could well be incorporated in the assembly line at the same time, each machine moving from assembly station to assembly station, where ultimately it rolled off the end as the finished product. Of particular interest here was the information imparted by the Works Manager that the proposals for this assembly Cell, as designed by the planning department, which included an estimate of the number of man hours for assembling each machine, this information was given to the workers who were to constitute this Cell, and they were given 48 hours to consider the layout. The result of this exercise was that the assembly workers came up with suggestions for modifications and alterations, that the management incorporated into the final layout resulting in a saving of some five or six man-hours.

Questioned about operator problems in G.T. manufacture an indication was given of the difficulty sometimes experienced by older workers to adapt to change. Company policy was instanced of the move sideways of such people until such time that alternative employment was found for them or they reached retiring age.

Apparently problems of communication, should they arise, would be met by a man-to-man confrontation.

The third company visited was engaged in the manufacture of water treatment plant. Product produced varied from relatively small impeller or centrifugal pumps, to large Archimedean-type screw displacement pumps perhaps two metres in diameter and eight or more metres in length, electric motors and complete instrumentation and control panels.

G.T. was not being applied to any group of products within the company's range. The General Manager of this company was extremely interested in applying G.T. to the small machined type of components particularly when it was emphasised that this could reduce the extent and quantity of holding stock for spare parts.

It is also probable that the company will investigate the application of group working, as practised in certain plants in Sweden for the manufacture and assembly of the very large installation which can measure some 20 metres in diameter by three metres in height. One interesting factor to emerge from this visit was that shop floor workers are not so highly organised as they are in the U.K. Works committees do exist as they did in this factory, and they considered similar things as they do in the U.K., but whether communications are better in Holland or they have a different concept and psychological outlook is difficult to establish. Industrial disputes they do have - these are few and far between - and little mention is made of these in the popular media. Social benefits equal those paid in this country, perhaps the calmer industrial atmosphere is the result of the high standard of living that the average Dutch worker enjoys. What all this must add up to is that the Management of Dutch enterprises are in an enviable position when compared with their U.K. counterparts when it comes to introducing changes such as G.T., remembering that G.T. affects everyone in one way or another in a company moving over to this form of manufacture.

CASE STUDY No. 16

This is a report of a conversation with an Amalgamated Union of Engineering Workers' official at their London Headquarters.

Since only a small number of organisations are involved in G.T. it does not pose any problems at the moment and therefore there is no official policy relating to Group Technology.

National Committee of the Union determines the overall policy on such matters. Again G.T. has never been an item on the agenda for discussion at such meetings and thus the Headquarters Staff have no information on the subject.

At the present time any problems connected with G.T. are raised at Branch meetings and thus would be left to local officials. All branches are apparently autonomous and thus have fairly wide powers to settle many problems on a local basis, and so long as workers do not suffer, Headquarters Officials are happy to leave things at local level.

If G.T. involved de-skilling then this would no doubt motivate Headquarters into action and then it is thought the Union would adopt the same attitude to G.T. as it did to the introduction of automation (see below).

The Union view is that since Group Technology invariably involves re-organising and rearranging production facilities, this is something that firms should do anyway, not only in the interests of their members but also in the wider context of more efficient production. The Union supports wholeheartedly efforts by industry to make itself more efficient.

An article was published some four or more years ago in the Union Journal relating to G.T. but was not very informative and did not provoke any verbal or written discussion.

The Union would probably welcome an article written by an authority on G.T. for publication in the Union Journal. Such an article it is believed might be the necessary stimulus for certain of their members to get their employers to look more closely at the possibilities of G.T.

AUTOMATION - THE A.U.E.W. POLICY -- probably the model for similar framework for G.T.

"This National Committee instructs the Executive Council to make a study of the extent, progress, economic and social implications of automation and to submit a report to a recalled meeting of this National Committee, for the purpose of formulating national policy on this issue and of inaugurating an educational publicity campaign amongst the membership.

Further, this National Committee requests Executive Council to secure from all District Committee Details of the introduction of all new methods of automation.

Meanwhile, this National Committee declares:-

1. No introduction of automation without previous consultation.
2. No redundancy arising from the introduction of automation; labour so displaced to be retained on pay-roll pending alternative work without loss of earnings.
3. The increased productivity resulting from these processes to be reflected in increased earnings and reduced hours without loss of pay.
4. Technical training in automation for all engineers.
5. We call on District Committees and Shop Stewards to insist on discussions with separate employers to ascertain plans and extent of

proposed introduction of automative methods in the various establishments.

6. Finally, we instruct Executive Council to seek discussions directly with the Engineering Employers' Federation, and other National undertakings; and to call for the establishment of a tripartite committee to control the introduction and scope of automation — such a committee to consist of representatives of the trade unions, the Employers and the Government."

CHAPTER SEVENTEEN

COMMON FACTORS ARISING FROM THE CASE STUDIES

17.1.1 COMMON FACTORS ARISING FROM THE CASE STUDIES

From an analysis of the case studies it is more than apparent that those companies that have embarked on a route leading to good communications and employee participation at all levels are the ones that have been most successful in achieving and realising the initial objectives for embarking on a Group Technology exercise. It is also in these companies that more of the fundamental concepts of G.T. have been applied, this being in no small way due to the aforesaid communication and consultation process. Three-dimensional models played a most important part in explaining the proposed layout and are obviously more than useful in providing tangible answers to queries, countering criticism, etc., than if only the spoken or written word is used. Many people can more easily identify with a three-dimensional model than a drawing. A key figure in the implementation is the chargehand, foreman or supervisor (Case Studies 1, 2, 3, 7, 8, 9, 12). If a company believes that worker participation and complete involvement is the essential ingredient for success then such people as foremen, chargehands, etc. are the ones most likely to achieve this, since in most instances they were shop floor workers themselves before promotion and are therefore better able to understand and identify attitudes and successfully influence these at shop floor level.

In the realms of middle and higher management the persuasion to G.T. commitment is in the hands of higher management, at times the Chief Company Executive (Case Study No. 1, 4).

Shop stewards can be a serious negative influence in any shop floor rearrangement (Case Study 2, 3); this, the author firmly believes, in many instances is due to 'bloody-mindedness' and a poor understanding of what G.T. implies rather than a profound interest in the well-being of his fellow workers. Many companies have found that the solution to this problem lies in establishing and then fostering good channels of communication with such people (Case Studies 1, 4, 12). This must be an extremely difficult task to accomplish when the calibre of the Union man is not very high or he refuses to co-operate.

From the case studies industry seems to be of two minds as to whether job satisfaction or job enlargement is an important issue. The evidence is conflicting. The temptation is to infer that because of the lack of, or poor management training, many managers have little appreciation of the factors that motivate people, believing that money is the only one. If the criterion for managerial success is on output then all of the managers interviewed during the gathering of information for this Thesis were successful, irrespective of their attention to the above two factors. What was noticed, however, was the dedication to G.T. because of enlargement to their jobs of people such as the chargehands in Case Study No.1 or Case Study No.2 and the foremen employed in the company that Case Study No.9 refers to. Surely all grades of personnel are more contented if they find job satisfaction and their ego is boosted if their job is enlarged to encompass more responsibility. Of course money is the prime motivating factor in all our lives, but it is wrong to forget or ignore the needs of the 'inner man' and managers do so to their cost.

A rather disturbing feature of the various case studies is the part that the Personnel Department plays - this varied in two instances (Case Studies 5, 8, 11) where there was considerable participation to nil participation in Case Studies 4, 6, 9. The Personnel Manager is part of the management team and it is completely wrong for line managers to assume that all Technological problems are of no concern to the Personnel Department. When these problems involve employees then they also involve the Personnel Department. It might well be that involvement by the Personnel Department in many cases will only be minimal, nevertheless he should participate if only to act on behalf of the employees that will be involved; making available his expertise of social and human problems and also indicating to the workpeople that someone is looking after their interests. In such instances there is much to be said for a Personnel Manager who is a fully qualified engineer.

Housekeeping is another matter that has received scant attention during re-organisation. As with job satisfaction a worker is more likely to give of his best if the environment is pleasant; good lighting, clean work places, good heating and ventilation, and under such circumstances would not refer to the factory where he works as a 'dump' and the attendant connotation of such a reference. Case Study No.8 and 12 are from companies that have paid attention to this important point, in one instance an old factory was considerably spruced up with pastel-coloured walls and machines and wide gangways all with adequate lighting. In the other a more modern building, wide gangways between machines, good order and cleanliness and other factors creating a pleasant working environment.

After limited experience with their present G.T. set-ups, some managers intimated that they would have to seriously look at the organisation structure. In particular was mentioned the various control systems, such as production control. One of the necessities of G.T. is to keep a smooth and continuous control system for a functional layout, which permitted batches of semi-finished parts to accumulate at various positions on the shop floor, is totally inadequate for a G.T. set-up. It is not sensitive enough. Also the lines of communication require shortening. These and others can only be effectively solved by altering the structure. Case No.3 indicates a step in this direction by latching on to each Cell a planning and tooling team. Case Study No.9 refers management's intentions in this direction, as does Case Study No.11. It is often said that the future prosperity of this country depends on adequate training of the youth of the country. In spite of this in not one company visited did the author find even the smallest attempt at interesting the training department in G.T. This seems to be a serious omission and an area that, given the right attention and atmosphere and if handled correctly, yield high dividends. Young minds are usually much more receptive to new ideas and practices and G.T. belongs to a new era of manufacturing activity.

CHAPTER EIGHTEEN

INDUSTRIAL RELATIONS

INDUSTRIAL RELATIONS

INTRODUCTION

In the final resort, the number of operators per group is a question of negotiation. What is acceptable will depend on the level of trust, or in other words on the state of labour relations existing in the organisation. The final choice in any factory, then, depends on negotiations (Bu/75).

The traditional consultative arrangements which exist in a firm should be used to their fullest to inform, educate, and dispel fear. The principles of Group Technology should be explained at this level, how it is likely to affect the firm, and particularly effects as it is possible to see them at this stage (Ga/73).

From the above two statements, and many others could be quoted, the successful introduction depends on negotiations, informing not only the workers on the shop floor but also middle and upper management.

Gallagher and Knight suggest that the traditional consultative arrangements already existing should be used. Many industries have excellent facilities for this and consult to the full all along the line.

Sad to say there are also many industries where the traditional consultative arrangements consist of the employees being told of alterations that will affect them, and this not until the very last minute, and with a nepotist attitude.

Also a most important fact overlooked by many is that consultation is part of communication and that communication is a two-way traffic, where management should be able to learn and gauge the mood and intent of those to whom information is being imparted. This is not possible unless the correct channels of communication exist or are made available.

