IMPLEMENTING INNOVATIONS IN ORGANISATIONS

by

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ABSTRACT

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Initial investigations with six small and medium sized firms were carried out where innovation of products and processes played a major role. On the basis of preliminary analysis one company was chosen for an in-depth investigation and analysis through participant observation. Innovation implementation situations were identified in the manufacturing unit of a small engineering firm and studied through observation of the process and in-depth interviews with participants. The concept of technological innovation was widened to include structural innovation and a theoretical framework was developed to describe and promote the innovation implementation process. This linked a classification of innovation with organisation structure and appropriate decision making process.

As a result it was found that the innovation process was only influenced marginally by overall structural characteristics of organisation. It was more influenced by the local structures made up of the individuals actively involved in the process - their decision making and communication patterns with each other and other parts of the organisation.

As these local structures were composed of different people for different innovations or changed in composition as the innovation implementation process proceeded, a need for one person to act as overseer - interpreter and integrator emerged. The researcher found herself fulfilling this role. Further work was carried out in examining this key role through an analysis of the researcher's own contribution and role within the company in innovation situations. This also contributed to the research process in its implications for research methodology, particular the Action Research model where the researcher is actively involved in learning and change.

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Most of all I want to thank John, my husband, my Caring Other, who was always ready to discuss, listen, initiate, enthuse about the research. It was he who gave me a sense of worth and direction and who made the process of research a less lonely path.

"Glendower: I can call spirits from the vasty deep.

Hotspur: Why, so can I, or so can any man; but will they come when you do call for them? "

Henry IV Part I, Act 3, Sc. I

Organisation of the Thesis

The inseparability of the changing objectives of the research and the different phases of research role are introduced and 'flagged' in Chapter I. Personal issues and insights relevant to the researcher's role are given. It is essential to understand this perspective for it illuminates and binds togetherthe whole of the research work with its emphasis on understanding and learning.

Chapter II contains the main literature relevant to the thesis and Chapter III sets out the main methodological considerations which have influenced the present design, and shows how a philosophy of research emerged over time. The next two chapters (IV & V) are concerned with the actual fieldwork in the organisation, while the findings on innovation and findings on role are set out in Chapters VI & VII respectively. A summary of findings, implications for research role and contributions to understanding the innovation process are included in Chapter VIII, together with some possible areas for further research.

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EXAMPLES

CHAPTER I

Introduction

As I started research work within one particular company, and as work progressed, my understanding of both the research task (how to go about it) and the area of research (what I was looking at) underwent a change. At the beginning I think I could say that I was firmly in the camp of traditional problem-solving: i.e. innovation implementation situations could be studied, information compiled and categorised, conclusions drawn and guidelines for future innovation situations recommended. The art of the soluble:-

> "Good scientists study the most important problems they think they can solve. It is, after all, their professional business to solve problems, not merely to grapple with them."
>
> (Medawar 1967)

For successful action, what was needed was to know what would be the results of alternative courses of action and therefore to be able to select the course most suitable for the company's purposes - so I thought. The goal was prediction and control. Proof of a correct course of action was in successful implementation. What I discovered was that anything predictable was so only on account of its 'fixed' nature; and that where people were involved (and perhaps more so in innovatory situations where the very nature of the game is change and flexibility) predictability became a nonsense. What would work and be true in one situation, no longer applied - or did not necessarily apply in another. There could be speculations, theories, classifications, observed regularities but never a certain re-application of 'the solution'. What I was left with was not a solving of problems or an explaining of mysteries: more an <u>identifying</u> of problems.

Schumacher divides problems into two kinds - those able to be solved (convergent) and those not able to be solved (divergent). He says:

> "Convergence may be expected with regard to any problem that does not involve life, consciousness or self-awareness."

On the other hand:-

> "Divergence incorporates elements of freedom and inner experience ..... divergent problems can not be solved in the sense of establishing the 'correct formula'. They can however be transcended by forces such as understanding, empathy etc."

Innovation falls into the divergent category: all sorts of reccommendations could be found to work in one particular isolated instance but these could not be repeated. The transcending force that seemed to arise out of the tensions of disparate innovation situations, however, was that of integration, based on individuals' perceptions and understanding both of themselves and others.

Let me regress a little to make this clear. My initial area of research (as stated on registration forms) was: "An investigation into decision-making processes during the stages of initiation and intra-firm diffusion in technological innovation" by which I meant - when a firm decides to innovate how does it make that abstract decision into a practical reality? - what is the process that is gone through? - how conscious is this process? - who is involved? - how do they interact? - what are the effects of the way the process is handled? - etc, etc. All fascinating stuff, - off we go, - observe, interview, gather data, analyse, evaluate, theorise, recommend. Alas, it was not so. This was all outside of myself - I had forgotten to take myself into consideration.

As I began work inside the firm I found I couldn't do it all from a detached 'outside' position. Because of the very <u>nature</u> of innovatory situations and the intimate interweaving of personalities and action I needed to know more about the company and the people involved – what made them tick? – how did they see their job? – how did they see themselves and their role within the company? – what was their perception of others? etc. These sorts of questions made necessary and acceptable a different order of data of a more subjective and anecdotal kind. But, I hastened to reassure myself, there is precedent for this in the concept of 'grounded theory' – so proceed, with caution!

I got to know the company – I had a 'feel' for what was happening – I became familiar with factory life and routines – what was normal, what was out of the ordinary: I understood the context of the innovatory situations I was looking at. With this came acceptance, familiarity with personnel at all levels from cleaner to tool room to industrial engineer. Incredible as it may sound, I still thought that I was safely observing from outside – a more participative position perhaps, but not outrageously so.

What I was unaware of, during that time, was that method and task are inextricably bound up: as my method (ways of gathering information) changed, so my task subject imperceptibly changed too. Questions that I now asked myself were – do members of the firm themselves see the process that they are going thoough? – can they see the totality of the situation? – do they learn from taking part? – do they apply any learning to another innovatory situation? – what is their understanding of Innovation?

You could say that the first questions that pre-occupied me were to do with the situation: the second questions were to do with the people: the third set were to do with the people in the situation.

The more I looked at this, the more I began to question and examine my own role – and the more I became aware of the significanoe my role was taking on in the Innovation implementation process: – I was part of the very thing I was trying to study!

I became aware of the significant way in which I was being used as part of the innovation implementation process by members of the firm – as an identifier of (possible) problems, as a communicator, integrator and innovator. This led me on to examine the specialist role of the integrator through my own experiences. This was not something planned at the beginning of the research programme, but something of importance which evolved from a combination of the nature of the research and my own personality.

I can see how the research objectives have shifted focus over time. Again this was not planned and although the objectives finally emerged out of an evolving shifting research programme, my real contribution is in the very <u>combination</u> of different elements. So that instead of answering the questions – what were my objectives and how did I tackle them in the research programme and what contribution have I made to existing knowledge, I would reverse the order and say – this is where I started, this is what happened and how I and the research task and topic changed, and this is my ultimate contribution in terms of understanding the Innovation implementation process. I feel that this is an equally valid and responsible way of doing research, with an equally valid and responsible outcome.

On the basis of analysis of data from various innovation situations a theoretical framework for classifying innovations was developed, together with suggested appropriate organisational structures for decision making and implementation. The conceptualisation of this model of innovation will possibly be of use to others in looking at the totality of the innovation process. But equally there was the key element of the role of integrator and identifier of the totality of the process. My contribution also lies in the conceptualisation of this role. It is in the <u>combination</u> of these elements that I feel new understanding of the Innovation process will develop.

Out of the research has come:-

(i) a theoretical framework underlying the totality of the innovation process;

(ii) a framework of five mainline issues depicting the on-going nature of innovation implementation;

(iii) the conceptualisation of the role of integrator underlying the understanding of the innovation process;

(iv) the combination of these elements providing for learning from the experience of taking part in the innovation process for the people (organisation) involved.

In conclusion, to represent me, the researcher, as learner, permits many (hitherto unacceptable?) thoughts. Among these are:-

- No, I do not have all the answers.
- Yes, I'm still discovering, uncovering ideas and possibilities as I change as a person.
- Research is an untidy business, and can rarely be neatly packaged and put away complete.
- This research means most and has most value for me.

This is not to say that it is of no value to anyone else, nor is it to present excuses for incomplete work or the on-going nature of research, but to claim recognition for the significance of the actual person involved in the research, and to try and highlight some of the personal and task dilemmas faced by the researcher.

CHAPTER II

LITERATURE REVIEW

The aim of this chapter is to review briefly existing theories and concepts of the innovation situation within organisations, and to set the present research in a contextual framework. A selection has been made on two counts:- (i) those studies which offer a wide background of innovation study, e.g. Sappho, Nabseth & Ray, and (ii) those studies more particularly affecting the interactive nature of the process e.g. Rogers & Shoemaker, Bessant. Attention has been drawn to the generalistic nature of most findings and the lack of practical applicability for organisational managers. A special emphasis has been on how practicing managers can benefit from research findings and this has led on to studies of the role of innovation consultants. It was seen as important to interweave appropriate experiences from my own research throughout the review to aid an analytic discrimination of the various contributions.

LITERATURE REVIEW

Introduction

The subject of innovation and the diffusion of innovations has been fairly extensively explored from a number of viewpoints. Before briefly reviewing some of the more significant areas in relation to this study however, I would like to clarify how this research differs from prior research in three important ways.

Firstly it is to do with the 'how' of innovations. There is a bewildering variety of case studies and reports on the why/where/when of innovation, but surprisingly little is known about the actual experience of managing the process. Many studies have concentrated on the determinants of adoption decisions - how the characteristics of an innovation affect its adoption (Rogers 1971); what characteristics are related to innovation success (Fliegel & Kivlin 1966) etc. Ostlund (1974) tried to use innovation perceptions as predictors of adoption and similar work has been done by Hayward & Masterson (1979) and Rothwell (1977). Another related area is the examination of adoptor categories (Rogers 1962).

It is evident that this type of study has concentrated almost exclusively on why a particular innovation was or was not adopted - what were the facilitating/retarding factors and what was the measure of success or failure. Many analysts have tended to ignore what happens to the innovation after adoption, whereas it should be clear that adoption is only the beginning of an implementation process that can lead to widely differing kinds of outcomes.

Implementation is the process of actually doing the innovating. In practical terms most innovations do not rely on one single adoption decision but on a series of adoption decisions affected by a series of variables and taking place over time. This research aimed to study how the intangible adoption decision became a practical reality within the firm; in other words it was studying the 'how' of innovation rather than the 'why'

This leads on to the second important difference in approach to prior research. Most other reports have tended to be generalistic in approach and outcome. They have looked retrospectively at a range of innovation within a variety of industries and attempted to determine emergent patterns (e.g. Rogers & Shoemaker (1971). Chakrabati & Rubenstein (1976)). The usefulness of this information to managers is limited because of the very general and non-specific nature of the conclusions. For instance Rothwell (1977) has summarised the conclusions of several recent studies of this kind to provide an indication of the range of factors associated with 'successful' innovation (usually judged on commercial criteria). But statements such as 'good internal co-ordination and co-operation', 'good use of management techniques', 'an effective selling policy', are not much real help to the practising manager.

"What does this mean to me in my situation with these people?" is what he wants to know.

Prescriptive approaches are typified by offering theoretical evidence of supposedly key issues in the process of innovation - derived from studies like SAPPHO - and then offering a set of techniques aimed at handling these issues. But, apart from covering almost all aspects of organisational well-being in what turns out to be a rather non-selective way, these key issues are different for each organisation and need to be handled according to the particular unique setting of that firm and its people. So this research has concentrated on providing a contingency approach to the implementation of innovations within one organisation. It is specific rather than general, with relevance for operating conditions within one firm, but hopefully with significance for others in the understanding of the process. It was not intended to provide prescriptive recommendations to facilitate the process of innovation, as I do not believe this to be practically possible, but central to the heart of this study was the belief that innovation implies learning - learning of new organisational behaviour.

This is the third area of difference. Technological innovation inevitably brings with it changes of other kinds - social, political, psychological, organisational etc. In fact the management of innovation could be regarded as a specific instance of the management of change. If this is allowed then the enormous variety of elements which may affect the process becomes frighteningly apparent. How can anyone hope to grapple with this morasse?

Perhaps one answer is for people, i.e. organisations, to be able to learn from their experience of taking part in the innovation implementation process and to be able to take that learning forward into new situations. Is change just an unavoidable consequence of innovation or can it be anticipated and planned for? If we are unable to foresee all the changes that are coming how quickly can we adapt and learn?

The research was concerned to be of practical value and help to the firm where work was undertaken through this emphasis on learning from the situation. This meant taking a further logical decision and becoming part of the innovation learning process myself; an investigation of my own role within the company constitutes an important part of the research programme.

So the three areas of difference between this research and much prior research are in focusing on:-

(i) the 'how' of the process

(ii) the specificity of the approach and outcomes

(iii) the understanding and learning about the innovation process for the people involved.

These are the three organising principles of the research. It is important to set the research in a historical context of other research findings, so with these three principles in mind I propose to briefly review other significant research findings which relate to this work.

One method of writing would be to select themes of importance and present each separately. This would provide a clear-cut structure but one which would be counter productive to the wholeness of the nature of the thesis. Differentiation in this way was not seen as compatible with the nature of the subject under discussion. Innovation requires an integrative approach and it was decided to use an integrative approach in the writing. The binding together of different areas of research with my own experience means that it is difficult to separate out compartments of specialised knowledge relating to one aspect of innovation but there are more important gains in an appreciation of the wholeness and complexity of innovation situations.

I begin the literature review at the historical beginning of research into innovation with economic interpretations and then move through the three organising principles towards the core of the thesis – the concept of integration.

Until very recently investigations into the nature of industrial innovation have tended to concentrate almost exclusively upon the economics of the process, an emphasis which may be ascribed to two basic reasons. Firstly, economic theory implies that firms seek to maximise the return on the resources they employ, so that measurement of the economic benefits accrued after adoption is seen as critical to the adoption decision. Secondly, economic factors are perhaps easier to identify and measure than other less tangible non-economic factors. Mansfield (1968) has been one of the most prolific researchers in this area investigating such things as the relationships between the rate of adoption and:-

1. The proportion of firms which had already introduced the innovation
2. The profitability of installing the innovation
3. The size of investment required to install it
4. The size of firm
5. Its growth rate
6. Past profits and liquidity
7. The rate of return
8. A measure of riskiness at the time
9. The age distribution of existing stock
10. The average number of innovations a firm had to buy to go from 10% to 90% adoption
11. The structure of the market.

From a summary of Mansfield's work the relationship between rate of adoption and some of the purely economic factors is not entirely clear-cut. Relationships (profitability and size of investment excepted) are not consistent and economic factors appear to have only limited capacity to explain rates of diffusion. A basic assumption which underlies most of the economic studies of the diffusion process is that organisational adoption decisions are motivated by the purpose of the organisation (assumed to be the maximisation of one or several economic functions) and constrained by the organisation's financial, technological and human resources. However the failure of economic interpretations to explain fully the rate at which a firm is likely to adopt a new technique has led to a search for other explanations. Mansfield himself stated:-

"... perhaps these variables (profitability, liquidity and growth rate) are less important than other more elusive and essentially non-economic variables. The personal attributes, training and other characteristics of top and middle management may play a very important role in determining how quickly a firm introduces an innovation. The presence or absence of a few men in the right place, who believe strongly in the value of a new technique may make a crucial difference."

This is echoed by Nabseth & Ray (1974) in their international study of the diffusion of technology in different countries. They suggest that managerial attitudes play an important part in influencing diffusion rates; explicitly they say:-

"the least tangible factor is however likely to have the greatest impact on the application of new techniques - the attitude of management."

If this is true for the adoption of an innovation it is probably equally true for the implementation of an innovation. Yet once more we are left with a rather vague implication for those actually concerned with innovation. Also it seems strange, that if as far back as 1968 these ideas about the human element in the innovation process were being mooted, so little of it has percolated through to practising managers. There is still a great deal of emphasis on the hard end of technology and economic criteria, and little on the process of introducing technological change or on the people involved.

A second tradition in the analysis of adoption behaviour is the study of ways in which new ideas and practices spread through a population. This approach traces originally to Ryan & Gross's (1943) work on the adoption of hybrid seed corn, and is approximately parallel to what others have called the 'social interaction' approach. Its major theme is that communication is the basic process by which people become aware of new things and decide to use them, and therefore the dynamics of the communication process are important to understanding innovative behaviour. There are many exponents of this theory of which I will cite a few; in many of the reports the original concept of understanding the dynamics of the communication process seems to have been watered down into observing how information or data is relayed. For instance Chakrabati & Rubenstein's (1976) studies of NASA innovations and their diffusion found that top management interest was important in the product cases only and that the success of process innovations was dependent upon the quality of information and the specificity of relationship between the technology and some recognised existing problem.

Burke (1965) isolates an important obstacle to innovation as being a lack of understanding between sponsor ('business innovator') and innovator ('technical innovator'). The National Academy of Science Committee on 'Principles of Research Engineering Interaction' states that 'close communication is critical; Smits & Bueche (1967) in looking at successful innovations in the General Electric Research Laboratories come up with 'the industry-university "interface" is a factor in successful innovation'.

These examples of necessity focus on the transferral of an innovation from outside to within a company - so of course quality of information is very important. But equally important is the manner in which information is communicated. I observed this at first hand during my research programme when the R & D department of the company (based at another site) sent off drawings and a prototype for a new product to the draughtsman at the manufacturing unit. He then had to redraw it to make it possible to produce it in sufficient quantities on existing machinery. Before production however, it had to be re-submitted to the R & D department for approval and there were delays, frustrations and needless 'aggro' because of a basic lack of understanding and communication. According to the draughtsman acknowledge of the machinery, the tooling, the manufacturing process, as well as direct contact with the shop floor is vital. The Industrial Engineer put it more forcefully:-

"People who have to manufacture parts are the furthest removed from the ordering situation or the discussion situation. This isn't an isolated instance. The chains of information and communication are too lengthy; it doesn't work: there are too many hitches and personalities involved; you have to piece together what information you can. Crucial people don't speak directly to each other: things get out of hand."

I have quoted this at length because it does seem to highlight this basic difference between information and communication - and that people in organisations are aware of this difference. Technicalities are not enough - how information is transmitted is just as important. There also seemed to be a plea to recognise the two-way interactive nature of communication. Too often it seemed the attitude was one of being in a passive receiver position with no felt power to contribute or influence events in an active way. This was resented, and also applied to the 'industry-university interface' mentioned by Suits & Bueche. Too often academics were seen to theorise and compile knowledge which they then wanted to bestow on industrialists without much thought for a common language or a readiness to receive information themselves. This lack of reciprocity is, I believe, one of the main stumbling blocks to a deepening of the understanding of the innovation process. A lot of intense research has been done but remains unread and unpractised on the library shelves. Hopefully research of a more interactive nature, tooted in the experiences and learning of industrialists will have a greater contribution to make to the dynamics of the process.

Communication has a major part in the adoption process and to a extent the diffusion of an innovation can be considered a communication process. This is also true of the intra-firm diffusion process as the adoption decision becomes part of the company and transformed into a tangible outcome. In the process of interpreting and sharing the information concerning an innovation, it is clear that the decision-making unit will be influenced by several possibly conflicting sets of goals - organisational, interpersonal and personal - such that if we accept a behavioural model of the firm as proposed by Cyert & March (1963) then it would be surprising if any single optimisation formula, such as is implicit in the economists' model, would prove an adequate explanation of organisational adoption and implementation behaviour. Cyert & March hypothesised that the innovative behaviour of an organisation will differ depending upon whether it perceives itself as successful or unsuccessful. Knight (1967) also sees innovative behaviour as a response to one of two kinds of situations which are roughly parallel to Cyert & March's successful or unsuccessful situations. He terms them as 'slack' or 'distress' situations.

In 'slack' conditions the firm perceives itself as being successful and conducts a wide search for new ideas. Knight suggests that organisational members try not to disturb the internal structure and operation of the organisation in slack conditions, but often a new group of specialist personnel is brought in, and in applying their skills and knowledge these people often bring about innovations in the organisational structure and people, although these represent changes that the company had not planned on.

In 'distress' conditions, a firm perceives itself as unsuccessful and internal changes will occur rather than changes in products or processes. The firm will emphasise cost-reduction projects. Under conditions of mild distress he suggests that the organisation behaves logically, adopting moderate rather than extreme steps or great alterations.

I respect both these points of view - they seem logical enough and innovative behaviour is in some way tied up with a firm's perceptions of its own success - but I think it is a less straightforward relationship than Knight has suggested.

In fact, when looked at more closely Knight's two categories seem to have the same result. In slack conditions new personnel are brought in resulting in organisational change: in distress conditions internal changes of a cost reducing nature occur. This often means moving or reducing numbers of personnel, changing their jobs and their relationship to others - in other words resulting in organisational change. The fact that from outside the firm one change seems more extreme than the other is irrelevant. Within the firm change is change, and each kind of change will being with it consequences of one kind or another. The important thing is how far these consequences are considered as unavoidable (desirable or otherwise) and how far they can be anticipated and planned for. Success in managing the innovatory process requires accompanying planned organisational innovation or at least the ability to recognise change and learn from it. As said before innovation implies learning new organisational behaviour.

Also, in Knight's terms, the company I was in, was operating under both slack and distress conditions. Management perceived the overall 'successful' trend abd brought in new personnel (specifically the Industrial Engineer and the Production Engineer) resulting in organisational change i.e. new systems of requisition and the setting up of an Industrial Engineering Department. They were also aware of the case in which the company could lose its successful image and operated according to distress conditions, i.e. continually trying to cut costs through time/energy/material/labour saving exercises. (cf Smith-Petersen profile.)

It isn't so easy in practice to distinquish between slack and distress. Obviously at extreme ends of the continuum the difference is clear, but many organisations are caught in the middle somewhere, oscillating almost daily from success to distress. The overall trend may be upward and successful, but in the day to day minutiae of organisational affairs perceptions of success can change very quickly. As one manager said:

"It all depends ...."

illustrating again the frustrations engendered by generalistic theories, and supporting the contingent specific approach.

There can also be conflicting perceptions within the same company. For instance, management perceived the firm's success in terms of full order books. In order to keep the books full and to ensure that more work could be taken on they introduced route cards as a method of ensuring a more even flow of work from section to section. Success on the shop floor however was measured in terms of having stock-piled a little mound of work to be done next to your bench. With the introduction of route cards these stock piles tended to diminish. The people on the shop floor interpreted this (especially in these times of high unemployment) as the first signs of a shortage of work - with all the ensuing fears of lack of overtime or redundancy - and tried harder to hoard work, giving them the visible security they needed. Try as they might management could not convince them of full order books. So two sets of people had perceptions that were in direct conflict and which caused them to pull against each other.

Knight's proposals also lead naturally to the conclusion that successful firms make more radical and more frequent product and process innovations than unsuccessful firms (radicalness being the degree to which an innovation departs from the present operation of the existing organisation). This may be so, and at the beginning of my research I thought the degree of radicalness might be important, but as research progressed I found that this was largely immaterial and that what mattered was how the process of innovation was handled, regardless of the type of innovation. Associations of distress or slack do have implications for the innovation process however, particularly with regard to time pressure. If the firm is seeking to change in order to survive it is more likely to adapt existing procedures than to adopt the more risky approach of bringing in new products or processes, and this had application for the ensuing implementation. The shortage of capital, resources and time will often mean that the process is hurried; there will be less inducement to carefully examine what changes the innovation will make and how these changes can be planned and prepared for. I think we can all recognise the temptation, particularly when time is short, to concentrate on 'content' rather than 'process'.

In connection with perceptions of slack and distress Carter and Williams (1957) isolated 24 characteristics which they claim are present in progressive firms but absent in non-progressive firms. (Ex. 1) They suggest a number of factors which are likely to influence positively managerial attitudes towards new technology incorporated in products and processes, butagain I find their conclusions disturbingly generalistic with not a great deal to say to a practising manager.

A number of other studies suggest a positive association between certain forms of organisational structure and a firm's overall receptivity to innovation. Most of these studies build on the findings of Burns & Stalker, first published in 1961. Prior to this, however, Joan Woodward (1958) in a study of the organisational structure of 203 firms, found that those using similar technical methods had similar organisational structures and that there was a relationship between successful performance and the organisational structure within each industry.

EX. 1

Characteristics present in technically progressive firms and absent in unprogressive firms. (Carter & Williams (1957))

1. High quality of incoming communication
2. A deliberate survey of potential ideas
3. A willingness to share knowledge
4. A willingness to take new knowledge on licence and to enter joint ventures
5. A readiness to look outside the firm
6. Effective internal communication and co-ordination
7. High status of science and technology in the firm
8. A consciousness of costs and profits in the R & D departments (if any)
9. Rapid replacement of machines
10. A sound policy of recruitment for management
11. An ability to attract talented people
12. A willingness to arrange for the effective training of staff
13. Use of management techniques
14. Identifying the outcome of investment decisions
15. High quality in the chief executive(s)
16. Adequate provision for intermediate managers
17. Good quality in intermediate management
18. An ability to bring the best out of managers
19. Use of scientists and technologists on the Board of Directors
20. A readiness to look ahead
21. A high rate of expansion
22. Ingenuity in getting round material and equipment shortages
23. An effective selling policy
24. Good technical service to customers

Following separate studies of two companies, an engineering concern with very large developmental interests, and a rayon mill, Burns identified two types of management practice almost diametrically opposed to each other. The authors relate that neither of these practices had been consciously adopted by management but none the less both practices appeared to operate effectively. They say:-

> "... one system to which we gave the name 'mechanistic' appeared to be appropriate to an enterprise operating under relatively stable conditions. The other 'organic' appeared to be required for conditions of change."

See Ex. 2 overleaf.

They take this further in their study of twenty electronic firms where they tried to elucidate factors making for successful and unsuccessful innovation - saying that unsuccessful firms fail to adapt their organisation structure and management style to meet the demands of technological change (i.e. they are mechanistic) and that successful firms do so adapt (i.e. they are organic). They also point out that there is a relationship between the different organisational structures and the norms and behaviour of members of the system: low structure appears to be appropriate for a changing environment and high structure for a stable environment.

The main implication of Burns & Stalker's work in the present context is that organic systems are better able to accept change in the form of new technology than are mechanistic systems. Hence firms whose subsystems are relatively formal are likely to be slower to adopt new technology.

What are the implications of this for the process of implementation? As we have seen it is suggested that organic firms are more likely to adopt innovations successfully; that they are better able to adapt to change because of relatively informal low organic structure.

EX. 2 Mechanistic and Organic Systems (Burns & Stalker 1961)

Mechanistic systems are characterised by:-

- the specialised differentiation of functional tasks into which the problems and tasks facing the concern as a whole are broken down.
- the abstract nature of each individual task, which is pursued with techniques and purposes more or less distinct from those of the concern as a whole.
- the reconciliation for each level in the hierarchy of these distinct performances by the immediate superiors who are also in turn responsible for seeing that each is relevant in his own special part of the main task.
- the precise definition of rights and obligations and technical methods attached to each functional role.
- hierarchic structure of control, authority and communication.
- a reinforcement of the hierarchic structure by the location of knowledge of actualities exclusively at the top of the hierarchy, where the final reconciliation of distinct tasks and assessment of relevance is made.
- a tendency for interaction between members of the concern to be vertical, i.e. superior/subordinate.
- a tendency for operations and working behaviour to be governed by the instructions and decisions issued by superiors.
- insistence on loyalty to the concern and obedience to superiors as a condition of membership.
- a greater importance and prestige attaching to internal (local) than to general (cosmopolitan) knowledge, experience and skill.

Organic systems are characterised by:-

- the contributive nature of special knowledge and experience to the common task of the concern.
- the 'realistic' nature of the individual task which is seen as set by the total situation of the concern.
- the adjustment and continual re-definition of individual tasks through interaction with others.
- the shedding of 'responsibility' as a limited field of rights, obligations and methods. (Problems may not be posted upwards, downwards or sideways as being someone else's responsibility).

- the spread of commitment to the concern beyond any technical definition.

- a network structure of control, authority and communication. The sanctions which apply to the individual's conduct in his working role derive more from presumed community of interest with the rest of the working organisation in the survival and growth of the firm, and less from a contractual relationship between himself and a non-personal corporation, represented for him by an immediate superior.

- omniscience no longer imputed to the head of the concern: knowledge about the technical or commercial nature of the here and now task may be located anywhere in the network; this location becoming the ad hoc centre of control authority and communication.

- a lateral rather than a vertical direction of communication through the organisation, communication between people of different rank, also, resembling consultation rather than command.

- a content of communication which consists of information and advice rather than instructions and decisions.

- commitment to the concern's task and to the 'technological ethos' of material progress and expansion is more highly valued than loyalty and obedience.

- importance and prestige attach to affiliations and expertise valid in the industrial and technical and commercial milieux external to the firm.

Differences in structure occur within one system in relation to the different tasks of the subsystems – differentiation is a product of the number of tasks or subsystems within an organisation. This would presuppose that small, relatively uncomplex organisations dealing with little variety would be more successful in adopting innovations. This may be the case (and may be why there is such an emphasis on small businesses at the moment) but the converse is also true, that small firms dealing with small markets of limited range have also restricted their interest in innovation. As organisations grow in size (and this seems almost as inevitable as human growth) so there is increasing vertical and horizontal differentiation. Research has shown (Lorsch 1965) that while differentiation is necessary for subsystem performance, the overall aim of the organisation is jeopardised by a lack of co-ordination and integration demanded by the interdependence of the various subsystems. This becomes clearer if we examine the polarities of integration and differentiation within an organisation on three levels – individual, group and organisational.

(i) <u>Individual Level</u>

At this level problems centre on issues like motivation and alienation which account for the degree to which the individual feels integrated with the organisation. Secondary consequences of poor integration include a reluctance to take risks or to strive for excellence.

Improvement strategies could involve a more open communicative climate where individuals feel they have access to information and decision making – where they 'count'. In connection with this, for individuals to be able to relate their creative contribution to a real outcome is an important factor, as is a greater understanding or closer contact with the market/user. Also an encouragement of external contacts via conferences, visits, discussions, relevent journals etc. – really a broadening of the context of work.

(ii) Group Level

Conflict - a symptom of lack of integration between groups - has been well described: as French and Bell (1973) put it:-

> "when there is tension, conflict or competition between groups some very predictable things happen; each group sees the other group as an 'ememy' rather than as a neutral object: each group describes the other group in negative stereotypes: interaction and communication between the two groups decreases, cutting off feedback and data input between them: what intergroup communication and interaction does take place is typically distorted and inaccurate: each group believes and acts as though it can do no wrong and the other group can do no right ..."