One company that have set up good channels of communication is KL Foundries, Limited, Letchworth, Herts, and the author is indebted to this organisation for permission to include their procedural agreement, which they use as a channel of communication. It was through this procedure that the company's intention to introduce G.T. was conveyed to the shop floor (Case Study No.5). The company claim no copyright for the agreement, it has been used in its present form or as a basis for similar types of agreement to be drawn up by other organisations. KL Foundries Ltd. revise and modify it as and when the need arises and it is included in this Thesis for those who feel that a more formal type of arrangement based on the KL one would be beneficial in their own company.

18.1.1 DISSEMINATION OF INFORMATION AT VARIOUS LEVELS

All co-operative human activity takes place within a matrix of communication. Where two or more people work together, communication serves to unify their behaviour, and provides means for continuing co-operative activity. Communications is a fundamental process in all social groups and in all group behaviour (Ba/38). Communications are the basis of good human relationships, for they promote the unification of effort.

Communications can be likened to a river which at its source is nothing more than a trickle, proceeding on its way to the sea, being joined by other rivers, canals and tributaries each contributing to swell the quantity of water flowing, and whilst each if disrupted will not stop the flow of water only the quantity but collectively can cause havoc to all who use the water or the facilities that depend on water.

And so with communication, at the top it begins with person-to-person contacts, progressing to communication between one section and another, continuing to broaden out until it MUST reach every section, department, division throughout the whole enterprise. Like the river flowing it is necessary for information to flow smoothly and extend into each and every section. Unlike the river where it is not necessary to know at the source what happens to the water when it eventually reaches the sea, i.e. no feedback is required. In industry, the reverse is the case and it is very necessary for communication to be two-way, since the workers' viewpoint is just as important as the orders emanating from the top. 'In the field of industrial relations, as indeed in all walks of life, communications is one of our growth industries and the spread of use by industry of all forms of visual communication: newspapers, notice boards, wall posters, charts, etc., is very wide indeed.' There is perhaps a danger that the purpose of communications in industrial relations can be lost sight of in the growing volume so that they become and end in themselves, and it is very necessary to ask oneself constantly the question "What is the purpose of our communications and how far are they achieving this result?"

"For any business interested in the development of industrial partnership, a major purpose of communications should be to increase the active participation of all workers in the enterprise and an essential step in this must be consultation. Each system of communications must be tailored to the framework within which it has to be operated. In our own case the framework is of a business mainly in retail distribution with a turnover that will this year exceed £130 million, and which engages the efforts of over 19,000 workers who are all Partners. It includes department stores, supermarkets, factories, textile mills, farming, and a full range of occupations from computer programming and interior decorating to planting roses and growing barley. It covers all kinds of selling, clerical and manual work - skilled and unskilled, and the whole range of professional occupations. In a small business communications can be mainly by personal contact. In a large and scattered undertaking such as ours, which extends from Edinburgh to Paris, more elaborate machinery will be required, which will provide for two-way communication. A wide variety of methods must be used: personal, pictorial, the written and spoken word, committees and meetings. Facts must be not only freely disclosed, but fully explained. There must be a continuous study by management of the results of the communication. All these things the John Lewis Partnership has attempted to provide in a variety of ways." (Sir Bernard Miller, Chairman, John Lewis Partnership.)

The links in the chain of communication are all levels of the management team, from the foreman on the shop floor, through supervisors, departmental managers to the top executives, through these all information must pass. The executives' main task is that of looking ahead, of formulating policy, gauging the market conditions for tomorrow, but it is at the ends of the various chains of communication, i.e. on the shop floor, or a supervisor's desk that most of the policy is finally put into effect. Therefore the links in the chain of communication must be sound in all respects such that at each and every level the exact reasons for a course of action and the results to be expected can be explained. Communication must flow smoothly and readily. The structure of modern industry requires it to be departmentalised and specialist divisions formed, but it is incumbent upon those in positions of authority in such departments and divisions to communicate willingly and those who are unable or unwilling to communicate the necessary information must be educated in the correct uses of the means and channels of communication available. It must also be appreciated that everything that is likely to affect the lives of all or any of the personnel, no matter how slight is potential material for communication, but of especial concern is the dissemination of information relating to changes and the reasons for them. G.T. comes into this category. Imposed change almost always leads to resentment and conflict. What is required is co-operation, and this can only come about by adequate communication. With the establishment of two-way traffic in communication, a sense of co-operation is generated, each will appreciate the other's difficulties and a state of mutual understanding will arise. All employees will have the feeling of belonging to a team, a similar sort of atmosphere still prevails in the smaller privately-owned company; the company acts in unison and more enthusiastic efforts are made by all.

Finally, communication requires a constant and continuous effort, because this is the only means of indicating to employees that the company is seriously minded and genuinely wants to attain and retain the team spirit.

18.1.2 FORMS OF COMMUNICATION

Three forms of communication exist:

(i) Oral: This is the most common method of communication. It usually takes place where speed is essential or where it is necessary to obtain an instant reaction or where discussion is absolutely vital or where the written word would be too cumbersome or difficult to understand. The author knows of one organisation where the General Manager regularly goes on to the shop floor, gathers all the workers round him and then imparts to all. This way he maintains all get the same message, no-one can misconstrue what he has said, and he gets an immediate reaction.

(ii) Written: This is invariably used where there is some considerable distance between the person who wishes to communicate and the object of the communication. The written word is also necessary when it is required to preserve the communication as in the case of shop rules or standing orders or where it is necessary to communicate to others an oral discussion as in the case of minutes of Works Committees. Unlike the spoken word, which is 'lost' immediately it is uttered, the written word can be preserved and referred back to time and time again.

(iii) Gesticulation: This is a very limited form of communication and is really a part of Oral Communication because it involves face-to-face confrontation and is perhaps more the forte of the politician, the public orator, than an integral part of industrial communication.

WORKS COUNCILS OF WORKS COMMITTEES

During the author's attempt at assessing the 'human aspects of G.T.' and collating the information resulting in the reporting of the Case Studies, it became apparent that, whilst all companies visited did not have a formalised Works Committee as such, many used a similar means of conveying to the shop floor personnel the philosophy and principles of Group Technology. Because of this and the importance therefore of Works Committees a separate chapter (Chapter 19) has been included and also what could be considered a 'model works committee procedure' by courtesy of KL Foundries Ltd. (Chapter 20).

18.1.3 NOTICE BOARDS

These are absolutely vital to ensure if nothing else that the business conducted at Works Committee Meetings is passed down accurately and without distortion as might be the case if oral means of communication only was used.

Past practice has shown that notice boards are only effective if they are maintained in a tidy condition and some firms find that a time limit set for the display of information helps in this direction and ensures that the people for whom the notices are intended are more likely to look and read than if they are allowed to become cluttered with out-of-date information. Also to avoid the display of non-essential material must carry the stamp of authority, otherwise it will be removed.

Siting of the notice board is important and a favourite place seems to be adjacent to the 'clock'.

It was noticed that in some firms articles from the Technical Press were also displayed on notice boards and where these involved the firm, and included photographs of products and shop floor personnel, these were pointed out to the author indicating that more than a passing interest was taken by the workers in their notice board and the information displayed.

18.1.4 WORKS NEWSPAPER OR WORKS MAGAZINE

This is probably the best form of written communication especially when a good standard of journalism is involved and includes relevant photographs.

Invariably they contain a large amount of information relating to the company products, contracts signed, new products launched, distinguished visitors to the plant, etc. Much information is also printed relating to the personnel, much of this being in a light-hearted vein.

Most people are conceited and like to see photographs of themselves in print or their colleagues or some aspect of the firm with which they are familiar or involved with. Thus most Industrial Newspapers are liberally interspersed with such photographs and most workers eagerly scan each new edition for such identification. A skilful editor will play on this vain streak and within the pages of the newspaper in a suitable position place an article of a serious nature which contains information that the company wishes to transmit to all or some of its employees. This is a method which has been used to first introduce G.T. to the whole of the personnel.

It is difficult to assess the usefulness of conveying such information; there is little feedback and in the present economic climate such publications are being drastically curtailed if not completely stopped.

18.1.5 <u>DIRECT LETTER TO EMPLOYEE FROM COMPANY CHAIRMAN</u>

If a company was sure that all notices were being read and likewise with the Company Newspaper, by all its employees, further need for written communication would not be necessary. Unfortunately this is not the case, many workers never so much as cast more than a glance at the notice board and convey the company newspaper to the waste bin immediately on receipt of it.

In recent years certain companies have tried to overcome these failings by including a letter from the Company Chairman or Works Chairman in the pay packet. Believing that such a letter is more likely to be read than if it was merely displayed on a wall. Invariably such letters are only written as a last resort and often relate to economic difficulties due to labour disruption or unrest. Organised labour tends to regard such efforts of communication as an attempt by management to indoctrinate the workers and thus might do more harm than good.

The author knows of no instance when such method of communication has been used to further G.T.

18.1.6 INFORMAL TALKS

Invariably these only take place between say a line manager and his supervisors. In many organisations these become a weekly-held event and are a very useful link in the chain of communication. They could be a starting point in G.T. discussions between supervisors and workers on the shop floor.

One difficulty of extending such talks to shop floor personnel is that attendance from the shop floor will only be forthcoming if the meeting is held in company time, i.e. workers get paid for attendance. Also if the meeting is held in company time, then not only is the company paying the workers for attending, but is at the same time losing production.

This can be a delicate issue and one which must be carefully considered by management in all its aspects.

Mention must be made of the regular meetings with Cell workers in the firm that Case Study No.1 relates. These meetings are fairly informal, an agenda is issued, minutes taken and displayed on notice boards.

18.1.7 CHARTS, POSTERS, EXHIBITIONS, OPEN DAYS, FILMS

Charts and posters, if cleverly designed, can convey a very great deal to people on the shop floor; care must be exercised to ensure that the message to be conveyed does not belittle the workers' intelligence, and sometimes the humerous ones are more effective than those with plain work-a-day situations.

Exhibitions are always useful. Many companies think that these are for the benefit only to visitors to the plant and so mount quite elaborate displays in the entrance foyers of the company. Why not in the plant itself? Let the worker identify with the product he is involved in producing. Coupled with exhibitions are the three-dimensional models or replicas of machines and equipment. These can very easily be placed in a position of prominence such that all can see them (Case Study No.1). They give a much better picture to people who are not accustomed to reading drawings. Further they form a focal point for discussion and since the models are not permanently fixed can be moved around to illustrate various points such as a worker suggesting a different sighting for a machine and hence whether such a move would be an improvement.

Opening the plant to employees and their families is another important link in the chain of communication. This can be useful when the change to G.T. has been completed particularly if a worker can show his family that he can be called upon to operate any one of several machines in a Cell and that his activities are no longer confined to one machine. Films can also be used. These are particularly useful in presenting a before and after situation - care must be taken to ensure that they have a certain amount of professionalism or they can be looked upon as just good for a laugh!

18.1.8 SUGGESTION SCHEMES

It is suggested that these can provide another channel of communication and no doubt examples can be quoted of workers' ideas being lost or no credit given when a company does not have such a scheme. Since G.T. is new it could well pay dividends to encourage workers to come forward with ideas to improve the layout or method of operation. Case Study No.15 makes reference to a Dutch company passing management's ideas relating to a proposed re-organisation to the work people concerned, resulting in a saving of several hours in assembly of the product.

Before such a suggestions scheme is inaugurated it is important to show to all that genuine suggestions and ideas will be properly considered and therefore it is incumbent upon management to lay down policies and procedures thus ensuring to all that all ideas will be considered and suitable rewards made to those suggestions taken up by the company.

CHAPTER NINETEEN

FUNCTION OF WORKS COMMITTEES OR WORKS COUNCILS

FUNCTION OF WORKS COMMITTEES OR WORKS COUNCILS

Group Technology means changing the methods of production. In certain firms the change may only be minimal affecting a very small number of persons. This is particularly so when only a very small Cell has been formed or an experimental Cell instituted. In other instances, when a firm goes over 100% to G.T., the effect can be traumatic in certain spheres of operation, for example, on the shop floor and in, say, the sales department affecting policy only slightly.

What should be apparent is, what was suitable for pre-G.T. methods of production is no longer compatible.

G.T. means change in FOUR basic 'areas'.

19.1.1 CHANGE IN THE COMPANY STRUCTURE

G.T. speeds up production, throughput times are shorter, the variety of components in the shop floor can be very large, the situation is very much more fluid.

Therefore, for example, Production Planning and Control must be more sensitive, must operate within a smaller tolerance band. Lines and channels of communication must be shortened. Departments must merge, traditional ones might disappear and new ones created.

This is basically a task for upper management.

19.1.2 CHANGE IN PATTERN OF PRODUCTION

Families of components have been formed. Machines and equipment must be re-sited. What was once considered to be the correct method and machine for a component might no longer be the case. Adaptations to machines, composite tooling can mean that a component is now produced on the one machine where previously several were required.

This is basically a task for the G.T. team.

19.1.3 CHANGE IN THE INDIVIDUAL WORK PATTERN

The worker is now expected to be able to cope with a variety of skills. He is no longer a turner, or milling machine operator. He must be prepared to operate any machine in the new environment and, if lacking in skill, be prepared to accept training to acquire the additional skills.

This is basically an exercise to change attitudes.

19.1.4 CHANGE IN OCCUPATIONAL COMMITMENT

The worker now finds himself no longer working on his own; he still retains his individuality, but in the new environment finds himself a member of a group. His activities are now more co-ordinated and he must think and act in a collective spirit, be prepared to help a colleague, accept help and advice, live in fairly close harmony with the rest of the Cell workers.

This is basically an exercise to change attitudes.

Of these four areas it is acknowledged by many industrial leaders (Case Studies Nos. 4, 6, 8) that the last two are the most difficult and frustrating goals to achieve. Yet it is in these areas that the success or otherwise of G.T. is rooted and where the fruits are most beneficial not only to the company but also the workers.

The problem is 'how to change attitudes'.

A recent publication by the Advisory, Conciliation and Arbitration Service (July 1976) advises employers to provide relevant information as an essential ingredient to good industrial relations and successful negotiations.

Examples of information which could be 'relevant' were:

1. Earnings and hours analysed by work group, grade, plant, sex or departments;

2. Redundancy plans, changes in work methods and health matters;
3. Proposed organisational or technical changes, saving from increased productivity, sources of employers earnings, allocation of profits, and state of order book.

The A.C.A.S. places a responsibility on management to set up a policy on disclosure. It imposes no legal obligations on an employer to disclose specific items of information. Failure to observe it does not render them liable to proceedings.

A formal method of acquainting workers with the facts, future ideas, proposed plans and trying to influence attitudes is by joint consultation through Works Committees or Works Councils. Such committees have a further advantage in that they provide a 'two-way' channel of communication, with a feed-back from the shop floor. This is a very necessary part of the process for unless management are able to assess the employees' reactions to prosed changes etc. it becomes extremely difficult to formulate policies to change attitudes.

Another point often overlooked is that the constitution of such committees embraces both management and workers and therefore the information that is imparted spreads all through the organisation. The membership of such committees varies and no hard and fast rules apply (see Chapter 20). Workers' representatives are usually elected annually. Management representatives are invariably selected by the Chief Executive and these should never exceed the number of elected representatives.

It is also very necessary to have a written constitution containing such information as:

(a) number of members;

(b) frequency of meetings;

(c) times of meetings;

(d) subjects which may be discussed;

(e) methods for implementation of committee's recommendations.

The principal purpose of a works committee is to keep in being a recognised means of consultation between management and workers. It provides an opportunity for contact and co-operation between workers in the factory and their management on a representative basis, so that an understanding of the separate, yet common, problems of employees and managers can be achieved.

Invariably most committees concentrate on the human problems that arise in the factory, leaving the technology of the various processes to paid employees of the company.

Some Works Committees have written into their constitution the power to set up sub-committees to consider specific problems, reporting back to the main committee. One company informed the author that if and when they decide to seriously consider G.T. then this would be their method of approach.

Works Councils, it must be remembered, are only consultative committees. They have no executive power, they can nevertheless become a valuable method of communication in both directions provided men with the right attitude to co-operation, not a 'them and us' attitude, take part in their deliberations.

It is a useful management tool providing a means of keeping employees informed on matters that affect them and of getting their views on these and other matters.

CHAPTER TWENTY

INDUSTRIAL RELATIONS AT K.L. FOUNDRIES LTD.

PROCEDURAL AGREEMENT

For the Settlement of Disputes, Grievances, Disciplinary Incidents, and Other Matters Arising Concerned With

INDUSTRIAL RELATIONS

at

KL FOUNDRIES LTD., LETCHWORTH, HERTFORDSHIRE

20.1.1 INTRODUCTION

This is a freely negotiated voluntary agreement which the parties agreed hereto pledge themselves to honour, and it is not legally enforceable.

Our chief objective must be to clarify the role of Shop Stewards and Management and recognise the respective duties and responsibilities in achieving good industrial relations through which we may jointly achieve a high standard of productivity through improved relationships and sound machinery for the settlement of differences.

It will be understood that what is finally agreed can be further amended should the need arise by giving a month's notice of proposals, or terminated by either side giving one month's written notice.

20.1.2 PROCEDURE FOR AVOIDANCE OF DISPUTES

This procedure is designed to minimise the time between the alleged dispute arising and the settlement of that dispute.

(a) Matters concerning individual employees

(i) Matters concerning wages and working conditions as they affect an individual employee will be raised by that person initially with his foreman.

(ii) In the event of a matter so raised not being settled at stage (i), the individual may consult his shop steward. At the discretion of that shop steward, the individual and the shop steward may approach the foreman. The foreman may, if he so desires, refer the matter direct to his superintendent but, in any case, the foreman will inform his superintendent of the situation and the action taken.

(iii) If the matter is not satisfactorily resolved at stage (ii) then it will be referred to the Personnel Manager. The Personnel

Manager will arrange a meeting of all parties concerned, i.e. the individual, the shop steward, the foreman and/or superintendent. This meeting will be chaired by the Personnel Manager.

(iv) If the matter raised is not satisfactorily resolved at stage (iii) then it will become an item on the agenda of the next Works Committee meeting as the next stage of procedure (see Section 2c below).

(b) Matters concerning groups or sections of employees

(i) Any issue affecting groups or sections of employees are to be raised by the shop steward concerned with the appropriate foreman.

The foreman will then raise this matter with his superintendent or departmental head and the shop steward will then raise the matter with the Chairman of the shop stewards. A meeting will be arranged between the superintendent and the Chairman of shop stewards in the presence of the shop steward and the foreman, where the matter raised will be discussed.

(ii) If agreement cannot be reached at stage (i), then the Chairman of shop stewards will report the details on any such issue to the Personnel Manager who will record and date each item separately upon receipt.

The Personnel Manager shall then call a meeting with some or all of the parties involved, to discuss and endeavour to resolve the issue.

The Personnel Manager will report to the Works Committee each item recorded and the action eventually taken shall be recorded.

(iii) If agreement cannot be reached at stage (ii), then the issue will become an item on the agenda of the next stage of procedure (see Section 2(c) below).

(c) Domestic procedure

Our joint aim is always to settle our problems domestically as far as is humanly possible. It is therefore in our mutual interests to do our utmost to reach settlement without recourse to a 'Failure to Agree' which will then lead on to a Works Conference.

To facilitate this and give representation on the widest possible terms to all hourly rated employees, any issue not settled at Personnel Manager level, i.e. items 2a(iii) and 2b(ii) will be referred to the KL Foundries Ltd. Works Committee. The item will be discussed at the next meeting of the KL Foundries Ltd. Works Committee and as a result of the discussion, the issue will either have been settled or it will have been referred back for further domestic discussions at Personnel Manager level or, alternatively, a 'Failure to Agree' will have been recorded.

(d) Involvement of outside parties

When a 'Failure to Agree' has been recorded at the Works Committee, then the issue under dispute shall be referred by the parties to their respective Associations/Unions when a Works Conference at a date and time convenient to all parties will be arranged.

In the event of the issue under dispute failing to be resolved under item 2d, it may, by mutual agreement, be referred to arbitration. The result of such arbitration shall be binding on both parties; the arbitration panel shall consist of 1 (one) representative of Management, 1 (one) representative of the Union, and an independent Chairman.

The appointment of Chairman shall be by mutual consent.

(e) Avoidance of unconstitutional action

The procedure laid down in this negotiating procedure will be adhered to at all times, and there will be no departure from normal working until full negotiating procedure has been exhausted.

20.1.3 KL FOUNDRIES LTD. WORKS COMMITTEE

(a) This Committee shall be representative of the whole works and will meet at four-weekly intervals according to a fixed schedule, on the first Monday of each period. The meeting will be in the Conference Room.

Dates of meetings can be amended by mutual consent due to extraordinary circumstances: no less than one meeting will be called in any one month.