There is a lack of trust and failure in co-ordination and communication. Basically these problems are concerned with a mismatch of expectation evinced as demanding too much or the wrong thing from each other, and a failure to understand the priorities and pressures of others. The relevance of this kind of problem is clear if we view innovation as a process involving high levels of co-operative activity. Once again, integration represents the dominant need through getting people to recognise their interdependence and need to work effectively together. This is bound up with valuing different contributions and clarifying goals and objectives, and a more effective climate of communication.

(iii) Organisational Level

Indications of poor integration at this level include structural ambiguities and ambiguity of role: issues of control, accountability and responsibility. A demarcation of responsibility is often observed and boundary definition so that as soon as a project reaches a transfer point it becomes another's responsibility with no continuity between them; 'buckpassing' and suspicion of involvement: a withdrawal into isolated positions and a minimising of information flow: keeping all contacts on a formal basis.

What is required is role clarification and a more global view of the organisation – its aims and objectives. A sense of 'pooling resources' towards a common goal. These issues can all be viewed as the consequence of lack of integration. This causal relationship may be direct, as with groups competing unproductively with one another, or it may be indirect, as with low levels of risk-taking arising out of a climate in which people have little trust or confidence in others; this climate is itself the consequence of poor integration.

But going back, 'organic' does not equal differentiated in the narrow sense of compartmentalised; on the contrary I interpret the term 'mechanistic' in this insular light. Organic essentially means ready and able to adapt, and Burns and Stalker lay great emphasis on the network of communication and interrelated responsibility characteristic of organic systems. This is as important for successful implementation as it is for successful adoption. Other studies confirm this view, e.g. Myers and Marquis (departmentalism is an obstacle) (1969), Roberts (1969) Rogers and Shoemaker (1971), Lawrence & Lorsch (1967). This leaves us with the problem of how to promote innovative behaviour through organic systems. Schwartz and Goldhar (1975) in their studies of prizewinners in innovation point to some positive ways of encouraging 'organic' thinking. They suggest easy access to information, a free flow of information in and out of the organisation, seeking and using 'new' (externally developed) information, rewards for sharing, rewards for risk-taking, rewards for accepting and adapting to change, and encouragement for mobility and interpersonal contacts.

The emphasis on rewards smacks of behaviour modification, but recognises that structures cannot be effectively changed without a change in <u>attitude</u> of the people involved. The existence of formal integrative devices to cope with the problem of differentiation is evident when looking at organisations - committees, liaison departments, maktix management etc.

The 'centrifugal' tendency (Child 1977) of organisations means that beyond a small size, where informal integration is possible because everyone knows everyone else and share common goals (though this is quite a big assumption) there will be a need for formal solutions to the problems created by differentiation - or at least a recognition of the problems and a willingness to overcome them. The problems often have the following characteristics:-

(i) communication links are tenuous; people tend to communicate within, rather than between, departments.

(ii) there is identity with one's own department at the expense of integrating with other groups.

(iii) different tasks and process, time limits etc. harden into 'them and us' attitudes.

(iv) disputes over resource allocations.

(v) variations in norms and values between groups.

Lorsch says that integrative devices to deal with these problems are of two types - structural and processual.

> "Structural devices are major organisational innovations. They involve the differentiation of a separate unit that has as one of its functions the integration of the basic subsystems. The processual devices may be either temporary project teams or longer term cross-functional co-ordinating committees, but in either case they provide the setting in which the process of integration takes place."

In 'mechanistic' organisations operating under stable conditions, integration can be performed by standardised procedures, regular meetings and referral of difficult decisions upwards. Frequently it is found that in order to introduce another innovation a new sub-unit or even a new organisation is developed, creating structural innovation to introduce another innovation. This can be seen in the work I did, where the setting up of a requisition system for tooling was a forerunner of the New Product Development Group. The Quarterly Meetings with management were also a structural innovation to aid better communication and integration. The danger here is of course that the very structures set up to promote integration become divisive in themselves (cf 'matrix' management). This integration by standardisation, to use Thompson's terms (1967), involves the establishment of rules and procedures which channel actions of differentiated units into a consistent pattern. But the existence of a pattern does not automatically mean there is integration; integration implies understanding and communication.

In the case of a complex and demanding environment, which requires rapid decisions and frequent adaptation involving different people in different relationships at different times, these procedures will be found insufficient. They become palliative, treating symptoms, rather than curative and reaching the deep roots of the problem. Since the rate of change and the complexity of the problems faced are increasing for most growing organisations, a knowledge and achievement of progressively deeper ways of enabling integration becomes a major priority. Thompson's (1967) third category of integration touches on this. He suggests integration by mutual adjustment involving a direct transmission of information between people and the mutual adjustment of their actions in the light of that information. This is comprehensible and rationally agreeable; the problem is how can it be achieved? It is not so easy in practice: the implication is 'do this and it is done'; but, as suggested before, routine practices (i.e. structures) can only change effectively where there is a change in attitude. It is not as easy as forming another committee or arranging another meeting;

organisational members need to learn about themselves and their groups and subsets and how they interact and what effect this has on their ability to adapt to and accept change. Buijs (1981) suggests consultants in innovation to help learning; Bessant (1978) advocates the role of an integration specialist to enable this process. When I entered the company to study the innovation implementation process I was almost unwittingly cast in the role of communicator/integrator. This was not through any merit or predilection of my own (although I was willing to take the role as well as it being offered). Being an outsider I was able to see more clearly the totality of the situation, and having no personal invested interest was able to help people to see that wholeness for themselves; to see themselves and their interactions as part of it – to identify and anticipate problem areas in the innovation process and to learn from their experience of taking part. I examine my role more analytically later on. Within the firm itself it is usually recognised that there is a subset of individuals who are responsible for making specific adoption decisions. Clearly, therefore, the composition and nature of this decision making group and the process by which it arrives at decisions is of major interest not only for the adoption of an innovation but also for the way in which it is diffused throughout the organisation. Decision making also provides a relevant example to examine the importance of people's interactions for the innovation process and how they can learn from their interactions.

Recognition of this underlies a study undertaken by Ozanne and Churchill (1968) in which they examine the adoption of a new automatic machine tool by a sample of industrial firms in the mid-west of the United States. In the case of this study the sub-group is identified as the firm's buying centre and the focus of the research is upon the interactions between members of this group in arriving at a decision. Thus this research represents a clear break with the economic research tradition as exmplified by Mansfield et al in that it is no longer concerned with the firm as a single unit but with a decision making group within the firm.

It might be helpful here to briefly review some theories of decision making which may have application to the present study.

Many disciplines have informed theories of organisation decision making. These include:-

(i) pyschology - Collins & Guetzkow (1964); Edwards & Tversky (1967)

(ii) public administration - Mailick & Van Ness (1962); Lindblom (1959)

(iii) a political sciesce approach - Dahl (1961); Hawley & Wirt (1968)

(iv) an interdisciplinary framework - March & Simon (1958); Cyert & March (1963); Gore & Dyson (1964)

(v) mathematical/economic approach - Cooper (1958); Wagner (1969)

(vi) game theoretical work - Van Neumann & Morgenstern (1944); Cross (1969)

(vii) political/power process - Mumford & Pettigrew (1975); Pettigrew (1973)

These again fall into two main classess - the normative mathematical/ economic theories and behavioural theories. Cyert Dill & March (1967) draw our attention to this when they say that the first category is derived from economics and treats business behaviour as a rational attempt to maximise profits. This approach implies that firms have accurate information on the costs to be incurred and the benefits attainable through adopting particular courses of action, and that decisions are made on the basis of this information.

In recent years a number of attempts have been made, notably in the field of operations research, to put decision making on this more rational quantitative basis. Some specific tools are linear programming, dynamic programming, game theory, probability theory. These can be used for constructing mathematical models which mirror the important factors in the management situation to be analysed, and the manipulation of such models can provide a manager with much useful information on which to base a decision. Byrnes & Chesterton (1973) give some examples of this approach applied to innovation and new venture decisions. The difficulty with decision making of this kind is that it takes place under conditions of high uncertainty. Baumann (1967) argues that the 'perfect' planning process is an impossibility. Thus rational 'optimising' or 'maximising' approaches will tend to be too simplistic; as Mumford & Pettigrew (1975) say:

> "The danger with this approach is that of over-simplifying complex problems in order to make them amenable to mathematical analysis, for in doing this all contact may be lost with the realities of the problem and of the environment in which it is occurring."

Simon's (1965) notion of programmed and non-programmed decisions is valuable here. The more programmable (and regular non-programmed decisions become programmable to some extent) the decision, the more susceptible they are to quantitative approaches. Most managers and organisations will attempt to order and accelerate their solution by developing systematic procedures for handling them. Perhaps what is more important is that managers should see non-programmed decision-making as a vehicle for learning about their own decision-making processes, or a means of building into the organisation for the future, processes of understanding which become adaptable to the individual decision situations that they find themselves in. This learning/feedback/adaptive approach will become more significant if present trends of increasing technological innovation persist.

Theories of decision-making suggest that it involves a choice between a set of alternatives, each of which produces a set of outcomes which are evaluated. Simon and his associates (1959) see human decision-making behaviour in organisations as encompassing searching, choosing and problem solving, but with these activities subject to human restrictions such as the limited amount of information that a human being can handle. This is the notion of 'bounded rationality' where man does not usually seek for optimal solutions, but accepts solutions which solve a problem satisfactorily, although not necessarily in the best available way. This restricted behaviour is known as 'satisficing' and is in contrast to the 'optimising' approach of the economist.

Etzioni (1968) too criticises the traditional approaches to decision making, but whereas Simon's solution is to satisfice or be as rational as you can, Etzioni puts forward a view of 'incrementalism' - small changes involving low risk. His solution is what he calls 'mixed scanning'. Fundamental decisions based on the rational model are separated from small decisions based on the incremental model, but he also stresses the fact that 'universal' theories of decision-making have serious shortcomings as they do notcconsider the forces generated in the culture in which the decision has to be taken. Braybrooke & Lindblom (1963) also point out the little account that is taken of the closeness of the relationship between facts and values when decisions are being made. Psychologists (e.g. Festinger 1962) suggest that various ego defence mechanisms can produce commitment to severely sub-optimal decisions via a process of 'unconscious rationalisation'. Other theorists e.g. Cyert & March (1968), Strauss (1962) and Pettigrew (1973) introduce the idea of power mobilisation and exercise to influence decision outcomes.

The innovative decision - a type of non-programmed decision - is our major concern. Knight (1967) defines it as:-

"the adoption of a change which is new to an organisation and to the relevant environment."

Such decisions contain major elements of uncertainty. As mentioned before Knight sees the innovation decision as a response to two kinds of situation - slack and distress.

Most writers agree that there are different ways of approaching the adoption decision, in particular:-

(i) authority decisions - these are the most prevalent within industry and represent unilateral decision by authority figures. The essential characteristic of this approach is that it involves minimum participation of the adoption unit in the decision process. (See Taylor (1911) ; Gouldner (1964))

(ii) 'marketing' decisions - this is an attempt to modify authority decisions by consciously 'selling' the decision to the adoption unit: it is still taken unilaterally and without participation.

(iii) consultative decisions - this process involves some interaction with the adoption unit in that their opinions, ideas, suggestions are sought - but the decision is still taken at another level.

(iv) participative decisions - this process also involves a two-way interaction between those involved in accepting it, but it is more on the lines of problem solving. The adoption unit is widely involved in identifying, evaluating and deciding activities.

There are advantages and disadvantages associated with each of these approaches e.g. authority decisions are most effective for organisations in terms of speed and formal acceptance. However, there is a growing interest in the innate resistances to change which can be generated, and in terms of successful decisions which mobilise support and commitment, the participative approach is generally agreed to be the most effective. Mumford summarises the responses engendered by these decision approaches. (Ex. 3)

In the initial phases of my research I saw it as important to classify innovations by the degree to which they departed from the present operations of the company and to then link this with suggested appropriate organisational structure and decision making style. This seemed to me to encapsulate the innovation process. I still believe this has relevance for understanding the elements that make up the innovation implementation process but as research progressed this model become largely redundant. (See Chapter VI)

Most of the innovations studied fell into one of two categories:- that is either -

5 - New Product, New Technology but existing Market, e.g. Oxford fixator, Gardener Kyphosis Distractor.

or

7 - Present Product, New Technology and existing market, e.g. Smith Petersen nail.

An appropriate organisational change was suggested followed by an appropriate decision-making process. In actual fact what was discovered was that it didn't really matter what type of innovation was being considered, what was essential, and what underpinned each situation, were the people actively involved with the innovation: - the local structures that emerged of individuals concerned with decision making and overseeing of the project: how they related to each other and how they eventually related to other members in different parts of the organisation. To put it another way, innovation involves a decision making process. That is there ate a series of 'choices leading to action', to be made by those in the organisation. Some of these choices involve the entire organisation and are made by the top echelons (often

EX. 3

Alternative Approaches to New Technology Adoption (Mumford)

1. **Command approach:**

Stimulus → Response

Authoritarian communication — Unfavourable interpretation

(low-power group)
Acceptance with anxiety
Implementation
Alienation/ Separation/ Non-Cooperation

(high-power group)
Non-acceptance
Negotiation
Compensation — Compromise — Withdrawal
High-cost Implementation

2. **Marketing approach:**

Stimulus → Response

Selling communication — Favourable but incorrect interpretation

Acceptance

Implementation

Disillusionment

Conflict/Alienation

3. **Participative approach:**

Stimulus — Response

Democratic communication/ Request for ideas and assistance — Correct interpretation

→ Participation

Acceptance

Implementation of jointly conceived system the initial adoption decisions). Some involve smaller parts of the entire system and are made further down the hierarchy (often to do with implementation). In any situation where there are many decisions to be made by different people, different styles are likely to be employed.

Also, if innovation is in fact largely a process of more or fewer small-scale decisions pyramided into each other, then it is unlikely that much 'rational' decision making enters into the process. Political juggling, power struggles, mutual adjustment of interests will all assume greater or lesser positions. It is generally true that the smaller-scale a decision seems to be, the less carefully it is likely to be reviewed and analysed (Lindblom 1959). Therefore it is probably true that much of the decision making in relation to innovation processes is more similar to 'satisficing' than to the rational models- despite the fact that major organisational commitments for the long run may be entailed.

It was found that recognition of this aspect of the innovation process had been largely overlooked (or it was too risky to acknowledge it openly and so it had been shoved under the carpet) both within the firm and in its liaisons with external members of the group or outside companies. A lot of emphasis was placed on the hard end of technology, but not much importance was given to understanding and managing the human side. Yet as the research proceeded and these issues were made more explicit and understandable, group members became aware of their importance (or were allowed to acknowledge their importance) and were keen to become skilful themselves in process type issues such as communication, feedback etc. It became legitimate and valuable to discuss the meaning of data, <u>and</u> the nature of the interactions both of the present situation and of the innovation situation. My role of integrator/communicator was gradually taken over by members themselves. It is important to a theory of implementation however to recognise that decision making processes which may generate adoption decisions or determine the way events move, are not simple linear sequences, but complex interactive patterns.