In the event of an emergency requiring a meeting of the Works Committee outside the scheduled dates, this can be arranged within 24 hours by the Personnel Manager.

A list showing the fixed schedule of meetings will be displayed throughout the works on the notice boards.

(b) Constitution

The Works Committee will consist of ex-officio, permanent, additional and co-opted members.

There will be two ex-officio members of the Committee; the Chairman and Secretary. The Chairman will be a Company Director or a Senior Member of Management and the Secretary will be the Personnel Manager of the Company.

The permanent members will consist of the Chief Works Study Engineer and the Chairman of Shop Stewards.

The additional members will consist of three representatives from Supervision and three from the Shop Floor.

The Supervisory members will be a Superintendent and two foremen who will be nominated by the Foremen's Association.

The three Shop Representatives will be nominated by the Company Shop Stewards' Committee in conjunction with the Shop Committee to represent the following areas:

(i) Moulding, Coremaking, Steel Plant;

(ii) Finishing, Fettling;

(iii) Works Engineering, Pattern Shop, Machine Shop.

These three representatives will be chosen to be as widely representative as possible of the hourly rated employees within the works. They will serve for a period of three months and at the end of their period of office they may be re-nominated by the Company Shop Stewards, if so desired.

In addition to the above members, the Committee may co-opt any individual who is specifically concerned or involved with any issue that is to be discussed. This individual can be a member of staff or an hourly rated employee.

(c) Agenda

Whilst the prime purpose of the Committee is to consider issues referred to from the earlier stages of the domestic procedure, outlined in Section 2, other matters may be brought forward for discussions. It is a condition on these matters that they have been progressed through the correct supervisory channels.

The agenda will also contain matters concerning wages and working conditions of common interest to the company as a whole which could be raised at departmental level.

Information concerning company policy will be given to the Committee for transmission back to their fellow workers, and matters of general interest between Management and Shop representatives will also be discussed.

The routine items for the agenda will be as follows:

1. Any items referred to the Committee from the domestic procedure.
2. Production review.
3. All internal agreements made since the last meeting.
4. Productivity information.
5. Recommendations to other Committees which are within their terms of reference to discuss, i.e. Safety and Welfare, Training, etc.

(e) Minutes

The Secretary of the Works Committee shall cause proper minutes to be kept of all meetings, copies of these minutes will be circulated to all the Directors, Departmental Heads, all Foremen and all Shop Stewards. Copies of these minutes will also be placed on the notice boards of the company. The Chairman of Shop Stewards shall receive a copy of the minutes for approval within 48 hours of a meeting; duly approved minutes to be issued within seven days.

20.1.4 TRADE UNION DUTIES OF SHOP REPRESENTATIVES

Shop Stewards and Shop Representatives leaving their work stations on Union business must first obtain permission from their Foremen.

All reasonable facilities will be afforded to Shop Stewards and/or Shop Representatives to carry out legitimate Trade Union duties.

Unless procedure is carried out, the Company will be unable to pay the 'Agreed pay for absence' as it will be considered that the person is absent from his place of work without permission.

20.1.5 DISMISSAL PROCEDURE

In the event of an employee committing a serious misconduct that in the opinion of his Supervisor warrants instant dismissal, the relevant Departmental Head shall discuss the offence with the appropriate Shop Steward prior to suspending such employee and immediately report all the facts in writing to the Personnal Manager.

An extraordinary Works Committee meeting will be called as quickly as possible, when all the parties concerned will consider the available evidence.

After detailed discussion of the valuable evidence, the Chairman of the Works Committee will convey the decision of the Company on this matter to the Committee.

Suspension of an employee will be without pay, although this decision can be changed if sufficient reason can be shown.

20.1.6 SUMMARY OF DOMESTIC PROCEDURE

1. Summary of domestic procedure for individual cases
   (a) Employee to Foreman.
   (b) Employee to Shop Steward.
   (c) Employee with Shop Steward to Foreman/Departmental Head.
   (d) Employee with Shop Steward to Foreman/Departmental Head/Personnel Manager.
   (e) KL Foundries Ltd. Works Committee.
   (f) Reference back to domestic discussion or 'Failure to Agree' and proceeding to Works Conference.

2. Summary of domestic procedure for groups and/or Sections
   (a) Shop Steward to Foreman.
   (b) Shop Steward with Chairman of Shop Stewards to Departmental Head or with Foreman.

(c) Shop Steward with Chairman of Shop Stewards to Departmental Head/Personnel Manager.

(d) KL Foundries Ltd. Works Committee.

(e) Reference back for domestic discussion or 'Failure to Agree' and proceeding to Works Conference.

3. <u>Timing</u>

To give the best climate for good industrial relations, it is essential that prompt attention is given to all domestic issues between Management and Work People. It is essential that delays, whether apparent or imaginary, are kept to the minimum.

In the early stages of this procedure, i.e. Stages 2(a) 1, 2 and 3 and 2(b) 1, 2 and 3, the aim must be to give an answer before the end of a shift. If this is not possible then the reason why must be stated and also it must be conveyed what additional time will be required. In many cases, detailed investigation is called for which, due to the circumstances at the time, cannot be carried out within a few hours, and this must be conveyed to the Shop Representatives concerned by the appropriate Supervisor when co-operation will be given.

20.1.7 **PROCEDURAL AGREEMENT**

For the Settlement of Disputes, Grievances, Disciplinary Incidents, and Other Matters Arising Concerned With

INDUSTRIAL RELATIONS

AT

KL FOUNDRIES LTD., LETCHWORTH, HERTFORDSHIRE

SIGNED ON BEHALF OF KL FOUNDRIES LIMITED LETCHWORTH, HERTS.	SIGNED ON BEHALF OF THE FOLLOWING TRADE UNIONS
Managing Director	Amalgamated Union of Engineering Workers (Foundry Section).
Production Director	Amalgamated Union of Engineering Workers (Engineering Section).
Personnel Manager	Amalgamated Society of Boilermakers, Shipwrights, Blacksmiths, and Structural Workers.
	Association of Patternmakers and Allied Craftsmen.
	Electrical, Electronic and Telecommunication - Plumbing Trade Union.
	General and Municipal Workers Union.
	Amalgamated Metalworkers Society.

On this day of

DATED ....

CHAPTER TWENTY-ONE

THE ROLE OF THE PERSONNEL DEPARTMENT AND PERSONNEL MANAGER

THE ROLE OF THE PERSONNEL DEPARTMENT AND PERSONNEL MANAGER

Several important stages occur in the growth of a company. Initially an owner of a small company can supervise all of the work of his employees directly. He is responsible for bringing in work, supervising all of the operations within the factory, costing and wage payments, despatching finished products and looking to the future. He also has first-hand acquaintance with all his employees. This state of affairs usually continues until the number of employees exceeds about thirty.

Continued growth in the company and the number of employees means that the owner manager can no longer attend satisfactorily to all of the above functions. He then delegates certain functions to particular employees.

This delegation continues with continued growth until such time as specialised departments are set up with the specific task of providing a service in a particular specialisation to the rest of the company.

One such department is the Personnel Department. This department is one of the most important departments, if not the most important department in the organisation.

It is responsible for the personnel policy of the company, the effects of which pervade every activity within the undertaking. Personnel policy cannot be confined to a single department as say with sales or research, since responsibility for getting things done through people is the characteristic of management activity. No longer does the owner have first-hand acquaintance of his employees, no longer does the employee approach the owner for an increase in pay, no longer does the owner approach the operators for a personal favour such as requiring him to work on a Saturday.

These are now the responsibility of the Personnel Department.

The personnel policy of a company is usually considered to embrace:

(i) Employment; sources of suitable labour of all types.

(ii) Hiring and firing.

(iii) Promotion plans.

(iv) Education and training of all grades.

(v) Establishment of joint consultation.

(vi) Negotiating procedures.

(vii) Redundancy plans.

(viii) Maintain all staff records.

(ix) To ensure Government regulations are put into operation.

(x) To provide suitable welfare facilities, deal and take precautions against accidents.

Strict attention to the above and other factors connected with personnel can result in a dilemma, that is, the conflict between the needs of the employee and the long-term interests of the company, and this is where the skill of the head of the personnel department, the Personnel Manager, is most important.

The control of the personnel department should be vested in a person who is well versed in human nature, who combines resolution with impartiality and fairness, and who, whilst being tactful and considerate, always acts in the best interests of his firm without causing offence. He must give emphasis to these qualities by his actions, thus encouraging his staff to act similarly.

Not less important is the need for him to be thoroughly familiar with the requirements of each grade of staff, and for this reason there is much to be said for the appointment of a Personnel Manager who is a fully-trained engineer.

21.1.1 THE TRAINING DEPARTMENT

Increasing public attention is being directed to the great need for vocational training and the continuance of education beyond the recognised school-leaving age.

The problem is by no means a new one.

In the engineering industry, provision has to be made for the recruitment of thousands of apprentices every year, who are to be trained as craftsmen or technicians.

In turn all must be encouraged to take advantage of the facilities available at technical colleges, polytechnics and universities to obtain competence in selected areas as will enable industry to fill the increasing requirements of technologists, technicians and others who are necessary to plan and carry out work and tasks that modern technology and developments demand.

Training is usually a sub-section of the personnel department and training is usually necessary following selection, transfer or promotion, and organised training enables a person to gain a specific skill, whether mental or manipulative, both speedily and easily.

Many companies have extremely good training schools; some of these have been established for a very long time, others the direct result of a recent Act of Parliament setting up the various Industrial Training Boards and a payroll levy to pay for the running of such schemes. Many companies have also a full-time training officer.

Training generally falls into three categories:

(i) APPRENTICESHIP - long-term training to develop a high level of skill.

(ii) OPERATIVE TRAINING - short-term training to raise the level of skill of the operative.

(iii) MANAGEMENT TRAINING - to fit people for managerial posts at all levels.

Usually an apprentice spends the first twelve months in the training school, where the curriculum includes various aspects of machining, fitting, drawing, welding, etc. Later periods of his time are devoted to the development of a project in which he submits a design of a proposed article, draws it, then manufactures and tests the final result. Other periods are spent in the various sections and departments working alongside skilled craftsmen or technicians. Operator training can also be carried out in the training school. Invariably this type of training is concentrated on the need to build up to a normal operational speed. For instance, a capstan lathe operator who is required to be trained as a milling machine operator would be initially given simple tasks to perform on a milling machine gradually building up to quality of production and then move on to more complicated tasks, again building up his operational speed and quality. During these training periods frequent checks should ensure that he does not develop bad habits of working in an attempt to build up to normal operating speed. Management training follows many different paths depending on the starting point of each trainee. For instance, a shop floor foreman would require a different programme to a deputy manager.

For a foreman he might receive training in the following:

(a) Job methods - for improvement of working methods.

(b) Job relations - for guidance on human relations.

(c) Job safety - to develop a safety awareness.

Since management involves responsibility for the economic use of resources and includes the direction of the work of other people, it is necessary to provide training in a wide variety of activities and these could include:

(a) the talent of each person;

(b) job knowledge to improve competence in work;

(c) a mature outlook so that the manager is broad and worldly in his dealings with other people.

CHAPTER TWENTY-TWO

THE TNO APPROACH TO GROUP TECHNOLOGY IN THE NETHERLANDS

THE TNO APPROACH TO GROUP TECHNOLOGY IN THE NETHERLANDS

TNO stands for the Organisation for Applied Scientific Research. It consists of various institutes dealing with a very wide scope of subjects.

The Metal Research Institute is divided into several departments, one of them being the "Centrum voor Metaalbewerking" (Technical Centre for Metalworking).

This institute, in turn, consists of three main groups, dealing with cutting operations, metal-forming operations and production control respectively.

TNO MICLASS INSTALLATION PROGRAMME FOR GROUP TECHNOLOGY

1. Survey

   (a) Introduction of T.N.O. and the components classification idea.

   (b) Interviews with management and staff about each individual and the general goal to be reached with a component classification system.

   (c) Making a case study classification.

   (d) Presenting to management and staff the possibilities of a components classification system in their company.

2. Preparations

   (a) Installing a steering committee.

   (b) Deciding who is going to take part in a classification training course.

   The general idea is that everybody who is involved in the process of designing and making the drawings, the production planning and the manufacturing shall take part.

   For the employees of the designing and drawing office the first two days of the course will be sufficient.

   The production-planners, manufacturing people and preferably also the bureau of standards and the scheduling people should take part in the whole five-day course.

In case there is an organisation and planning department they should also follow the whole course.

(c) Preparations for the classification course:

(i) number of groups (max 20 participants and well mixed);

(ii) date and time;

(iii) premises.

(d) Deliberations about the way the classification system shall be implemented and used.

T.N.O. prefers for a general implementation that the easiest way (and less costly) is to fix a date from which every drawing that leaves the drawing-office or that is being worked in and leaves the production planning department has to be coded (classified) and a copy has to be filed that way (or stored in a computer file through time-sharing). Generally speaking it may be expected that at least 70% of all current parts are then coded after a year with a minimum of effort.

Of course, if this implementation is part of a bigger re-organisation and efficiency plan and special goals have to be reached it can be done by pre-selecting from the parts collection which then are to be coded to make more or less homogeneous families for work-cells, data-banks, etc. This, however, asks for extra effort and manpower.

3. <u>Classification course</u>

The handbooks used and handed to the company concerned are copyrighted by T.N.O.

The information, however, is confidential and the user has to sign for receiving the handbooks.

4. Assistance with implementation

(a) Concerning problems with classifying.

(b) Concerning drawing conclusions

(i) families

(ii) standardisation.

(c) Concerning application in the production planning for instance:

(i) work cells;

(ii) data banks.

(d) Concerning application in the investment plan.

5. Reporting Progress

(a) Monthly reporting in steering committee.

(b) Monthly reporting to all concerned.

6. Closing of the implementation

(a) Conclusive report about:

(i) the results obtained and the costs involved;

(ii) the work still to be done by the company employees;

(iii) suggestions about periodical checks by T.N.O.

(b) Concluding meeting with steering committee.

CHAPTER TWENTY-THREE

P.E.R.A. METHOD FOR IMPLEMENTING GROUP TECHNOLOGY

P.E.R.A. METHOD FOR IMPLEMENTING G.T.

'The implementation of the group system involves a sustained production engineering planning effort and the acceptance of substantial departures from traditional operating methods.'

1. Least information that management must have in order to come to a decision about applying grouping in their manufacturing situation.
   (a) The overall scope for grouping in relation to the company's manufacturing activity.
   (b) The estimated tangible benefits of grouping within the company.
   (c) A plan of implementation giving preferred order for the introduction of family groups and estimates of time and resource.
   (d) The approximate identity and number of viable family groups contained in the workmix.

2. Converting to Group Technology.

   This involves two broad phases of activity:
   (i) an overall planning phase and
   (ii) an implementation phase.

   The steps involved in overall planning for group technology are:
   (1) Analyse the component spectrum in terms of criteria relevant to group technology planning.
   (2) Nominate provisional component families and machine groups.
   (3) Investigate machine hour loads and assign machines to Cells.
   (4) Investigate the scope for creating tooling families within Cells.
   (5) Specify the parameters of group technology families and Cell membership.
   (6) Determine the changes in production programming and ordering required to take advantage of planned shorter throughput times.
   (7) Estimate the benefits and costs to the company of group technology.
   (8) Produce a plan for the phased implementation of group technology in the company.

Completion of the overall planning phase at an early stage is needed to establish the scope for grouping and to satisfy company management that a sustained development towards group technology is justified.

FURTHER WORK

At the completion of the group flow analysis there should be no reasonable doubt about the general composition of viable component families and the eventual layout of the machine shop. Thus the analysis will have brought the company to the following point in its development towards group technology:

(i) The scope for group technology in the company will be known.

(ii) Good estimates of the tangible benefits to be expected from the implementation of group technology will have been produced.

(iii) The planning information needed for a phased implementation of grouping will be available.

Further work will be concerned with determining the balance and layout of machines in the groups, the possibilities for creating tooling families within a machine group, and how the groups should be manned and operated (Le/73).

CHAPTER TWENTY-FOUR

IDEALISED METHOD FOR INTRODUCING AND IMPLEMENTING GROUP TECHNOLOGY

IDEALISED METHOD FOR INTRODUCING AND IMPLEMENTING G.T.

FOREWORD

One of the interesting, some would say fascinating, others frustrating, things about British industry is that no two organisations are alike in every respect, even though they may be producing exactly the same things and employing the same number of people. This fact has been highlighted time and time again when seeking material for this Thesis.

Certain organisations appeared to be well structured, others, even though part of the same group, had a totally different structure. These differences are of course a result of the pattern of growth and development. They reflect very much the attitude of the various managements. Also, it is the author's belief that the British character, even on such a small island, varies considerably from area to area affecting attitudes, ideology and idiosyncracies. The factory location and the general industrial experience of the community as a whole are other contributing factors.

Such things as the above mean that the following chapter, whilst only a suggested idealised method, assumes a situation in a well structured industry in which the responsibilities have been defined and delegated and have the necessary authority.

Readers, no doubt, in reading this chapter will relate it to their own industry or experience with industry and find little agreement with this idealised method.

Nevertheless, it is the author's belief that it contains the essential 'spine' for any company wishing to explore the possibility of G.T. in their own circumstances and would if followed lead to better, more efficient G.T. systems than those which have been implemented with less formal or non-existent guidelines. At all stages emphasis and prominence must be given to the human aspects.

IDEALISED METHOD

1. Establishment of the reasons for wishing to change to G.T. This will be from top, middle management or even shop floor.
2. Establishing a small group to report on the feasibility. Initially under direction of General Manager. Group to consist of Chief Planning Engineer, Works Manager, Chief Production Engineer.
3. Report to General Manager. Report to include type of approach, i.e. experimental Cell or complete system; reduce lines of communications; need for change in company structure; information from other companies; financial considerations; time scale.
4. If report is favourable the next step would be to organise the communications system.

    (i) Report to Works Committee.

    Initially this could be a statement from the General Manager outlining what G.T. is and the reasons for its particular application to the company. Care must be exercised in indicating the overall benefits to all employees, i.e. economic reasons, facing challenge from competitors especially from countries where product can be produced at lower cost; improved delivery thus enhancing standing of company in market; better working environment; more worker involvement; co-partnership, etc. Statement concluded by reference for the need for adequate consultation with every sector of the plant and brief details as to how this will be achieved.

    An indication of the time scale should be given.

    (ii) More elaborate statement could include a pamphlet containing a statement of the above and including an example using some of the existing products.

5. Setting up of overall G.T. control group. The terms of reference should

be clearly defined. This team should be small, under the direction of the Works Manager, and include among others the Chief Planning Engineer and Chief Production Engineer. Its main efforts should be seen as one of co-ordinating the work of all departments. It is necessary for this group to produce a time scale for completion of the various activities.

6. Formation of smaller teams within each department. Each team charged with specific tasks, e.g. component classification for D.O. team; families of components for the Planning Department; Cell formation, Engineering; methods of pay and bonus system for the Finance or Costing Department, etc.
7. Production of models of the proposed new G.T. layout. Preferably three-dimensional, failing that, suitable templates.
8. Shop floor involvement. To convey and emphasise the importance of G.T. the Works Manager needs to play an initially prominent part. Need to start formulation of teams of Cell workers; to involve the shop steward and personnel department and ensure that a freely available system of two-way communication is established. The first discussion in conjunction with plan or model of proposed G.T. set-up. The idea of a financial payment system based on output from Cells could be introduced. (Instances have been noted of initial savings not being maintained because of lack of financial incentive.) Emphasis on re-training for those who would be required to learn additional skills.
9. Organise peripheral activites such as the Inspection and Quality Control procedures to service each Cell. Stores and need for getting material quickly to Cells. If G.T. is to be implemented in assembly departments then the re-organisation should have proceeded at same pace as for the manufacturing areas. If this is not the case then at this stage the assembly area requires to be considered.

10. Consider requirements of Cells with reference to new acquisitions, additional tooling, provision of additional services, also the storage of tools and other facilities either within the Cells or in close proximity.

11. Convey the importance of his job to the supervisor, his job will now be different, considerably enlarged. Let him see what has happened elsewhere. Seek his advice on the selection of natural leaders in each Cell.

12. Carry out simulation exercise involving scheduling, planning, tooling, etc. to ensure that the proposed system is compatible with objectives initially set.

13. Modify in light of simulation exercise.

14. Meeting of heads of different departments under chairmanship of General Manager. Main purpose to ensure that all departments are in sympathy and act in concord; also to produce a detailed network chart and fix a final timetable.

15. Final communication to all the different sections requesting final comments and suggestions relating to any aspect of the re-organisation.

16. Discussion by heads of departments of information coming from (15).

17. Communication to all personnel informing them when change is scheduled to start. More detailed information to departments such as Engineering, Scheduling, Planning, etc.