Earlier, implementation was defined as the process of actually doing the innovating. In the context of the analysis of organisational innovation, implementation models describe the process whereby the innovation decision is put into action and diffused through the relevant members of the organisation. Such models are much less well developed than adoption models. Many analysts (and managers) have tended to ignore the problem of implementation, assuming that any variance in the innovation after adoption is a form of error to be corrected rather than seeing that adoption is only the beginning of an implementation process which can lead to widely differing kinds of outcomes. Research into implementation focusses on the sequences of changes which occur in organisations when new ideas are introduced and on how methods of communication and decision-making affect both these changes and the innovation idea itself.

There seems to be no single theory of implementation but rather a series of insights into the dynamics of what happens after adoption. Implementation as an analysable variable in its own right is first described by Pressman & Wildausky (1973) in their study of the activities of the urban redevelopment programme in Oakland. They observed that there was to date almost no systematic study of what happened organisationally after a particular policy decision was taken. They note specifically that, within the political context they studied, those who made the policy were not those who had to carry it out; the same point is probably applicable to most organisational settings - certainly it was so in the company I worked with, and it is understandable that it should be so, where job boundaries are clear cut and areas of responsibility are clearly marked out. But this just throws into greater relief the importance of recognising and understanding the way in which the two parts are interconnected and how the change over from policy to practice is achieved.

Pressman and Wildavsky comment further on the large number of specific decisions which had to be made to implement the legislation (confirming the pyramidical view mentioned earlier), and the number of points at which almost any of these decisions could sway the programme in a different direction. They define implementation as the process whereby meaning is given to a policy decision which has inherent within it a very large number of possible meanings without one necessarily dominating. In practice, however, for each participant in the process, one meaning does dominate, according to their perceptions of the situation and their particular interests at the time, as mentioned before, Hyman and others (1973) also emphasise the importance of the political interaction of different actors in the situation and the ways in which the ideas of the programme are redefined, as time passes, by different actors to suit their own purposes. They suggest that as the implementation process becomes involved with more people, changes in programme shape are almost inevitable. Implementation becomes a process of adjustment, compromise and accommodation of different interests. Unless this is recognised and catered for, particularly by those in power positions who have perhaps initiated and confirmed the primary adoption decision, resistance breakdown and even rejection can follow. An example can be provided from my own research in the Smith Petersen Nail Profile. Briefly, to save time in producing the nail it was arbitrarily decided to reduce the standard of quality - 'just a little' thought top management, 'reduce the final polishing time'. This seemed rational and easy: but for the glazer, who had spent twenty odd years faithfully polishing each piece to a high quality standard, this proved well nigh impossible to do. He was confused as to how much could be left undone, and it hurt his pride in his work to actually turn in what he considered to be sub-standard work. It also reduced his self esteem and the importance he had always attached to his work and the importance he had felt <u>others</u> attached to his work. More time was lost sorting this out than in the initial production run-through time – and there were the more lasting damaging effects of conflict and upset among the workers – all due to a basic lack of understanding of how to cope with other participants' invested interests.

Frequently innovations are a response to perception of effectiveness and the criteria which generate these perceptions – e.g. Is the firm economically competitive? Do we need to reduce manning levels? Can we improve quality? Can we make this another way so that people feel more involved with the work? etc. (This has been mentioned in relation to perception of slack and distress conditions.) It is therefore an implicit reflection of the underlying value-structure of the organisation – a reflection which may become explicit when problems surface and changes take place. Clearly these concepts of the management of innovation, highlight the behavioural issues involved.

Overall the management of innovation is well represented in the literature but there tends to be a great deal of similarity in approaches offered. Diffusion of knowledge about what effects innovation success and failure has been widespread but there is still a lack of guidance in the important area of behavioural variables – in particular the sources of resistance which lie in the behavioural area. It is widely held that the bulk of variation in the innovation process is associated with the human element, but as just indicated most of the literature on the management of innovation does not attempt to consider this element in any detail. It _is_ possible to glean some information on this aspect in looking through various studies, but they are often included as 'asides' and are of a very generalistic nature. I have found that general statements such as 'economic, social and psychological factors influence innovative behaviour in organisations' (Chakrabati 1973) are all very well but do not actually help the practising manager in his situation. He needs an interpreter - someone to help him understand the generalities in his own context - and who can help him apply his understanding.

Over and over again in examining the literature on innovation I have been struck by what I could call 'the great divide' between idea and practice. This is typified in many ways which are highly relevant to the central theme of this thesis. First there is the divide between academic research and practical management: then, more explicitly, between policy and practice: this spills over more particularly in the area of innovation into the divide between innovation idea and innovation reality - adoption and implementation. In between lies the grey area of how to manage the transition from one to the other most effectively.

More recent research has pointed to the importance of the people involved in the process and the skills of communication and integration needed to enable the process - though those skills have been usually reserved for those in management positions.

Havelock's work (1977) notes the crucial role of the intermediary change agent, who must translate the basic innovation into terms relevant to the organisation. The great significance of individuals and their ability to advance or retard the process is central to this tradition and is also particularly stressed in 'human-relation' analyses such as that of Argyris (1965). The necessity for multiple strategies involving different approaches for different parts of the organisation is stressed by Rowe & Boise (1974). Bessant (1976) advocates the role of an integration specialist.

Attempts have also been made to develop a contingency approach to management – that is that the demands of different operating situations will require different patterns of management. Cetron and Goldhar (1970) devdop such a model as does Eveland (1977).

Eveland suggests a process model which attempts to overcome the dichotomy which has developed between adoption and implementation studies, by putting both processes in the same overall context. The key notion developed is that the process of innovation is essentially the process of specification of just what shape a general innovation idea will take, and what the reactions of the organisation to it qill be, through a series of sequentially-occurring areas of decision making.

Five general decision-making stages to the process are suggested – each characterised by a particular range of decision to be made at that point.

(i) <u>Agenda setting</u>:

the stage at which general organisational problems are defined

(ii) <u>Matching</u>:

a problem from the agenda and an idea for an innovation to meet that problem are brought together

(iii) <u>Redefining</u>:

characteristics of the tool derivable from the innovation idea, and the dimensions of the problem, are defined in terms relevant to the organisation and to each other.

(iv) <u>Structuring</u>:

organisational structures and processes related to operating the innovation are defined

(v) <u>Interconnecting</u>:

relationships between the innovation and other parts of the organisation and its environment not directly involved in the earlier stages are clarified and elaborated.

As Eveland points out, the easiest steps to ignore are redefining and interconnecting. In redefining the invention/problem set must move from being the property of a single individual or small group, to being the property of a substantial group within the organisation, if not of the entire organisation. Essentially this is a process of communication – a search for the appropriate vocabulary to describe the innovation to parts of the organisation not already sharing it (cf Katz and Kahn 1966 coding schemes) and also the appropriate means for doing so.

The process of interconnecting is partly a political process of coalition-building within the organisation – and is also a continuation of the process of redefining. In the course of developing relationships outside the innovation unit, its personnel are required to rethink and redefine their innovation further, in terms relevant to parts of the organisation which may not have been involved in the original redefining process. This can be hard to do particularly if you are receptive to feedback which may challenge your ideas or indicate changes that could be made. It is comparatively easy to share information but less easy to adapt your own ideas without feeling threatened. An example of this from my own research is in the introduction of route cards, where great attempts were made to smooth their intoeduction with the foremen by a sharing explanatory meeting, yet where the foremen were left with a feeling of uninvolvement and lack of commitment because they had been unable to contribute to the making up of the card. (It had not even been thought that they might want to contribute.)

If these two key conceptual stages of redefining and interconnecting are omitted or slighted, the overall effect could be an innovation which is largely peripheral to the rest of the organisation – and therefore probably dispensable.

The ease with which a group can make one of its issues part of the organisational agenda will vary considerably. If the group is part of the 'dominant coalition' (Thompson 1967) or representative of the 'owners' of the organisation (Becker and Cordon 1966) the chances are strong, it is suggested. I believe this to be true for adoption but not so logical or inevitable for successful implementation. Implicitly every innovation has a sponsor and a group of back-up people interested in it but they still have to be skilled in communicating and promoting the innovation in the organisation. Skills of interconnecting and integrating do not belong as of right to the dominant coalition or those possessing most hierarchical power, although this would seem to be a general belief of many management writers.

Integration as a functional specialism has been recognised already in a piecemeal fashion - most manager's job descriptions include aspects of co-ordination, planning and liaising. Galbraith (1977) takes this further in his work on organisational design when he puts forward ideas for a new integrative role for managers:

> "The managers who occupy these roles do not supervise any of the actual work. Instead they assist those who do, so that the work is co-ordinated in the best interest of the organisation. This is the general manager's job, but he does not have the time when the organisation tasks become diverse and uncertain. The integrator becomes a little general manager with respect to the particular decision process for which he is responsible."

Sayles & Chandler (1971) in their study of NASA focus on the new management approaches which are needed, particularly in large scale organisations, though problems of integration are also experienced by smaller organisations as a response to external complexity. Needs for integrative process type skills are also evinced where "a high degree of interdependence is combined with demands for autonomy and organisational and professional freedom." Instead of concentrating on the traditional aspects of managerial behaviour - e.g. planning, directing, controlling, - more importance is attached to things like bargaining, confrontation, intervention, coaching, negotiating etc.

Other recent research thinking on the nature of management (e.g. Mintzberg 1973, Stewart 1976) suggests that management is essentially a fragmented activity carried out under pressure. Typically problem solving is characterised by a pragmatic approach and solutions based on strategies and rules of thumb developed from previous experiences, so that managers may have difficulty in getting close enough to integration problems to form an objective and realistic diagnosis, or they are too close to some problems to be able to evaluate objectively the issues or the best response to them. With innovation this can take the form of increasing psychological commitment to an idea so that resource allocation decisions appear not as a new set of decisions to be made, but rather as a simple and logical extension of a series of implicit commitments already made. Simon (1976) has commented on the strong tendencies toward "following up sunk costs" which exist in organisations.

Equally it is suggested that they are too far removed from some problems to get adequate feedback - they get a distorted story if they get one at all (or it is perceived as such by some organisational members). They are too far removed from operational levels to enable implementation and understanding of strategies aimed at reducing integration problems, and have little time for reflection so that symptoms rather than root problems are dealt with. On top of all this (!) if they do get a correct diagnosis they will only have a limited repertoire of solution strategies not necessarily applicable to the actual contingencies of the situation.

This is probably an exaggeration of all possibilities, but for reasons of these kinds it may be that in activities like innovation processes involving high levels of complexity and change, management are facing problems that they are growing less competent to deal with.

This would logically suppose that the skills of importance in enabling the implementation of innovations - namely those of integration and interconnecting - should not be thought of as the prerogative of those in management positions, but that attention should be paid to developing these skills in managers and others at all levels who become involved in the innovation process. Belbin (1981), in his research on management teams, has suggested a number of team roles (eight to be precise) which are of importance in an effective team. It would seem that just as it is important for an innovation implementation team to comprise members having technical skills and knowledge so it is equally important to incorporate members who have preferred team roles of 'company worker, team worker and completer/finisher' - to use his terms. This shifts the emphasis slightly away from task and on to people and process - and would point to a learning process for those involved in team work of this nature in understanding their own and others role contributions.

This is what I recognise as a key element in understanding and facilitating the innovation implementation process. All the conclusions of research findings have a bearing on innovative behaviour in varying degrees for different people in different situations. The use to potential innovators in all this, is in being able to see themselves and others in these terms; - in being able to understand the reasons underlying actions etc. and to use their understanding to help with innovation processes of the present and in the future, - to analyse their learning and take it forward. As Sherwin says:-

"There is a learning process in the innovation sequence."

(1966 Report on Project "Hindsight".)

An interesting research project on the application of process consultation in innovation processes and with an emphasis on seeing the innovation process as a learning process is being carried out at the moment in the Netherlands. It is part of a Netherlands government programme to stimulate innovation called Project Industrial Innovation. I quote from a paper by Jan Buijs (October 1981) - the member of the PII team responsible for research and training.

> "The origins of this programme go back to the early seventies, when a Sappho-type study was executed in a specific branch of the Netherlands industry. The results of this study (Beckers 1974) were a number of factors which had a positive correlation with the innovativeness of the company. The main internal factors were:
>
> (i) an active innovation policy and a structured approach towards it
>
> (ii) an external orientation
>
> (iii) learning from the past
>
> (iv) an 'open' management behaviour
>
> (v) a positive attitude towards training and education."

It is interesting to note that the Dutch group were not content to rest with these general statements but went on in another study to find out whether external consultants could help firms to develop these factors, and if this then stimulated innovation. It was found that external consultants <u>could</u> do this by manipulating the factors (Beckers 1978). It followed naturally then to help firms <u>learn</u> to innovate through innovation consultancy.

Buijs confirms my emphasis on innovation as a learning process when he describes the stages of innovation through Kolb's learning model (1971). (The four stages also parallel Eveland's model described earlier.)

(i) Strategy: the organisation rethinks its present business and decides whether to continue to behave in that manner or whether to change. (Kolb Reflective Observation)

(ii) Conceptualisation: the organisation designs concepts of future business if it wants to change present business (Kolb Abstract Conceptualisation)

(iii) Development: abstract concepts have to be developed into tangible things - product design, prototype testing etc. (Kolb Active Experimentation)

(iv) Implementation: developed concepts should prove themselves in the market and become the new business activity of the organisation (Kolb Concrete Experience)

The cyclical nature of the model highlights the importance of learning, not only of the whole process, but within each stage as well. My active research has been in helping people learn from taking part in the innovation process so that they can take their learning forward to the next situation and in effect manage the innovation process for themselves. As Buijs says:-

> "From two basic assumptions of the innovation process as a learning process and a change process, came the conclusion that if a consultant wants to help a mature organisation with their innovation process, he or she has to behave as a process consultant, not as an expert consultant."

The research I have undertaken has shown a distillation of innovation situations into particular needs for co-ordination, communication, involvement, motivation etc. The skills can be seen as integrative process type skills - linking up the terminology of Bessant and Buijs.

In carrying out this research project I operated within the role of innovation process specialist and integrator. I was regarded by members of the firm as someone who was interested in and had knowledge of the process of innovation. In this respect I was 'expert' with something to contribute although I was in no sense regarded as a technical expert. The fact of my being in the firm researching the topic of innovation gave innovation a status and a tangible identity which had not been perceived or openly recognised before. As innovation became more recognised as a viable area for planning and monitoring within the firm so members became more identified themselves with the promotion of innovation (cf Myers 1968). My role of researcher/communicator seemed to complement Havelock's concept of the interdediary change agent and went some way to bridging the great divide between research and practical management. It was also one of my objectives to reduce my interventions through promoting learning in organisational members so that they would be able to manage the innovation process themselves.

The implications of this literature review are clear and give weight to the direction of my research. - Innovation is a specific instance of the management of change involving high levels of integration; but change cannot be truly effected without a parallel change in attitude. This implies understanding of the total process of innovation with an emphasis on communication and decision making and the implications for self, group and organisation. This in turn focuses on learning and the ability to advance learning into other situations.

So to reiterate, this research concentrates on:-

(i) the how of the process

(ii) the specificty of the approach and outcomes

(iii) the understanding and learning about the innovation process for the people involved.

Attention has been drawn to the value of learning from taking part in the innovation process and the best way of facilitating this learning. The innovation process was seen as a situation in which people were intimately involved and which could be facilitated by the presence of an integrator or innovation consultant. The next chapter details the methodology of the research and also examines the twin function of the role of researcher within the company.

Summary

An examination of different research approaches to the implementation of innovations – economic, structural, behavioural – has shown specific needs for skills of integration and co-ordination in managing what is essentially a process of change.

A lot of emphasis in other research has been placed on the hard end of technology and only token gestures made towards understanding and managing the human side – (this despite the fact that the importance of the human side had been mentioned as long ago as 1968 in Mansfield's work.) Many analysts have also tended to focus on adoption per se and to ignore the problem of implementation, rather than recognising that adoption is only the beginning of an implementation process which may lead to widely differing kinds of outcomes.

More recent research has pointed to the importance of the people involved in the implementation process and the skills of communication and integration needed to enable that process – to make the transition from idea to practical reality – though often these skills have been reserved only for those in management positions. The establishment of rules and procedures channeling differentiated activities into a consistent pattern has not automatically ensured integration. Integration implies understanding and communication: structural change has to be matched by a change in attitude – and this in turn indicates 'a learning process in the innovation sequence'.

All the conclusions of research findings have a bearing on innovative behaviour in varying degrees for different people in different situations. The key element for potential innovators is in understanding the processes underlying the whole implementation sequence, in analysing their learning and in applying their learning in future innovation situations.

CHAPTER III

Research Methodology

Introduction

A consideration of methodology must be central to any piece of research writing for it is only in the context of appreciating the close interrelationship between what is studied and how it is studied that any data or findings can be justified.

But beneath the surface study of the pros and cons of using particular methods at different times and places lies a much wider and deeper unknown which concerns the less easily captured epistemological questions also central to a programme of research. These incorporate philosophical issues such as the nature of truth and reality, the struggle for objectivity, the values underlying behaviour, the implications of the person and biography of the researcher herself.

It is not within the scope of this thesis to analyse these issues in any great depth, however a brief discussion is necessary both to give recognition and weight to the importance of these issues in relation to particular methods and to set the ideological base from which the research design sprang.

The values and assumptions intrinsic in the researcher's style are outlined through the stage of selection, entry and contracting with an organisation. This leads to a description of the main phases of the research followed by more specific details of methodological techniques - their validity and/or weakness. Finally there is a short recommendation for further research in this area.

The Nature of Knowledge

All traditional teachings answer the question 'How can I understand, or acquire better knowledge of other people and how they act?'

with roughly the same answer: 'You can only understand others to the extent that you know yourself.' Many examples could be quoted from all time and all parts of the world. I like this one in particular:

> "For pray do not .... spin your airy fables about moon or sun or the other objects in the sky and in the universe so far removed from us and so varied in their natures, until you have scrutinised and come to know yourselves. After that, we may perhaps believe you when you hold forth on other subjects; but before you establish who you yourselves are, do not think that you will ever become capable of acting as judge or trustworthy witnesses in other matters." Philo 1st Cent. B.C.

In expanding and deepening self-knowledge, 'inner' things, there comes a similar opening out of awareness and knowledge of 'outer' things. We can only know and recognise things in the world about us if there is some chord ready to vibrate and respond within us. As St. Thomas Aquinas says:-

> "Knowledge comes about in so far as the object known is within the knower."

Or Schumacher:

> "When the level of the knower is not adequate to the level (or grade of significance) of the object of knowledge, the result is not factual error but something much more serious: an inadequate and impoverished view of reality."

Similarly, this also means that, just because only those facts exist for us that we can respond to, we are not entitled to think that something real to another person but inaccessible to us does not exist or is a figment of their imagination. This starts to pose the questions 'What is truth? - Is there a whole truth? - If there is such a thing as a whole indisputable truth, whose truth is it? - Whose understanding would it be? - Of man? - Well which man? - Any man?'

These are thorny questions indeed! But how do they relate to research findings or data collection? Historically speaking, scientific data has been recognised as 'true' if it could be quantified - rigorously measured and re-applied. Scientific positivist methods leave no room for values, meaning, interpretations. But where people are involved this type of qualitative data assumes great importance. The view that only counts as 'real' inanimate quantifiable matter and holds as 'unreal' the subjective (and therefore scientifically non-existent) and invisible dimension of life must surely be absurd. It is difficult anyway to distinquish between fact and theory, observation and interpretations.

If something exists in the shadowy world of doubt and uncertainty, could it not be said to have more intrinsic interest and value than that which is beyond doubt?

> "If I limit myself to knowledge that I consider tbue beyond doubt, I minimise the risk of error, but I maximise, at the same time, the risk of missing out on what may be the subtlest, most important and rewarding things in life."
>
> "Increasingly more people feel it in their bones that the ever more successful solution of convergent problems is of no help at all - it may even be a hindrance - in learning how to cope, to grapple with the divergent problems that are the stuff of real life."
>
> (Schumacher 1977)

But it is not enough just to uncover these issues - to pose the questions and leave them as unanswerable (or only answerable within one's own personal framework of values and motives.) This would be for the researcher merely to assert 'It is true for me!' This is not an unworthy statement, but a limited one.

One of the first problems a researcher grapples with is:- 'How do I know that my ways of seeing and knowing are valid, i.e. right for this subject and task? Do they have any meaning or application outside of me? - If so, can others capture and evaluate that meaning?'

A concern with universality represents a painful longing for certainty and a value free position which is not practically tenable, particularly in the areas of social science or behavioural research. There is an insidious dilemma in the position of researcher between objectivity and subjectivity which has to be recognised and taken into account. Recognition alone is not enough.

It is useful to look at these two stances as polarities at either end of one continuum instead of in direct conflict. Each extreme can be typified: e.g. objectivity by the 'scientific' method - theorise, experiment, observe, record, conclude - and subjectivity by perhaps the most familiar example - the social anthropologist living amongst his subjects for a sustained period of time collecting data and interpreting experience in an attempt to arrive at a better understanding of the culture. Neither approach is intrinsically 'better' or more right than the other: the rightness comes in the 'fit' between subject and method and researcher and method - in a recognition of the possible limitations of the approach chosen and the acceptance of findings within this understanding.

There is of course another mind-boggling circulatory feature when looking at this subject of 'fit' which Kaplan (1973) has noted:

> "Give a small boy a hammer and he will find that everything he encounters will need pounding. It comes as no surprise to discover that a scientist formulates problems in a way which require for their solution just those techniques in which he himself is especially skilled."

Because the researcher is the scientific instrument through which the research is played out there must be an obligation to examine one's own values and assumptions as the intrinsic ground for methodology and the inevitable fitter through which all data passes. As Cheras (1970) says:

> "Unstated and ideological preferences determine both the kind of data we seek and the way in which we present and draw conclusions from it."

So, apart from the reactive effects of observational methods, there is a more serious threat to observational data in respect of the non-rational determinants of the observer's perceptions. Schwarz & Schwarz (1955) give a detailed account of the difficulties which this factor introduces, particularly in the evaluation of the observer as a scientific instrument. They suggest that the act of observation is in fact a sequential process involving registering, interpreting and recording and that this introduces an unavoidable retrospective element to the research. This becomes more apparent if one considers that the observation of any event will involve too many factors to be simultaneously considered by the observer e.g. social context, background factors, effect of observer and/or others etc. On this basis, they argue that what occurs during this retro-spective phase is 'a reworking of the representation of the phenomenon as originally registered'. In other words observation is a contin-uous process of evaluation. This hypothesis brings into sharp relief the possibility of the observer introducing a strong (though possibly unconscious) element of personal interpretation and construction. Kelly's Personal Construct Theory (1955) illuminates this and grew out of a necessity to explain why people respond differently to the same event. His theory includes three fundamentals:-

(i) a person's processes are psychologically channelised by the way in which he anticipates events;

(ii) a person anticipates events by construing their replications;

(iii) persons differ from each other in their construction of events.

Interestingly Juch (1980) takes this further to include self-awareness and interaction with others: viz

"A person's behaviour and psychological processes are channelised by his learning style, which combines:-

(i) the personal meaning he infers from all his experiences;

(ii) the expectations he construes of future events;

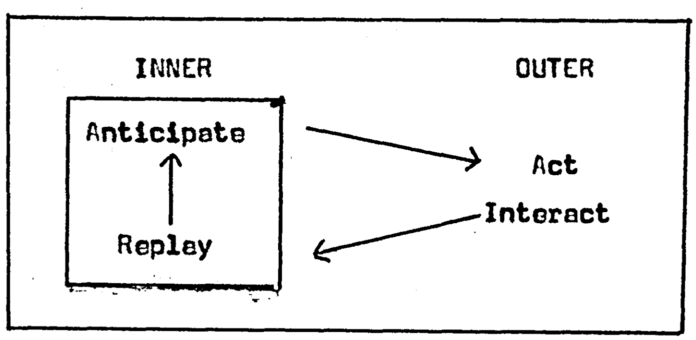
(iii) the way he wants to assert himself and to be accepted."

This strikes a chord of recognition in me. The way I saw research and organised it was a combination of:-

- anticipating and planning events
- acting and interacting
- replaying these events in myself
- from this, according to how much I felt accepted/confident/'on the right lines' - planning future events.

(This applied to both the academic and fieldwork sides of research.) Planning future events did not necessarily mean creating nice situations. A measure of self confidence was sometimes in being able to contemplate future conflicting, risky situations.

S E L F



And this brings us back again to the importance of the person who is doing the research - the researcher is part of the data.

If then, it is accepted that the researcher is central to the data how then is the possibility of the research only reinforcing certain predetermined in-built assumptions to be tackled? - the old truism of 'I know what I like' is the same as 'I like what I know.' Is it a matter of collusion with self - making it comfortable - or a need for a certain level of intervention which it would be foolish to deny? Are we autonomous beings or slaves? Again the question poses not so much a conflict of being one or the other, but a continuum of existence, and finding a place (not necessarily a static place) on that continuum from which to work. This implies a readiness to move and change - to redefine aims and methods, - and also an allegiance to personal integrity and authenticity, while admitting doubts.

Out of this discussion have appeared several key strands which affect the whole relationship of researcher and researched. These can be summarised as:-

(i) an acknowledgement of major epistemological questions and a concern to work within them;

(ii) the need to recognise and value different research approaches as being part of the same process of the search for truth;

(iii) an understanding that any contribution to knowledge is within the context of a parallel understanding of the methodology used;

(iv) and that this implies an equal exploration of the values and stance of the person of the researcher

(v) a concern for the universality of knowledge from research;

(vi) while retaining a personal integrity and responsibility towards the findings (or non-findings) of the research.

These principles underlie the action of research and form the basis from which a more detailed research design sprang. In order to find a suitable company to work with I approached the Industrial Liaison Centre in Sheffield (part of the Sheffield Centre for Innovation & Productivity) and spoke to the manager. It was agreed that I could send out a memo with his next circulation to the 1,500 small firms on his mailing list.

From the replies I received and from some personal contacts of my own, I investigated the possibilities of working in six different companies. This involved arranging initial interviews and follow-up interviews in an effort to assess which company would prove to be the most profitable to work with in the first instance. Before going on to examine the actual phases of the research and the methods and techniques used, I propose to review the pre-research stages of selection and entry of an organisation, and contracting. This is because these stages disclose the initial values and assumptions from which I operated, on which the research was built and from which it evolved.

Three essential points of reference in the researcher/client relationship are described in the process of selection and entry. They are:-

(i) reciprocity and openess

(ii) expectations

(iii) authority

A diagram helps show how these points were extended and developed in the contracting stage:

	Selection & Entry			Contracting
(i)	reciprocity & openess	→	trust	→ fears → motives → expectations
(ii)	expectations	→	expertise	→ expectations
(iii)	authority	→	autonomy	/ absorption

These issues form the framework through which it is necessary to see the research process.

Selection & Entry

"The basis for any transaction between policy maker and social scientist requires:

(a) some shared values sanctioned by their mutual relationship;

(b) continuously re-negotiated terms of reference." (Cherns 1970)

This quotation pinpoints for me several basic assumptions. First, research was to be a transaction - an opportunity for working together - a collaboration of effort involving organisational members and myself in a process of discovery and change. This implied a common ground of shared values from which to initiate the research. It was seen as important to examine the relationship between my research style and the culture of the organisation. The words 'style' and 'culture' are taken to have a synonymous meaning in that they provide the set of values from which an individual or an organisation operates: the values which underpin behaviour. Values signify what information is more or less useful, what persons are included, what mode of working is acceptable and perhaps most significantly what ends the research or organisation is supposed to serve.

In considering an effective research process it is necessary to have some understanding of the values from which both researcher and organisation operate and of how these contribute to their relationship.

A number of writers have examined the consultant/client relationship (Lippitt 1959; Argyris 1970; Davies 1975), however the researcher/client relationship differs from the accepted consultant/client relationship in one very fundamental aspect. While subscribing to a very large extent to the values and modes of operation inherent in the previously mentioned consultant/client relationships, the researcher has not been contacted by the client to investigate or help with a particular organizational problem. Quite the reverse is the case: the researcher has contacted the organisation with a request to study a particular phenomena - in this instance the implementation of innovations.

The organisation does not cast itself therefore in the role of 'client', with all the overtones that word suggests, nor does the researcher view the organisation in that light. I believe that this very basic difference made for a very different initiation; issues of role, dependency, credibility, influence were very much to the fore. These 'process' issues assumed greater importance, because I, not the organisation, was in a subordinate help-seeking position, and it was in my interests to work them through to a satisfactory relationship - satisfactory in the sense that my needs were met and also that I was able to offer something of value to the organisation.

This involved exploring a number of cultural dimensions according to researcher style; for example:-

- What does a given culture say about openness?
- About the expression of feelings?
- About participation, involvement?
- About authority?
- About change?

Of necessity, this sort of tentative testing out of each other, will need a shared language, shared ideas and concepts, involving greater degrees of openness, trust and co-operation. Schein (1969) regards this 'psychological contracting' as a particularly crucial stage. Barber and Nord (1977) in their contingency approach to the consultant/client relationship suggest that some consulting styles, are more compatible with certain types of client and certain problems than are others. Their contingency approach also cautions against the adoption of one particular consulting style as best and suggests that style may change with the phase of the consulting process. I would suggest that style, based on values, does not change, but that the researcher may choose to operate within different research roles according to the contingencies of the situation. I would also suggest that the more congruence between a researcher's style and the organisation culture the better the chance of establishing an effective working relationship, and that determining and exploring each other's style is an essential part of the contracting stage.

The Researcher/Client Relationship

Reciprocity & Openness

These two characteristics were seen as the essential in any relationship. For instance, in my search process to find a suitable company to work with one of my main considerations was to test the 'climate' of the organisation. (See Appendix 1) Quote:-

"So I set the following aims for the first meeting:-

(i) to get a background knowledge of the company emphasising the exploratory nature of the meeting;

(ii) to define my ideas on innovation and decision making;

(iii) to discover how far my perceptions were shared;

(iv) to get the contact to realise that data collection within the company would create expectations among employees;

(v) to get the contact to commit time to the project so that he would feel involved in it and give me authority in the eyes of others;

(vi) to get a feel for the climate of the company through observing management style;

(vii) to establish client expectations about the project and agree on how I would proceed."

A typical structure for these preliminary interviews was to move from safe 'content' issues to more risky 'process' issues. So I started by asking about:-

- the type of industry : Product : Process
- the size : people : the formal organisational chart
- the background history
- the innovative background
- the present innovative state.

From these issues I moved on to:-

- the position of my contact : relevant others : personalities
- power : authority
- Decision-making procedure : norms : rules : constraints.