    Proviso that as far as possible normal production procedures must continue and many people will have to act a dual role during the change to G.T.

18. Monitoring of the new system.

19. Consideration of defects and whether the original objective has been realised.

20. Meeting with Cell workers to obtain a feed-back of information.

21. Stabilisation date after which no further modifications will be considered.

22. Progress report circulated to all personnel.

23. Appraisal of the G.T. system after full twelve month's working.

24. Involvement of training department.

25. Consideration of complete formation of factories-within-a-factory giving much more control to the Cell workers. Possible formation of small management teams for each Cell composed of 'shop steward' as permanent member, two operators (for a fixed period), cell supervisor and chaired by a member of management. (This would be a move toward Industrial Democracy.)

26. Necessity to pay heed to the fact that whilst adequate consultation is vital, meetings do cost money and this is particularly so when line workers are involved. It is incumbent on managers to ensure that such meetings are conducted in an orderly and efficient fashion and although it is not necessary to minute each and every meeting the results should be distributed to all employees particularly when contentious matters are discussed.

CHAPTER TWENTY-FIVE

DISCUSSION

DISCUSSION

The work contained in this Thesis has been directed toward the gathering and analysing of information relating to the human aspects of applying group technology and noting any changes in management structure as a direct result of the implementation of G.T.

This work could not have been completed before since many of the organisations, in the early days of G.T., ventured very warily and were much more concerned with the technology and the apparent benefits as measured by increased output, reduced stock, etc., and not with the personnel involved. Neither did they realise that, if G.T. meant increased output, reduced stocks, reduced throughput time, then management structures would need changing to streamline them to be able to cope with a new situation, be more flexible, and more sensitive particularly to control, thus ensuring a freer and continuous movement of work through the various G.T. Cells, work centres, or flowlines and not the rather erratic movement pre G.T. implementation.

Now with many of the engineering companies visited having had several years experience of operating along Group Technology lines it was conceivable that a considerable variety of knowledge and experience existed and that this should be collated and presented for the benefit of future companies contemplating exploring the possibilities of changing from conventional batch production methods to group technology.

During the gathering of information for the various case studies it was impossible to isolate the human problems and facets of production from the actual operations and processes and in many instances it was necessary to understand the process and what was going on before looking at the personnel involved. This, the author found, was a useful adjunct, since he is a trained Production Engineer, and this understanding of the technology goes some way in countering the criticism made by some industrialists that academics see things through rose-tinted spectacles where everything fits perfectly or can be expressed in simple numbers and never includes any of the everyday worry and strife or the 'nitty-gritty' or running a manufacturing organisation.

Probably the most important element resulting from this work was the answer given time and time again to the following question: "What do you consider to have been the main problems, human or technical?" Answers varied from a bland statement such as "Human - machines don't answer back" to "Technical problems because of human deficiencies'. Few thought that technical problems were pre-eminent. Having made such statements no clear or decisive answers were offered for their solution. The General Manager referred to in Case Study No.4 was pondering this problem very carefully. The type of product and degree of skill of his workforce will probably be strong influencing factors for successful implementation if and when his company decide to re-organise. Other companies had had mediocre or nil success in producing a satisfactory solution to such problems. Case Study No.2 highlights the difficulties and the negative results. Other case studies indicate varying degrees of success.

At this stage one cannot but help question not necessarily the quality of British Management, but more its selection and subsequent training.

Some firms employ Management Selection Agencies for the initial selection. The methods such organisations employ vary only slightly and are usually based upon initial selection from curriculum vitae followed by a series of interviews by various people, the final choice, from a short list of about three being left to the employing company.

Where such organisations are not used, the company itself will perform the necessary functions and invariably existing company employees are among those considered for the vacant position. Such methods are not without their successes. Of course it is always argued that the unsuccessful manager is soon found out, and either leaves or is dismissed. The number of times this happens must be very small and what is overlooked is the power that a manager has, not only in covering up his own deficiencies, but also ensuring that others shoulder such deficiencies.

Whatever method is used for management selection or promotion, the law of averages and human falliability will produce failures at infrequent intervals. An important omission is the need for management training or re-training. Many companies adopt the attitude that little if any benefits accrue from management training schemes. Many managers adopt the attitude that they know it all, and that their job is to run the company, and since its profits are satisfactory, management must be doing a good job, and in any case what would happen if they were sent on such a training course? Analysis of a manager's job would probably indicate that he only spends about 5% of his time dealing with the 'product' - his other tasks are involved almost exclusively in either dealing with people or arranging other people's work. It is in these areas of dealing with people, of directing the work of others, that management skills appear to be lacking in a great many instances. With group technology we have considerable change taking place, not great changes to the technologies of producing the product, but in the ways that all levels of people will fit into the new rearrangements. Not surprisingly the problems of G.T. are mainly human centred. Surprising is the inadequate attention that appears to be given by management to management to overcome this problem. Laurens van den Muyzenburg, writing in 'Management Today', February 1975, states: "Surprisingly, it is easier to make or install productivity gains in a high-productivity company rather than a low-productivity one. This is because high-productivity companies are on the lookout for improvements and more skilful in installing them - it is in their blood. Low-productivity companies resist change." This surely reinforces the argument for management training or re-training.

From the investigations the author comes to the conclusion that management are not using all the resources and help that should be available to them. The particular area is that of personnel management. Time and time again the Personnel Department was either ignored completely or relegated to a minor role in any G.T. implementation plan. Where it had been involved, as in Case Studies Nos. 5 and 12, the results in human harmony were detectable both in the managerial and shop floor areas and no doubt because of this productivity must have been approaching the calculated.

Wherever one person works for another, there are 'personnel management' considerations - pay, working conditions, shop and office rules, departmental relationships, and all the remifications of exchanging human effort for reward.

The task of using human assets and resources effectively is an integral part of the total management job. This fact must make the personnel manager a key participant in all phases of management thought and activity. Further no manager can neglect or delegate his responsibilities for the people on whom he depends to achieve his goals. The personnel manager does not relieve his colleagues of their responsibility for people, on the contrary his job in large measure is to stress and support the line manager's need to give priority to this part of his work.

Over the past few years a great many people in the engineering industry have got to know what G.T. means, what perhaps has not been emphasised is that for maximum success it should be a team effort. It is completely wrong for the line manager to state that personnel were not consulted, and that it is just a service for recording national agreements, attending to employee welfare, keeping employee records, etc. In just the same way it it wrong for the personnel manager to state that what happens on the shop floor or in any other department concerned with the technology of the product or running of the department is that department's responsibility and therefore does not come within the scope of personnel management.

This again emphasises the need not only for training or re-training line managers but also staff managers.

Perhaps line managers have been disappointed with the quality of personnel managers. Organisations have in the past and some still do, offer top personnel jobs to retired forces personnel in the mistaken belief that because such individuals have risen high in the service ranks, that such experience of commanding an army unit, or piloting an aeroplane or commanding a ship is good training and a pre-requisite for personnel management in a totally different environment. Alternatively they may have been disillusioned with graduates from Social Science Faculties of Universities who have seen their future careers in personnel where they will be able to use their influence, indulge in fantasy, to improve the lot of the under-dog, with little thought for productivity which is an input/output relationship with comparison possibilities. In such instances one can only sympathise with a line manager, understand his attitude to personnel, but in no way condone leaving matters as they are.

Training is an adjunct of personnel. During the investigations no evidence was forthcoming to indicate that instructions had been given to the training department or its officers to lay the foundations for the basic principles of Group Technology with either apprentices or any other form of training, such as the training of foremen. The stock answer was that training of apprentices was very much in the hands of the I.E.T.B. and nothing could be done about it. Similarly, foremanship training was not practised in the company or, if it was, no request had been made for it to include any reference to G.T. Most considered that it was perhaps worth investigation! Another reason for including the personnel manager in any G.T. plans.

The Chief Planning Engineer Case Study No.3 has been able to sonsolidate his own company's G.T. exercise by lecturing at the local Technical College, to a class mainly consisting of the same company employees. Such a situation must be unique and the opportunity to do likewise in other parts of the country are probably non-existent. Certain Universities, Polytechnics and Technical Colleges are certainly writing into their various syllabi Group Technology and its connotations. Unfortunately this will still mean that knowledge of G.T. will still be spread fairly thinly. This then is another avenue that the Personnel Manager should explore, more so at the present time now that the newly-established Technician Education Council is busily engaged in drafting schemes of work and considering requests from among other industry, for items that should be included in Technician Studies.

Another facet of the investigations that came out load and clear, time after time, was that those companies with a good communications system and means of ensuring that decisions taken were conveyed as quickly as possible to all concerned and the decision implemented as quickly as possible, where those firms having a much greater success with G.T. compared to those with poor communications. As has already been stated in Chapter 18, communications can take a variety of forms - all should be explored. One particular form of communication particularly relevant to G.T. cellular methods is that of consultation with all the workers from a Cell (Case Studies No. 1, 7). Such meetings initially might have to be at say monthly intervals, thereafter twice a year would seem to be adequate providing other means of communication were made available during the interim periods. In Group Technology talk is of Families of Components, why not make this all embracing and include the Cell workers - operators; setters; inspector; chargehand; foreman - everyone connected with the Cell? The sense and feeling of belonging, pride in belonging, of being considered does a great deal to one's ego, more so if what one belongs to is successful, and what better way to have a hand in that success than by being consulted and listened to.

This also accords with the present mood for 'Worker Participation'. What better place to start than on the shop floor? What better place to start than a G.T. Cell to ensure warmth and understanding, to re-kindle the old with-it-togetherness but without the forelock tugging. Not in the paternalistic way but in the way of partnership; surely the right starting place such that all have pride in the enterprise. If one could be sure of 100% success in this area of worker participation then all other problems would pale into insignificance. Such efforts if fruitful could be expanded to include such things as:

(i) Earnings and hours analysed by work group, grade, plant, sex or departments;

(ii) Redundancy plans, changes in work methods, health matters;

(iii) Organisational or technical changes, savings from increased productivity;

(iv) Allocation of profits, state of order book.

Another area of confusion was that related to method of payment.

Certain companies had carried out a Job Evaluation exercise. This followed the conventional pattern, with agreement by all the parties concerned, Case Studies Nos. 1, 2, 11. Then with two exceptions, and these related to two separate divisions of the same company, all paid some form of piece-work incentive.

The Chairman of the company concerned with Case Studies 1 and 2 said that any form of premium system or piece-work system is degrading to the workers, hence in his company an hourly rate was paid. That, he believed, compared very favourably with that paid to workers in similar industries. Certainly workers in one of his plants were quite happy and contented, in the other plant the view was expressed that some form of bonus should be paid. On reflection it would seem that productivity would have been improved by some incentive system. On the other hand no factory should become a sweat shop and it is incumbent upon even junior line management to ensure that for a fair day's pay a fair day's work is performed.