From these latter issues I formed my impressions of the organisation climate and culture, and made a decision about whether my style would match sufficiently for an effective working relationship to be established. The following extract from my diary (25.9.79) makes this clear:

"The whole process (decision-making) described, is one of rational contents; <u>where</u> information is sought, by <u>whom</u>, political bias, employee participation, <u>how</u> actual decisions are made, <u>what</u> interaction is involved - these were not touched on, nor, I suspect, even thought of.

This seemed to me to be an 'extreme' firm in its rigid structure and apparent lack of informal contact. If it were really possible to penetrate the layers it might be interesting to see what really goes on. It is doubtful whether I shall be allowed to do anything very much. I was carefully steered away from my suggestion that I talked to a production engineer. I was definitely being told what I ought to do and how to do it - almost what the results would be as well!" (Extract from diary 25.9.79).

Expectations

Again, in looking at the aims set out for the first meeting with an organisation, great emphasis was laid on expectations about the research project and on the expectations that would arise from the mere act of entering the company and collecting data. In two of the companies I was given different impressions about expectations. In the first there seemed to be a lack of expectation: they were willing to co-operate but I found it difficult to convey my ideas nor did I feel that there was much understanding about the contingent areas of the research topic - the changes and expectations that it might arouse.

There seemed to be a conflict in understandings: an extract from my diary (4.10.79) illustrates this:-

Quote: '"Management are always open to ideas from the shop floor and if they are 'red hot' ideas they are taken up. I decide if they are red hot or not!" - Technical Director.'

I was unable to foster an understanding of the inherent contradiction in his statement.

In the second company, while the M.D. seemed to have a very open, aware management style, any change or expectations that might arise in employees were denied. I was seen as being a prop to the prevalent style: I could do what I liked as long as I didn't disturb anything. Havelock (1979) also remarks on the danger signals of a history of client unresponsiveness to change, or the client already committed to a particular position and wishing to use the consultant as a pawn. Any behaviour which differed from expectation would be seen as a threat either to an individual or to the organisation as a whole. Concern for reducing the threat in the existence of a researcher led to a phased research programme in the company finally selected. (See later)

Authority

Another central issue was in establishing myself as a person of competence and in gaining commitment from the person contacted to me and the research project, so that I would be given authority in the eyes of others: the 'top man' phenomenom.

I approached one firm through the Technical Director and although he himself seemed very keen to allow me to conduct the research within the company I felt again tendencies to try and manipulate me and the research role for his own ends. However, some hitch in communication (about which he was never very explicit) occurred between him and the Managing Director and the project was never actually agreed upon.

I view the authority/commitment issue as processual. As the research proceeded greater involvement and participation of others was envisaged. So concern about authority also led to issues of involvement and accessibility of people and information. This, in turn, led to point (v) in Havelock's list.

> "Successful relationships need to have a <u>structural</u> basis, some redefinition of roles, working procedures and expected outcomes."

As will be seen, these were formalised in the contracting stages of the research programme. Generally speaking the concepts of organisation development also underlie my research style: concepts of collaboration, problem solving, renewal. This has implications for the kind of data regarded as legitimate - perceptions, feelings and attitudes, and also for the method of gathering data. The basic intervention model which runs through most organisation development efforts is 'action research'. This is described more fully in Argyris (1970). He believes that the consultant is in the business of enhancing the client's abilities in problem solving and assisting him to internalise skills and insights rather than to create a prolonged dependent relationship. He describes this as a facilitator role which he believes creates less dependency than traditional consulting modes. This too was an essential ingredient of any research style: it was seen as important to help people i.e. organisations learn from their experience of taking part in the innovation implementation process.

Having assessed to some extent my own research style, it remains to investigate some of the indicators of organisation culture. The importance of diagnostic activities is emphasised by Beckhard:-

> "The development of a strategy for systematic improvement of an organisation demands an examination of the present state of things. Such an analysis usually looks at two broad areas. One is a diagnosis of the various subsystems that make up the total organisation. These subsystems may be natural 'teams' such as top management, middle management, or the work force.
>
> The second area of diagnosis is the organisation processes that are occurring. These include decision-making processes, communication patterns and styles, relationships between interfacing groups, the management of conflict, the setting of goals, and planning methods."

Obviously it is impossible to achieve such an in-depth diagnosis in one or two interviews. Likert and Siepart (1973) believe that a prime indicator of organisation culture lies in the leadership pattern.

> "In whatever manner the top leaders supervise, this pattern sets the unwritten ground rules within which the next tier of supervisions can perform safely their managerial role over subordinate groups."

They maintain that the effectiveness of a leader depends on four things:-

(i) <u>Support of his subordinates</u> : how friendly and accessible is he; how interested is he in their ideas and their work-connected problems?

(ii) Goal emphasis : how high and how realistic are his performance goals for himself and his work group?

(iii) Team building : how well does he get his subordinate to work with others, exchange ideas, and jointly solve problems, – not just working on a one-to-one basis with the supervisor?

(iv) Work facilitation : how much does he help subordinates do their jobs by adequate planning, scheduling priorities, offering ideas and showing how to improve performance?

They also say that the most effective managers develop networks of high interaction and mutual influence across functions and levels of authority. French and Bell (1973) also support this view emphasising the need for initial top-level involvement and the importance of the perceptions of the organisation and its state by key people.

An initial interview therefore, with someone high up the hierarchy can give many indications of the organisation culture. In my case, with the initial research topic of "Innovation and Decision-making" it was seen as legitimate to ask about decision-making processes and get a feel for issues of participation communication, involvement etc. (See Appendix 1)

As Mumford (1975) says:

"Decision-making processes cannot be understood unless there is good knowledge of the personal values of key figures; unless also there is an awareness of group values and interests and an understanding of organisational values."

The converse is equally true: the way a manager talks about decision-making indicates his personal values and the norms and behaviour of the systems of the organisation. Such things as:

- who is involved in decision-making?
- how is it physically organised – formal/informal, committee/board etc.

- what rules are there about decision-making - explicit or implicit?
- what are the clashes of interests and values between important individuals in the firm? - between different occupational groups?
- what mechanisms are used to mediate between different interests?
- can the decision be openly and co-operatively altered or modified?
- what determines which sources of data are used?
- how is information communicated through the organisation?

It is possible to move from 'safe' factual areas to more risky value areas to gain an understanding and insight into the organisation culture. Mumford again states:

> "Decision-making behaviour is as likely to be influenced by values as facts. Rational and objective considerations tend to be mixed up with emotional and social factors."

Having assessed features of style and culture, how then to determine what mix will create a potentially satisfactory relationship between researcher and organisation? As has been indicated a lot hinges on the initial contact within the organisation; it is through him that the researcher gets a feel for the organisation and initially it is on him that the researcher is dependent for authority and acceptance in the rest of the organisation.

At the initial interviews, the very <u>process</u> of the meeting will also indicate to the contact the nature of the researcher's prevailing style, things such as:

- the areas she is interested in
- the kinds of questions asked
- the depth of the questions
- her receptivity to information
- her concern primarily for technical or human factors.

The process will generate feeling of openness and trust perhaps, on the one hand, or feelings of anxiety, fear and threat on the other.

And this is a two-way process: the researcher is equally susceptible to fears and anxiety about the real or imagined things that might happen if the research programme were commenced. Anxieties about lesing her own free choice and being controlled by the anxieties of the contact or others in the organisation. Or as Mangham puts it:

> "Once having been cast for the part (the researcher) is carefully coached so that he plays his part in accordance with the wishes of those who selected him."

We are therefore back at the central questions 'What values do we share?" and 'How do we go about building and maintaining an effective relationship?' I would argue that these issued are what the initial interviews explore, in a way irrespective of subject matter or content. Content, of course, obviously <u>is</u> important; in this case it would have been of little use to have established that a potentially fruitful relationship was possible, if then it were discovered that technological innovation was unheard of in the firm. But I maintain with Mumford that:

> "... the process of producing plans is rather more important than the plans themselves. The outcome is subsumed by the process. It is participation in the process, not the consumption of the product, which is critical, not only because the nature of the process will crucially effect the degree of commitment to the plan, but also because the process is an important mechanism for learning to learn, and without this no system under change could hope to develop the adaptive capacity to cope with future organisational uncertainties."

Contracting: The nature of the relationship

Introduction

Once an entry has been made the researcher and contact begin to negotiate a contract. The concept of the psychological contract was first elaborated by Schein, and since then has been applied to many situations which have required people sharing and negotiating their expectations of one another. Mumford used the concept of contracting to give a new perspective on job satisfaction; Ottaway (1976) sees the development of a viable contract between OD consultant and client as essential to the success of any OD intervention. Egan (1970) has used the concept of contracting between encounter group leaders and participants. French and Bell (1973) give a useful list of inter-related issues that can arise in consultant/client relationships and need to be managed appropriately to avoid adverse effects. Several of these are central to the contracting process and will be described in the following sections.

<u>The Contact</u>

In the initial meetings, a single person, preferably someone high in the hierarchy, as mentioned before, is the contact. As trust and confidence develop however, there has to be a widening of this relationship to include others in the organisation. This poses questions about the accessibility of others and the introduction of a new person into the system. The researcher needs to be perceived as non-threatening to all other relevant parties as well as to the key-contact. It is essential that there is not an air of secrecy, or that the researcher becomes identified solely with management - seen as carrying out some secret missive for management. The bonding of interrelationships within the organisation needs careful management and raises issues of trust:- how far do I trudt the key-contact to introduce me to others? What is his credibility with others in the organisation?

In my own case I was fortunate enough to witness a parallel 'joining-up process' at the same time as my own tentative beginnings in the company. A new Production Engineer had been appointed: his key relationships were with the tool room foreman and the machine shop foreman:-

P.E. ⟶ T.R.F. ⟶ M/C.F.
ideas — make it — use it

Previous to the appointment the T.R.F. and M/C.F. had solved their own problems albeit with restricted solutions. They saw no need for a P.E. The first intimation they had of the new appointment was in meeting him over a pint with the Industrial Engineer, <u>after</u> he had been given the job. They immediately went to the G.M. to voice their objections: his tactics were to listen but to leave things exactly as they were. So although their objections had been voiced the T.R.F. and M/c.F. were left with a lot of submerged feelings about the appointment.

The P.E. was then given his first project to do. He was set on a machine on the shop floor and asked to devise a fixture to produce cancellous screws. Because of the high feeling around his appointment no-one offered any help - he was left to struggle on for two weeks and when he finally had to admit defeat the M/c.F. was brought in to show him how to do it.

As the Works Engineer commented:

"Paul was stood there watching Alan do it; I don't think it were really fair on Paul; they should have got him in the office and told him how to do it and then let him go out and do it. It didn't look very good for him - that's gone against him more than anything else that's happened. For my part, I didn't help: that was an overflow from Bob (G.M.) telling me he didn't think I could do the job anymore and putting me onto the Works Engineer's job. He keeps emphasising that you do what you're paid to do; he doesn't seem to like any overlap."

Having witnessed this rather clumsy handling of the P.E. I tried to manage my own 'induction' with rather more control. Between 1st October and 12th November, 1979 I liaised solely with the G.M. (my key contact) the Industrial Engineer and the Production Engineer. This was partly because of the nature of an innovation that was being proposed at that time. When it became clear that I needed to meet and talk with others in the organisation I asked for a meeting with the four senior managers to clarify my position and role with them. Typically this was held in a pub. There was an informal relaxed atmosphere but I was presented as a 'fait accompli' by the G. M. and had to work very hard to ensure that the others understood that I was looking for their co-operation and that their acceptance of me was essential and crucial.

One of the managers was very anxious and kept trying to pin down why exactly we were all there. However he was consistently ignored by the G.M. who seemed unaware of his over-riding of other people. Immed-iately we returned to the firm I asked to see this manager, and in a one-to-one meeting managed to help him feel easier about my position, although he was fairly reluctant to begin with.

The process of extending my network of relationships continued rapidly over the next three months. I was always aware of a reluctance to entrust this extension to anyone else. For instance, I knew that the Works Superintendant would have mentioned the research project to the foremen by himself: I was also aware of the great influence the W.S. had over the shop floor, having worked his way up the company over thirty years. I knew that any misinterpretation or hint of bias (how-ever unwitting) would take a long time to redress - if ever - and so asked to go with him round the shop floor to meet the foremen. He was more than ready to agree to this. The key issues in this process seem to be a balance between control and openness, and one way to keep this balance is to meet others on a personal basis.

The Trust Issue

"A good deal of the interaction in early contacts between client and consultant is implicitly related to developing a relationship of mutual trust." (French and Bell 1973)

This was certainly true in my case: trust had to be earned and developed. It involved three main areas:-

(i) What are the hidden fears?

(ii) What are the hidden motives?

(iii) What are the expectations on both sides?

(i) Fears

Initially all these three areas apertained to the contact but as the research programme extended the same areas had to be worked through with other people - the earning and maintaining of a high trust level was a central and on-going issue.

In my initial interviews with the G.M. we spent some time discussing decision-making, especially his personal style (see Appendix 1) There seemed to be a struggle going on between two opposing views. On the one hand a fairly open progressive management style and on the other a more rigorous tightly controlled style. The feeling was that externally he recognised and wanted to implement newer styles of management - team work, consultation, etc. but had not yet managed to internalise that for himself in terms of change of style, increased delegation.

"Again seemingly open and aware, but I was left with a feeling of guardedness. He knew what academics say should happen (e.g. Macgregor X and Y) and seemingly went along with it, but I was left with a fairly rigid, self-reliant, tightly controlled view of him. A ruthless man if he really wanted something." (Diary 1.10.79)

Over the first two months this impression was confirmed and crystallised into seeing a struggle going on in him between two behaviours.

One he reserved for me, the 'academic', in which he tried to almost justify his management style - and the other he reserved for running the organisation. For instance he said to me:-

"If I end up subjecting someone to a decision, it will fail."

and yet I frequently encountered this sort of behaviour in his dealing with others. Why then did he show any interest in me and the proposed research? Why didn't I constitute more of a threat to his prevalent style of managing?

<u>(ii) Motives and Expectations</u>

The reasons can perhaps be found in his motives and his expectations of me. The company had suffered from a considerable turnover in management (seven G.M.s in five years) - and he was comparatively new himself having been there for only one year. There was a split between what another manager called 'the old group and the new group: the old came through the ranks - the new came in over the ranks'. The present G.M. had a policy of expansion and was keen to bring in new people and ideas from outside: this was in the main perceived as unacceptable by the majority of the workforce who would have preferred to see some of their own members promoted into positions of increasing responsibility. These policies of expansion were bringing with them a need to reassess both his role (hence his dichotomous behaviour) and the roles of others in an attempt to cope with the inevitable changes in system structure and lines of authority and responsibility. The company seemed poised at a time of fundamental change and I feel that the G.M. saw me as contributing positively to that change by:

(i) 'breaking up the surface a bit' as someone else put it: being able as an outsider to cross boundaries and sets - acting as a cross-communicator - allowing opinions to be expressed and transmitted - bringing things out in the open a bit. For although I was initially engaged on a 'safe' topic - innovation - it was recognised from the very beginning (the G.M. actually said this) that if I were to come into the company from outside and start interviewing people and collecting data, this in itself would create change.

(ii) by expanding the image of change: another new person who could perhaps take the heat off some of these new people who had just formally entered the system, and who could provide some indications of the climate of the organisation.

(iii) by affording him an opportunity to talk on a more subjective level about his own style of management and issues that confronted him. As I was an outsider he did not have the same need to 'control' me and maintain his functional power base - although ultimately he knew that he was in control of whether I was physically permitted to be there or not.

(iv) by supporting to some extent the 'good guy' image of him rather than the 'bad guy'. It looked good to have a researcher on the premises; it added to a sense of importance and keeping up with the times. There was value in having a different contact with the external environment.

My own research style matched his expectations in the very fundamental area of the recognition and anticipation of change: the indication I was given of a general receptivity to change reinforced the likelihood of being able to create an effective relationship for research.

His need for control was matched by providing a structure which centred on giving and receiving information. This was the Quarterly Report meeting, which provided a formal structure, as well as more informal meetings to keep him up to date. My needs for openness and dissemination of information and my interests in helping people learn from the situation, and also learning myself, were also met via this structural device. It provided a ground for co-operation, surfacing conflicts and fears, establiching roles and expectations.

Expertise

Expectations and expertise are closely bound together in the eyes of many. Lapsing into the expert role frequently stems from an overriding desire to please the other person and to be perceived as competent. For a researcher who starts from a position of seeking help (as opposed to a consultant who has been specifically brought in) there is an inherent conflict between establishing competence and being cast in the role of the expert: firstly you are forced into a position of defence which tends to negate a collaborative, developmental approach; secondly it can lead to a dependency by the organisation such that the researcher is only led to information that supports her already declared views. Conversely there are reasons for wishing to be perceived as competent, the main one being concerned with credibility. This assumed more importance as the research proceeded towards an action research framework; my perceived status within the receiver's field of experience conditioned the level of response to my communications.

In my case I was perceived as expert in that I came from a different world - the 'academic' world rather than the 'real' world. The difference was compounded by the fact that I was a woman in a largely all-male organisation. On a few occasions I found that I was being pushed into defending academic theory as opposed to real practice. The difficulty here was in maintaining some sort of integrity of purpose. As Mangham (1979) says:

> "Once having been cast for the part, the social actor is carefully coached so that he plays his part in accordance with the wishes of those who selected him."

To a large extent I found that I could diminish the role of expert by describing myself as 'research student'. This obviously held overtones of not being an expert, of not having arrived or having all the answers,

- so a process of inquiry and finding out was seen as legitimate. Also (certainly on the shop floor) being a woman meant that I was not an expert - that I could be in a position to receive help and advice.

The expert issue, however, was not solved once and for all at initial meetings. It was something that kept recurring. For instance, after the first Quarterly Report, the I.E. cast me in the role of expert on communications, which would have hindered the organisation from developing its own resources in that area. One helpful strategy is to be aware of the expert areas of others and be able to reciprocate on that level.

Autonomy or absorption

Closely allied to being cast in a certain role is the possibility of being absorbed by the culture of the organisation. This assumes greater importance for an action researcher working within the system than for a detached observer who remains relatively separate from the system. Who I am, and how I act, determines the kind of data sought. How I present myself or what labels I am given also determines the accessibility of data - and are there labels given to me that I find difficult to reject or contravene? Mangham (1979) graphically describes how carefully organisations build up their cultures by a system of rewards:-

> "The actor who conforms, who allows himself to be shaped in accordance with the wishes of the more powerful actors around him, may be rewarded by the offer of parts within other, more valued, situational scripts. Such promotion to star status, signals to all others involved what the desirable attributes are, and serves to reinforce the shaping going on throughout the enterprise. Thus many of the key actors assimilate en route through the organisation, the deeply-held scripts which hold it together in its present form."

The issue for the researcher is how to preserve an individuality and an objectivity for purposes of research while becoming sufficiently part of the organisation in order to make available a certain type of data which would otherwise be inaccessible.

When I first entered the organisation there were many 'seduction' attempts. Many people, mainly from management levels, although not solely, took me out for a sandwich at lunch time, in order to find out 'what I was up to' and to put their case to me. Another attempt was to 'join' sufficiently to be included in the jokes – and then only be able to communicate on the joke level.

The only way, as I saw it, of handling these attempts was to refuse from the outset to be identified with any one particular grouping. For instance, a day when I helped to serve in the canteen, broke down an imminent identification with management and 'lunch with the boys'. Also, while respecting confidentiality, to avoid colluding and taking sides, to encourage expression of feelings about what was happening but to be non-evaluative; to give feedback in a constructive way. This is not to say that I succeeded all the time, only that an awareness of these issues was there. The dysfunctional element of becoming part of the politics of the situation – part of the problem, was countered by trying to preserve feelings of openness.

<u>Summary</u>

This review of the stages of selection and entry, and contracting has indicated the issues which were uppermost in my mind in establishing a working relationship with the organisation. These can be distilled into specific needs for:-

(i) a congruence between research style and organisation culture based on a common ground of shared values;

(ii) a clarification of expectations and a willingness to be open to change;

(iii) a sense of commitment to the research from organisational members (re-inforcing the idea of collaboration);

(iv) an establishment of an atmosphere of trust;

(v) a retaining of an objective stance while working within the company.

Research Design

From October 1979 to November 1980 there were four main phases of the research programme. Ex. 4 (overleaf) shows these four phases as it appeared in retrospect. There was a progression in change of role and level of intervention as increasingly a different order of data was sought. At each stage the impetus for re-negotiation of role was an attempt to find an appropriate level of intervention in the organisation to accomplish the aims of the research at that time. The diagram shows how within each phase there was a consistency of purpose expressed through a bonding of:-

(i) the type of data sought;

(ii) the role of the researcher;

(iii) the techniques used.

As the research programme proceeded a change in the first of these categories necessitated a corresponding change in the other two. This was largely instinctive as the aims of the research encompassed deeper areas, but was formally re-negotiated with organisational members. Negotiation has connotations of hard-headed bargaining and may seem to be out of place when applied to the development of relationships. Nonetheless, by sharing and agreeing expectations one is negotiating a relationship, and helping to classify and define roles.

The four phases are now described in more detail.

Ex. 4.

Basic Research Design

Techniques	Phase : Role	Type of Data
Direct observation Formal interview Taped interview Document analysis Questionnaire	Phase One Detached Observer	Specific, factual; Historical background Innovative background Feasability study Limited contact
	Renegotiation	
Exploratory mapping of formal & informal structures Diary keeping Formal & informal interviews Dialogue Formal & informal reporting to generate feedback Past case histories	Phase Two Participant Observer	Wider/deeper contextual data not specific to innovation 'Qualitative' data incorporating feelings, perceptions, anecdotes etc. Theory generation Widening contacts at all levels
	Development	
	Renegotiation	
Direct observation & use of other interested individuals as alternative data sources More participant/collaborative techniques. Jointly deciding meaning of data & possible action through group meetings Interactive interviews with an emphasis on feedback	Phase Three Action Researcher	Present innovation implementation situations, and the sociotechnical systems associated with innovation Increasing emphasis on learning from situations - and coping with change. Forecasting. Process issues associated with facilitation of implementation process Action based Theory verification
	Renegotiation	
Analysis of recent innovation situations Generation of course of action based on mutually negotiated and agreed diagnosis implementation process Learning cycle	Phase Four Co-researcher	Development & involvement of subjects themselves. Personal and group oriented process data On going learning on implementation process. Feedback and redesign of learning cycle Anticipatory, pre-emptive, action based
	EXIT	

Research becomes independent of researcher, leaving behind respondents who continue to examine and learn from their handling of on-going implementation situations.

Phase One

Having gained entry to the organisation my initial contract was to look at innovation and decision making processes in connection with one particular innovation possibility - the use of micro-processors on existing machinery. The company was taking advantage of a Department of Industry grant to conduct a feasibility study for assessing the application of micro-processors and were using an outside team of consultants. Over the first month I liaised closely with the I.E. and the consultants, attending formal meetings and also informal meetings with the people concerned. (See Appendix 1) Following the consultants' report it was decided to use intermediate technology - ie adapting existing machinery by means of jigs and fixtures, on the recommendation laid down in the report. This was to be a phased programme of events running from January 1980-April 1980, and was the responsibility of the I.E. In the new financial year the possibility of using micro technology for new systems of production planning and control was to be investigated.

This stage was dominated by a 'detached observer' role. I was gathering information on the historical background of the company, the innovative background, the present state of affairs and testing tentatively the climate of the organisation through liaising in a rather factual way with two or three people connected with the feasibility study. I was an outsider sitting on the edge of the organisation recording events as they happened. I found, however, that recording events was not enough. To understand the processes that were going on I needed to have a greater understanding of the people, systems and values - the <u>context</u> in which they were occurring. This was because, owing to the impossibility of recording everything, I was obviously making a selection of facts to be recorded - presumably of significant (as opposed to trivial) facts - and in so doing I was making a judgement as to which facts were important and which were not. The record of events was therefore a reflection of the particular emphasis that I chose to give it. This would pre-suppose that I had certain views and attitudes towards the subject under study and perhaps certain expectations of the outcome of the investigation. The consequence of this was an understanding that if I could learn more of the wider social context in which the data was collected and imbue some of the values of the organisation without losing my objective research stance, I would better comprehend the processes going on - especially given the contingency theory of innovation.

As a result I arranged a meeting with the G.M. to re-negotiate my role and to get the go-ahead for building up my understanding of the company as a background for my work on innovation and decision-making (See Appendix 1). My first aim would be to build up a realistic picture of the organisation as seen by an outsider, and I undertook to reflect this back to senior management in the form of a report - the first in a series of Quarterly Reports. These Quarterly Reports became the structural basis for exploring and re-negotiating my role, as well as a means of providing a regular channel for communicating information about the research.

<u>Phase Two</u>

This was dominated by a participant observer role; data was collected over the period from mid November 1979 to mid January 1980. I began by holding fairly formal interviews with members of the senior management team interspersed with more informal discussions with personnel at all levels. This was supplemented by conversations and observations at shop floor level in connection with the daily activities of the factory. I felt it important to make as many contacts as possible and to assure people that what they said to me was confidential in that individuals would not be quoted but that I would generalise what they said as I built up an overall picture; that I was not there to be judgemental but to act as a mirror for the organisation, reflecting back to them any key issues that emerged. I began an exploratory 'mapping' of formal and informal structures. The main aim as I have said was to increase my understanding and knowledge of the organisation. The research role of participant observer differed from that of detached observer in that I was not merely recording objective facts, but also feelings, perceptions, opinions and this type of data was perceived as real and legitimate. I was also using formal and informal reporting to generate feedback so in a sense I was part of the system and interacting with it. I had moved from an outside position to an inside position, and while changing the system was not a prime objective obviously by just being there and collecting data I was introducing change. (Appendix 2 gives a full report of this stage.)

Development

At the Quarterly Report meeting in January 1980 I requested permission to study particular innovations that were happening on the shop floor. It was agreed that I could liaise more closely with the relevant people and I felt more confident of my contextual understanding in doing this. A developmental phase was now entered with more participant techniques:- the use of other interested individuals as alternative data sources e.g. the P.E., the S.D: others jointly deciding the meaning of data e.g. the I.E. There was more emphasis on learning jointly from situations.

The activities of the developmental phase are documented in the April Quarterly Report. (Appendix 4) I became increasingly involved in working with the I.E. on an effective structure for a New Product Development Group. There was a definite shift in emphasis in my role.

I was helping to change the system not by merely studying it and proposing (in a consulting role) how it could be altered, but by being part of the system and helping to change it from within. As Eilon (1974) says:

> "(He) debates issues with members of the system not just with the object of everyone concerned (including the investigator) gaining a better understanding of its structure, but with the view of influencing their attitude and their mode of operation, even with the intention of changing the structure and organisation of the system."
>
> "His aim is to assist members of the enterprise to define 'the real problems' facing them and to evolve solutions (preferably his own) for change."

Phase Three

This shift in emphasis in my role provided the basis for re-negotiation. In the April Quarterly Report I proposed becoming increasingly involved in this way, particularly in the Industrial Engineering Department. I also expressed my interest in helping group members to draw out the learning from co-operating in such a group (NPDG) and in taking that learning forward into further innovation situations. In effect I was moving from a participant observer to an action researcher, action research being actively involved in change of/within the organisation. I also asked for feedback from them of their perception of my role within the company.

So action research was the dominant element in Phase Three. This involved a generation of a course of action based on mutually negotiated and agreed diagnosis of the innovation implemenetation process (see July 1980 Quarterly Report - Appendix 5) and the use of feedback in determining and designing courses of action based on increasing involvement and learning. (See Appendix 6 - A Review of the Industrial Engineering Dept.)

Phase Four

The July Quarterly Report specifically explored these issues at the request of senior management:

(i) the separation/dependency aspect of innovation; and

(ii) pressures of innovation.

The request to study these two areas sprang from the April Quarterly meeting. I decided to present them as two case studies of actual innovation situations within the firm, to highlight the relevant issues. Out of the last study came a further application. In looking at pressures to innovate and pressures caused by innovation, (the local areas of the case study), I tried to anticipate, in a similar manner, the pressures that were likely to arise in another imminent innovation - computerised production control - and to suggest guidelines for handling the innovation implementation situation. (See Appendix 5) In connection with this I found that I needed again to re-negotiate my role. Up until then I had been actively involved in change and redesign, putting forward ideas and working on them jointly with others. I had views as to what goals and solutions the system could adopt and participated in the responsibility for implementation. In continuing to look at innovation situations I now felt the need for a shift in emphasis again with less reliance on me and more on others: a need to co-operate with others as co-researchers. This meant exploring ideas and suggestions with them and gaining feedback on the usefulness of these ideas when put into practice; in effect 'reality testing'.

The co-researcher role demanded quite a lot of clarification for members of the organisation, but I established a co-researcher relationship with the manager who had oversight of the computerised production control project and the manager in charge of the New Product Development Group. In a way the co-researching relationship can be seen as the first stage of withdrawal from the organisation - where research becomes independent of the researcher. I had to learn to stand back a bit. As one co-researcher said "innovation is always a tussle between the 'best thing' and what is practicable". My interest in keeping the research relevant at a grass roots level for workers and management demanded a greater input of their own experience. My role involved maintaining a level of awareness of the process issues of innovation - the human factors of communication, co-ordination, surfacing fears, enabling feedback - although increasingly through an on-going learning process, this role too was assimilated by other participants.

More detailed notes on methodology

Having looked at the broad overall research design more specific techniques of data collection are now described. This section will also consider questions of methodological weakness and data validity.

Traditional research has an emphasis on theory testing and verification within a correspondingly large sample frame. However, in keeping with demands imposed on a research programme which is closely involved in a real rather than an experimental situation, this research adopted an interactionist viewpoint - one that viewed research methods not as atheoretical tools but rather as a means of acting on the environment and making it meaningful. The philosophical basis to this approach is essentially one of 'grounded' as opposed to 'grand' theory (Glaser & Strauss's terms 1968) linking practical experience to a body of existing theory. Initially the research was in the business of theory generation involving an in-depth case study approach. The process of technological innovation and implementation was seen to depend upon a range of contingencies representing factors which were 'specific to innovator' (Downs & Mohr 1976) so any comparative theory would be severely limited. It was hoped that the research would aid the organisation involved by generating practical guidelines for improving the innovation implementation process. Approaches which seek to develop and extend theoretical knowledge or conceptual frameworks through general testing procedures are not so easily related to the needs of the sponsoring system.

A longitudinal research design was deemed appropriate: one principal reservation about general research into innovation being the lack of information of the case study variety. Where case studies have taken place they have often been retrospective or critical incident orientated. In effect the respondent is asked to reconstruct his past history of innovation experiences. This will clearly provide less than completely accurate data; a retrospective study will tend to represent the process as more ordered and rational than it is in reality. Therefore it seemed important to observe events as they happened to aid understanding of the innovation process.