In Sweden, many companies abandoned incentive schemes and work measurement simultaneously. In the forty companies that took this step, the average drop in productivity was 30%, and no other gains were noticed. In addition, as the products and manufacturing methods changed, historical data became useless, so that even planning became impossible. That is why work measurement is being introduced, using sophisticated techniques such as MOST (Maynard Operation Sequence Technique); the sophistication is used to produce a system so simple that workers can apply it themselves to determine what is an acceptable output. The new approaches also mean greater participation of the people concerned. If a payment scheme is involved, it is generally a premium system, paying more for output above a pre-determined level, rather than straight piece-work.

In the delicate, tendentious and politically explosive area of pay the Personnel Department could play a more than useful part. This is only possible if it has been involved with all the discussions relating to G.T. from the very beginning. Personnel ought to be well versed in the various payment systems and methods and should be well aware of the likely positions to be taken by organised labour. They should also be well aware and familiar with the company's reasons for changing to G.T. knowing full well that the majority of the reasons tend to centre around increased productivity and that such increases can only be achieved by operator dedication and participation. Also at the same time realising that invariably such an increase will only be forthcoming if a financial incentive is involved.

Those that have expounded the principles and philosophy of Group Technology have always maintained that now it is possible to discard piece-work and all its ramifications, especially those connected with quality assurance, recording output, costing, etc. Now it is possible to pay an incentive premium based upon the output from a group of workers be they in a line or Cell. Now it is possible to have one productivity index based upon the total value of output from each Cell. The case studies indicate not one company visited had adopted a group incentive scheme, and those that were paying an incentive invariably based this upon a piece-work system.

This seems to be a failure on the part of management and when questioned invariably stated that all hell would be let loose if any attempt was made to change the method of payment, citing instances of the car industry that went over to measured daywork, the worker resistance that they encountered and that productivity was now abysmally low. One cannot help feeling that this is an area where academics could have been of more help; instead of concentrating on the technology should also have turned part of their attention to this most important aspect of G.T.

Worker mobility, flexibility or versatility does not appear to be a problem on the shop floor. This again is another instance where theory and practice differ. Within a Cell or on a G.T. line all workers should, in theory, be able to operate any machine. In practice, it is found that versatility is restricted to one or two operators and involving perhaps the same number of machines. Here the author gets the feeling, that cannot be substantiated, that management are taking the easy way out, by minimising this facet. In a family of parts, very few should require processing on all the machines, and few parts should need processing in exactly the same sequence or with the same operations. This means that different machines and different operators will be idle and, so far as the operators are concerned, should be moved to those machines for which there is work. This is total involvement and total flexibility. Flexibility is linked with job enrichment and yet in none of the organisations visited did there appear to be any deliberate attempt to improve job enrichment. Case Study No.1 mentions enrichment for one of the chargehands, and this man was highly delighted, certain operators at the same plant had also been given the facility to operate, observe, and self-correct. This was probably due to management's intention to integrate the work rather than enriching the job for the operator. Case Study No.13 reports the negative attitude to enrichment. Yet job enrichment or job enlargement is a motivational factor and as such could be a very important factor in improving productivity. A recent television programme highlighted flexibility by showing seven workers operating a continuous casting process. There was complete flexibility. Each worker, including the foreman, did a fortnight's stint at each particular task, including sweeping the floor and keeping the workplace tidy, the task that was being performed by the foreman during the filmed interview. Rates of pay except for the foreman were uniform and a happy and contented relationship seemed to exist. Each are treated as equals and each has the same privileges and responsibilities.

One of the facts requiring confirmation when seeking material for this Thesis was the extent to which Group Technology had changed the organisation. Surprisingly little information was forthcoming on this subject. Many companies still do not have a structure chart. Yes we have one, but it is out of date; or it only shows top management; or it is not available. Some of the stock answers. Gallager and Knight make reference and include two organisation charts, showing the before and after situation. The author could find no concrete evidence of this - in fact at the particular company, the view was expressed that the continuance of G.T. was very much in the balance.

It is a recognised fact that as a company grows or changes its methods, the old structure is no longer suitable. Total commitment to G.T. would inevitably mean organisational changes. Channels of communication must be shortened, production control must be more sensitive, maintenance must be more readily available, quality control decisions made and implemented much more quickly, etc. Unfortunately no company visited was totally committed to G.T. although Case Study No.13 was the best example in this direction and one suspected that all their efforts to date had been directed towards the technology and little thought given to re-structuring the organisation. Case Study No.3 makes reference to the formation of project groups consisting of existing personnel from the planning and jig and tool departments, but this exercise has not resulted in structural changes in the organisation because the particular company does not have an organisation chart to refer to. Of course, if one took the trouble to produce charts of the before and after type then it is supposed such changes would become apparent. So far as the author could establish was there any deliberate move to reduce the levels of management or to shorten lines of communication. Nevertheless it must be recorded that instances were noted of changes in the channels of communication and a shortening of these. The chargehand in Case Study No.1 was given the computer print-out of the work for the coming month for his Cell and also the responsibility for scheduling the work. In other organisations visited certain foremen expressed satisfaction with the new system since they now knew what was going on.

People resist change particularly when it affects them personally. Promotion of a bigger job is perfectly all right, but the opposite or a change in status is, if possible, quietly ignored - this is a reflection on one's ability and to have an organisation chart which might show such changes is out of the question. It is a pity that this attitude exists, since the structure is the organisation's framework, and whilst "an organisation is people" to ignore the structure is like ignoring structure in the study of metallurgy where the structure determines the resulting physical properties. Flaws in the organisation structure can cause untold difficulties, and the structure defines the functions if nothing else!

The case studies also reveal the importance of shop floor supervision in G.T. It is next to useless having the production engineering department wholly committed to G.T. if the last link in the chain, namely the foreman or chargehand, is also not of the same mind. Mention has been made of the importance of this man, and this was emphasised time and time again by the people interviewed in industry and, by talking to one or two foremen, the author concluded that he was indeed the key figure on the shop floor. This being so then much more attention should be given to his initial selection, his training and by making him truly a member of the management team.

Group Technology is a little like Work Study. You try to make products at less cost; you try to make them with less human effort; you try and simplify the work; and as with Work Study there is a need for continuous re-appraisal to see that the new methods are being used, so too with Group Technology the same applies. Although with G.T. the same opportunities do not exist for reverting back to pre-G.T. production methods as they do with Work Study it is nevertheless necessary and many managers quite openly admitted that their efforts in G.T. were anything but perfect and that they were continually looking for improvements.

Looking back at the various industries visited, the final conclusion must be that not one was practising G.T. book fashion. The technologies and principles were reasonably understood, the methods of implementation had varied, each to suit its own particular circumstances. All the problems seemed to be human centred and management preferred to think that they did not exist and since their G.T. efforts had more-or-less come up to budgeted expectations they preferred to let matters rest.

Finally it would be more than useful if it was practically feasible to pick the Technical Director from Case Study No.8, give him the General Manager from Case Study No.4, the Production Engineer from Case Study No.11, the Planning Engineer from Case Study No.3, the Personnel Manager from Case Study No.5, the Foremen from Case Study No.1, the Workers also from Case Study No.1, and all located in the factory from Case Study No.12. This would seem to be the best possible combination of all those involved in G.T. The outcome would be debatable since what a person achieves in one set of circumstances does not necessarily imply that he will achieve the same elsewhere, neither does it follow that one set of workers will co-operate and give of their best when confronted with a different supervisor. This is part of the British character, it is conditioned by geographical details, by history and also by the art and skill of manipulation by leaders and after all, what is a manager but a leader!

CHAPTER TWENTY-SIX

SUGGESTED AREAS FOR FURTHER INVESTIGATIONS

SUGGESTED AREAS FOR FURTHER INVESTIGATION

26.1.1 SIMPLE EXPLANATORY BOOKLET FOR MIDDLE MANAGEMENT AND SHOP FLOOR PERSONNEL

Many books and publications are now available dealing exclusively with G.T. All without exception are aimed at the higher ranks of management. All without exception have lengthy chapters devoted to such things as component statistics, classification systems, production and control, advantages, etc. Some include reference to experience with G.T. in a number of industries. A top manager contemplating G.T. would be well advised to study carefully any one of the books classified at the end of this Thesis.

What is suggested, in the light of experience gained during the collection of evidence for this Thesis, is a small booklet written in such a style that shop floor workers could more easily appreciate what G.T. is and means to them. Better still if such a booklet could be illustrated.

It is not enough for workers to be expected to accept change without adequate explanation.

Most companies visited were producing products in competition sometimes with other local industries, others with competition from abroad. If management had the skeleton of a booklet to which they could add or alter to suit individual circumstances then the economic factors of G.T. become much more vivid when related to something that the worker can identify.

Similarly, classification systems mean very little, except to those in design and drawing offices. What is important is the people, operators and others, who will be working within the new set-up. This and other aspects could be again simply explained. It might be possible to include in the booklet facts relating to the methods of payment, to relationships with other departments, etc.

Strangely the National Economic Development Office produces a booklet

'Why Group Technology'. This is aimed at senior management and says: "G.T. offers both to companies and their employees substantial potential benefits which have not always been exploited in the past. The E.D.C. hopes that all company managements and their trade union representatives will consider seriously what G.T. might have to offer them."

Such a booklet, it is contended, is practically useless. Past experience of Government Department intentions indicate that industry is very wary of such help. N.E.D.O. would have been much better employed producing a booklet as suggested above. Good management is able to assess the usefulness or economic benefits of different processes or methods, what they are not always sure of is that the shop floor appreciate them in the same way. Many senior managers can instance examples where a negative response has been forthcoming from the shop floor and suspicion of management's intentions.

In overcoming such suspicions relating to G.T., N.E.D.O. could be doing a useful service to the many thousands of companies that could still benefit!

26.1.2 WORKER PARTICIPATION

Reference to this has already been made and it is felt that more detailed information should be given here.

Much has been written and spoken about G.T. producing factories-within-a-factory. Meaning that a Cell should be autonomous to a very large extent, and that providing the work produced by the Cell is of the right quality, of the right number and at the right time, and that this fits in with the overall policy of the company, the Cell should be left pretty much to chart its own destiny.

If Cells could be made completely self-contained, with their own stores, maintenance, inspection, etc., then the above is a possibility.

Even where this ideal is unobtainable the author believes that it is possible to achieve and maintain a high output and morale with a certain amount of worker control.

What is suggested is that a mini-management group be set up to run each Cell.

This group should consist of the Production Engineer as permanent leader, since he would or should always have access to overall company policy. The foreman or leader of the Cell should also be a permanent representative - he is the man most familiar with the work in the Cell. Two Cell workers, who should be elected for a definite period. These are the people most familiar with the problems encountered in operating the machines and other Cell equipment. The final individual should be the Shop Steward who would be a permanent representative.

If this group acted in a democratic way, then the likelihood of unnecessary industrial strife on the shop floor would be greatly diminished, since the union man would only get support if it was thought by the two Cell workers that he had a just case. Also by electing the two Cell workers for a definite period, management would know that unsatisfactory performance by these two would be for a fixed period of time and it would be unlikely that the next two would be of a similar disposition.

Such a team would have to operate within well and carefully defined terms of reference, issue proper minutes and be restricted in the number of meetings per year and the duration of such meetings.

26.1.3 METHOD OF PAYMENT FOR G.T. SYSTEMS

The take-home pay still appears to be the most important item in the make-up of the working life of the majority of people. Job satisfaction, job enlargement, work involvement all are of secondary importance or of no importance at all until the financial side has been amicably settled.

Perhaps of more importance is the difficulty of changing the method of payment even when this could be to the benefit of the employee. Ingrained habits die hard. Piece-work systems are easily understood, the individual can easily work out the amount accruing to him, it is also due to his own effort. Unions also seem to favour this method of payment.

Yet Group Technology in its various forms and application, i.e. cellular or flow-line, is ideal for a prémium system based on the output of a group of workers and should, if applied properly and fairly, result not only in increased output but a much greater harmony in the Cell or whatever.

Wages and all that is involved is always a difficult area, an area where management treads very warily tending to retain the status quo. This is also an area that could easily be incorporated into the previous two suggestions. Where in the first instance, take-home pay pre-G.T. could be compared with the hypothetical take-home pay utilising a group method of paying an incentive. Admitted it would be purely theoretical, but would have much greater chance of success if the operators could identify with the products with which they are familiar instead of talking in terms of value of output or machine utilisation, etc.

26.1.4 G.T. IN THE FOUNDRY AND ALLIED INDUSTRIES

Practically all the work and the present applications of G.T. relate to the secondary industries or those in which metal cutting forms a very substantial part of their operations, i.e. valve manufacture, gauge manufacture, machine tool manufacture, etc. In a great many instances the raw materials that the above use are the products of the primary industries, namely the foundry industry.

Case Study No.3 refers to the application of such an industry producing steel castings. G.T. has been applied in a very small way with moderate success and the author firmly believes that with assistance this company could have done a great deal more but for the fact that no help was available either from the Foundry Industry itself or from work in the academic field or publications. In the write-up of Case Study No.3 reference was made to the difficulty of rearranging facilities with so much fixed plant, but this only applied to the actual casting of the metal itself. In other areas of such industries opportunities exist for the application of G.T.

It is also possible that the environment could be improved by applying G.T. techniques.

Some foundries have fairly extensive machine shops for the production of, among other things, metal patters, core boxes and cores; fettling and the removal of gating systems is another process; invariably core making of one form or another is carried out on a batch production basis. Moulding machines of one form or another also operate on a batch production basis and it is possible that G.T. could benefit the manufacture of wooden patterns.

These seem to be virgin fields for the application of G.T. and this is without consideration of the die-casting industry, or those which produce shell mouldings, or use the lost wax process. Economies resulting in price reductions or stabilisation in the primary industries should eventually be reflected in the secondary.

26.1.5 D.T.I. INVOLVEMENT WITH GROUP TECHNOLOGY

Industry at the present time seems to be in a state of stagnation. Politicians and others are continually stressing the need for a re-vitalisation of industry, more investment, increased productivity to take advantage of the de-valued pound etc.

Group Technology can also play an important part, and the author firmly believes that very many industries could use this technology to advantage given the right type of help, and that this help should come from the Department of Trade and Industry.

Very many industrialists appreciate the advantages to be gained from the application of G.T. or else attendance at the various seminars, conferences, etc. devoted to G.T. would have been very poor. What many of these industrialists lack is G.T. expertise in their own plants, a few have advertised appointments for Production Engineers with G.T. experience, but such people are still very few on the ground. G.T. is a gamble, there are many difficulties and pitfalls especially on the human side, and one can sympathise with an industrialist who prefers to maintain the status quo.

How can the D.T.I. help?

The author is of the opinion that if initially the D.T.I. would sponsor small groups of people to help with re-organising for G.T. many, many more organisations would be prepared to go along the G.T. path.

Each G.T. team would consist of an experienced production engineer, a planning engineer and a high grade foreman with considerable shop floor experience, the team to be controlled by an academic who has had all-round experience of G.T. preferably with post-graduate type students.

This team would move into a firm that requested help and carry out a fairly intensive survey relating to the products produced by the company. This exercise should take not more than a week, and would be followed by a report assessing the potential and would include facts relating to advantages, benefits, costs and an indication relating to the time factor. The team would discuss the report with senior management.

If a positive decision was made, then the implementation should follow along lines suggested in Chapter 24, "Idealised Method of Introducing and Implementing G.T.", but with the following important addition. Responsibility, with the active co-operation of management, would be with the D.T.I. G.T. team. They would move into the various areas, and recruit workers for the various tasks. For example, if a classification of components was thought necessary, then a draftsman would be the recruit and would be given necessary instruction by the planning engineer, similarly he would also start a pilot scheduling and control system. The production engineer would start assessing the machining and equipment potential and the foreman would look at the existing methods and assess the potential of personnel on the shop floor and he would also pave the way for discussion at shop floor level. The academic would co-ordinate the various activities.

Once a scheme was under way the team could start again in another company, because the author believes it is the initial impetus and knowing that help is available that are the main difficulties. Progress reports and discussions should take place at frequent intervals with all concerned, snags, difficulties and problems being solved with the minimum of delay. Everything moving toward a date fixed for the introduction of the first G.T. Cell or Flowline.

No payment should be made to the D.T.I. until the G.T. scheme has been running for at least a year after which time it should have been possible not only to monitor progress but compare results. Only then, and only if the results are favourable, should negotiations start toward costing the D.T.I. contribution and the amount payable by the company.

The above is only an outline of the scheme. It might be fraught with all sorts of difficulties which at this time are unknown or not considered. A similar analogy can be drawn with the help already given to a number of industries by staff and students from the various Universities, but the G.T. scheme should be all-embracing and not fragmented. Employing skilled personnel would, it is believed, give the necessary drive and urgency to the exercise. The benefits to industry would be measurable and the dividends considerable. What is more the expenditure would be recoverable and expenses if any incurred by the Government would be far less than those incurred by the G.T. centre at Blacknest!

26.1.6 SELECTING PERSONNEL FOR GROUP WORKING

In the early stages of gathering material for this Thesis it did occur to the author that it was perhaps possible to devise some test or series of tests to determine whether a man or woman would make a useful and contributing member of a team.

Reading the various accounts of the training of astronauts it seems that they undergo very extensive tests to determine their suitability for living and working in a confined space, for very long periods of time, with one or two other men. Could similar tests be devised, of a less exacting nature, for assembling the members of a G.T. Cell?

Requests for information in this direction proved negative. Questions to people in industry revealed that almost without exception the various groups had come together almost naturally, probably because they had been doing similar operations prior to being moved into cellular formation. It was also revealed that most of the groups were self-disciplining. This included the request for unsatisfactory workers to be removed from the group, to requests for workers themselves to be removed.

From these facts it is concluded that whilst a test or tests if they could be devised might be helpful, they would in all probability detect those workers considered unsuitable, but there would be no guarantee that the others would succeed. The human make-up is so complex and such an exercise is fraught with danger, the cost would be considerable since only a trained psychologist and sociologist would be able to conduct the test and interpret the results; and in the end it would be the other workers who would determine the suitability.

CHAPTER TWENTY-SEVEN

CONCLUSIONS

CONCLUSIONS

It is incumbent of all senior management in companies engaged in batch production to give careful consideration to the apparent and possible benefits to their companies and their employees of introducing Group Technology methods of manufacture. If the decision to implement G.T. is positive, the results of this Thesis indicate to the author, that the full potential of, and a satisfactory transfer to G.T. is more likely to be successfully achieved if due consideration be given to the following.

1. A steering committee be appointed reporting high enough in the organisation for everyone to see that its decisions carry the weight of executive authority.

2. The committee to incorporate top, middle and shop floor managers, shop floor operatives, union representatives and the personnel manager.

3. Need for clear concise statement relating to the reasons for re-organisation with considerable emphasis on the economics of production and the need to fight and beat the competition.

4. Massive communication exercise to ensure that everyone gets the message. The situation analogous to that of a battle, top management being involved in putting management, professional staff and shop stewards fully and frankly in the picture and dispelling those cynics who have 'heard it all before'.

5. Communications aided by the use of statistics, slides and models; to look at the competition, their equipment and, so far as can be assessed, their plans for the future. No member must be left in any doubt about the formidable forces facing the company.

6. Need for total co-operation and commitment from everyone; communications being two-way, frank question and answer sessions should generate the necessary enthusiasm and acceptance.

7. Need to maintain enthusiasm placed on the shoulders of senior managers

of functional departments with a clear message - to get everyone in the department involved.

8. Careful and detailed planning of all stages of the change.

9. Need for acquainting people with the possible changes in their roles - managers, supervisors and shop operatives.

10. Reference to job satisfaction and the need for total commitment.

11. Dispel fears of redundancy or have adequate and satisfactory plans should this eventuality arise.

12. Consider carefully changes likely to be necessary in the method of payment. Such changes must ensure high productivity coupled with economically produced end products.

13. Examine the role of the personnel department and the need for changes in training school curricula to include techniques of G.T. for operative training, apprentices, in-service training of managers and foremen, etc.

14. Establishment of a pilot Cell and the need for carefully monitoring its input and performance.

15. Draw up a new organisation structure with written job descriptions for departmental heads but still retain 'unity of command'.

16. G.T. is not a static technique. It is in a more or less continual state of flux and 'consultative' management should be encouraged which should include shop floor operatives. By doing so it will be seen that there is no lack of sincerity and an impetus will be given to stimulating new ideas and suggestions for improving overall efficiency.

> "The cause which is blocking all progress today is the subtle scepticism which whispers in a million ears that things are not good enough to be worth improving."
>
> G.K. Chesterton.

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