The crucial question in the whole field of research methodology however remains that of data validity and quality. Observational data, of the type culled from a case study approach, is most susceptible to threats of the realistic type e.g.

- reactive effects of the observer's presence
- distorting effects due to the observer's perception and interpretation
- limitations to the observer's ability to see all sides of the situation.

As Webb et al (1966) note:

> "no matter how well integrated an observer becomes we feel he is still an element with potential to bias the production of the crucial data substantially."

Bias of perception and interpretation must always pose a problem to the researcher. In my case an awareness of bias and an attempt to reduce it was the prime motivating force in changing the research role from detached observer through participant observer to action researcher and finally co-researcher. This progression represents a continuum of increasing involvement and a parallel examination of the observer's effect on the observed. This becomes more explicit if we categorise the major differences in emphasis between the stances of participant observer and action researcher, as shown in Ex. 5 overleaf.

The issue is to what extent the observed data represents the real situation and to what extent it represents an evoked response of some kind. A method of testing the validity of observational data was seen when data collected through participant observation led to theory generation which was then tested and applied in the action research phase. This was taken even further in the co-research phase when an evaluation of the researcher's own role and behaviour was seen as an essential part of the data. (This corresponds to Argyris' (1970) description of organic research.)

All data must be viewed in the wider context of an understanding of the major social dimensions of the situation in which the data was collected. And while no single method is completely reliable measures can be taken to increase the validity of data. One such measure is the concept of 'triangulation' (Denzin 1970) which is basically concerned with multiple approaches to the same phenomena. In addition to multiple methods a research design could include multiple sources of data, multiple observers and multiple levels of analysis. Again, this was seen as a natural progression; as the aims of the research broadened to encompass different people at different levels of the organisation less reliance was placed on the researcher's own viewpoint and more emphasis was given to a working out of a common meaning of the data which could then be practically activated. This in turn provoked a need for a more adequate base for interpreting and clearly communicating the content and meaning of concepts used.

EX. 5

The difference in emphasis seen between the roles of participant observer and action researcher

Participant Observer	Action Researcher
(i) essentially a static reflection of data - content oriented	(i) a method capable of reflecting process and change as well as static behavioural form
(ii) enables generation of hypothesis in the context of the organisation	(ii) flexible in enabling development and testing of hypothesis within the context of the organisation
(iii) creates patterns of reflection and feedback but not necessarily any action on these	(iii) interactive dialogue resulting in mutually agreed change and action
(iv) a reflection back to the organisation of data collected	(iv) a concern with being actively involved in change of/within the organisation
(v) of value to organisation members in increasing understanding	(v) of value to researcher in terms of greater understanding of own behaviour and ideas
(vi) involve individuals in a participative manner to generate valid data	(vi) concern with feedback procedure and their importance to learning and development

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Action research aims:

> "to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework." (Rapopart 1970)

> "Action research is a vehicle both for concept - swapping and for changing and re-designing organisations." (Cherns 1970)

Footnote

The difference in emphasis cited are not necessarily those generally agreed upon, however they establish the relevant framework within which I operated. It is important too that the roles of participant observer and action researcher are not seen as opposites (or in conflict) but as polarities on one continuum, i.e. each role has potential for being the right 'fit' in a given set of circumstances.

Data collected in this way is of a qualitative nature and therefore invalid or unusable in statistical treatment. Variables that are difficult to quantify are probably less distorted by unstructured observation than by an abortive attempt to operationalise them for quantification by survey or questionnaire. While statistical findings have an essential part to play in research procedures there is no reason to assume that particular methods are more capable than others in typifying conditions actually present in a given situation. However the problem of analysis of qualitative data remains. An interactive approach to data using other's perceptions and analysis helps to mitigate this problem within the overall concern for a proper objectivity and search for truth.

The philosophy of 'triangulation' was dominant in my research thinking and as far as possible date was collected from more than one source using more than one method.

Most techniques fall under one of the following headings:-

(i) direct observation

(ii) interviewing

(iii) questionnaire

(iv) document analysis

(v) case histories

(vi) feedback/reporting sessions

(i) Direct observation

This includes those situations in which I was a passive observer but which nevertheless offered important data collection opportunities:

(a) Formal meetings e.g. senior management planning meetings, union/management meetings, manager/foremen meetings.

(b) Informal meetings were also studied, e.g. the unplanned meeting on the shop floor to discuss a particular technique; two people collaborating on a project etc.

(c) Direct observation of work on the shop floor, in the drawing office, in the production control room etc.

(ii) Interviewing

This was held to be the dominant data collection method and attempts were made to try and regard every interaction as a potential information source. Again these can be divided into formal and informal occasions.

Formal: sessions (usually pre-determined) when respondents were asked specific questions about an innovation -- when my need was for clarifying and explanatory information. Often these led into Informal situations where more qualitative and subjective data was obtained. As far as possible the central principle in these encounters was to listen as carefully as possible, to be aware of all incoming stimuli (e.g. non-verbal signals, the relationship between others in a group, reaction to my presence etc.) and to delay evaluation until the session was over.

As the research developed this kind of interview became more participative in that through direct feedback, learning for members was drawn out; it became seen as legitimate and valuable to discuss the meaning of data and the nature of the interactions both of the present situation and of the innovatory situation. In the final stages of research it became apparent that the researcher herself was part of the integral data of the innovation implementation situation. This demanded an examination of her role through extending the interview situation into an interactive co-research situation where ideas and suppositions could be explored in a more 'equal' way - so that personal knowledge became validated through acceptance as public knowledge. There is still of course the element of 'affective participation' (Schwarz & Schwarz 1955) in which the emotional responses of both parties are brought into play, which constitutes another element of bias. A wider validity however was possible through mutually negotiated courses of action related to the actual innovation implementation process.

Interview data brings with it a wealth of detail and richness which is difficult to capture and poses problems for analysis. Many initial interviews were tape recorded and then transcribed verbatim. This provided many useful quotations at a later date to illuminate a particular point using words other than my own, thereby circumventing the bias of interpretation (though not necessarily of selection). Interviews were also subject to content analysis where various common issues were categorised: these built up into quite substantial files and were useful in pointing me in directions that had not previously been thought of. Qualitative data such as this is not easy to analyse or present but often presents insights which could otherwise be overlooked.

(iii) Questionnaires

These were used at specific times to obtain relevant participants' reactions to the same questions. In effect interviewing incorporating specific questions was generally seen as more useful. This was for the following reasons:-

(a) With certain groups (e.g. the foremen) a written document posed some sort of threat. There was obvious anxiety about the standard of their written replies.

(b) they were time-consuming; it was easier for workers to reply to questions while carrying on with their work;

(c) the researcher recording data from interviewing was accepted as 'normal'; their own recording of data was seen as potentially more threatening;

(d) observation and interviewing being non-standardised were highly responsive and made use of the relationships established between the researcher and respondent, whereas questionnaires, being highly structured were of more limited use, and did not allow for a reformulation of ideas;

(e) Questionnaires by their very nature omit to use the respondent's skills and insights: it is difficult for them to question or disagree with inherent assumption on the researcher's part;

(iv) Document analysis

A number of documents to do with the technology of the organisation were studied and also proposals for innovation (e.g. the feasibility study report). These were mainly of use in identifying relevant techniques and in giving me a 'common language' with organisational members. Meetings were sometimes tape recorded and then subjected to content and process analysis to identify relevant issues and foci of interest. Document analysis was extended in the later stages of research to include document generation. Initially this meant that I collected analysed and presented data in document form for discussion: then increasingly other organisational members compiled their own documents of events which were then open for discussion and feedback;

(v) Case Histories

This was an attempt to build up a picture of past innovations making use of individual recollections of events. Often two different stories about the same sequence of events revealed individual orientations and beliefs; it was then possible to link these to present day management of innovation implementation. In the main though, case histories provided a context for looking at 'real time' innovation.. As the research developed of course 'real time' studies became part of a collection of case studies which the researcher had observed.

(vi) Feedback/reporting sessions

These were seen not only as sessions prodiding information on research progress, but also as data generating times themselves. They were also times when data observed and presented could be checked out with other individuals - an interactive strategy aimed at testing out the reality of any perceptions. This was particularly so in the formal Quarterly Report Sessions but also in more informal small group meetings or with specific individuals.

Summary

In looking at the overall issues of methodology it is apparent that there are several emphatic strands interwoven throughout the whole research strategy. These are threads of involvement, development, change and learning, which became more overt as time proceeded and which gave the research its fundamental methodological shape.

The 'great divide' seen between academia and management was mentioned in Chapter II where the large amount of research on innovation and implementation of innovation with potential value for practical managers has been left languishing on the library shelves, partly because of the frustrating generalisation of many of the conclusions, and partly because of a lack of recognition of the need for a closer marriage between researcher and management so that research is seen to be relevant to their needs.

A concern to be of practical help to the sponsoring organisation and to aid in a fusion of academic idea and practical reality was a prime motivating force in giving the research an interactive collaborative intention. This progressed into a concern to develop the necessary skills of integration and communication in organisational members themselves through an emphasis on joint learning.

An obvious focus for further research would be to explore this relationship further particularly with regard to the possibilities of collaborative research. More research of an in-depth nature needs to be done in this way. This would then of necessity mean devising some means of comparative analysis and presentation.

CHAPTER IV

The Organisational Setting

Introduction

This chapter aims to evoke the organisational setting where the research on innovation implementation took place. I say 'evoke' advisedly because it is not just a matter of statistics - size of firm, product, processes etc. - that is needed, but a more contextual knowledge of the firm and a feeling for the interplay of people, task and structure.

The chapter consists of a factual description of the company in a general classifying sense plus the areas of innovation which were deemed suitable for study and innovation areas that emerged as research progressed.

A further set of documents relevant to the organisational setting is included in Appendices 1-3. Appendix 1 contains an initial description of starting the project and the entry and contracting stages. Appendix 2 is the first Quarterly Report as presented to a senior management meeting in January 1980, together with a commentary on the report meeting (Appendix 3).

These provide a time-oriented sequence of events and insights into the 'workings' of the company and also illuminate my style of working and my understanding of my role. I have conceptualised the research role in Chapter III (Methodology), but this is a more graphic 'real' presentation as it felt to me at that time. To capture these feelings is essential for understanding the growing importance that my research role assumed in the project.

The Background to the Company

A synopsis of the company in which the main body of research was undertaken occurs in Appendix 1 but for clarity I reproduce the most significant points here.

C.D. (Sheffield) Ltd. is a manufacturer of surgical instruments and orthopaedic implants. It is a wholly owned subsidiary of C.D. Ltd. with an annual turnover of c£1,000,000, and is one of four manufacturing units, the London HQ being responsible for sales, marketing and distribution. The relationship of C.D. (Sheffield) Ltd. to relevant others is shown in Ex. 6 overleaf.

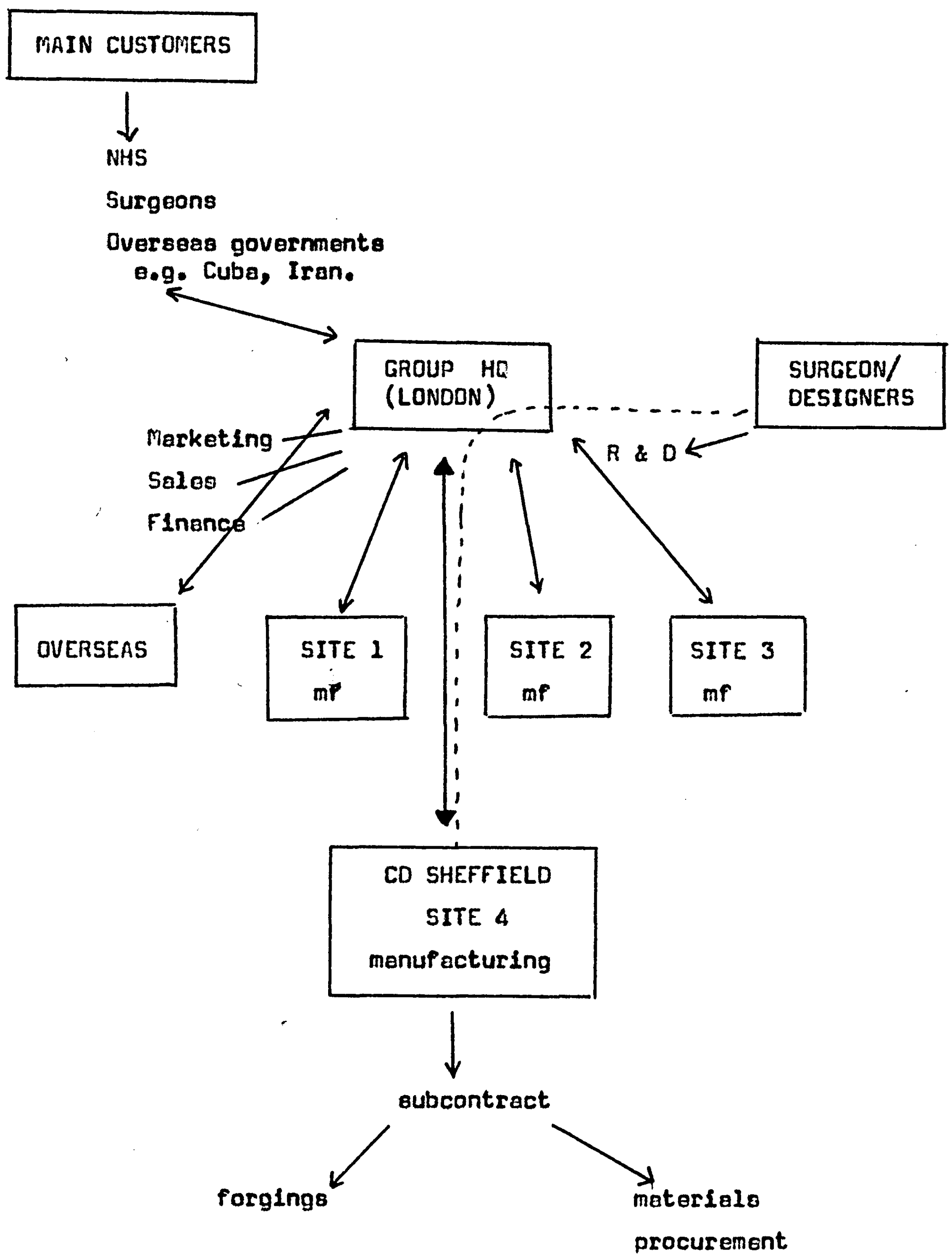
The link between the Sheffield site and London HQ is of prime importance. Sheffield receives orders for work from London and is solely concerned with meeting those orders. They have a catalogue of 16,000 lines but these are not all operational at the same time, nor do they always manufacture everything on the premises – they buy in certain requirements.

The two main divisions in the work are surgical instruments and orthopaedic products. Surgical instruments contain five main departments – (i) scissors, (ii) retractors, (iii) specials bows, (iv) general tools, (v) cheap end – numbers of expendable items eg towel clips. The orthopaedic department is relatively small, especially in relation to the profit it brings in, and is due for expansion. There are also other allied departments whose functions cross the main product division – e.g. forge, toolroom, finishing, polishing, passivation, warehouse.

The basic cellular structure of C.D. is important. The industry had grown out of the old cutlery trade of Sheffield where within the original firm there were sub-companies doing sub-contract work – negotiated work – under the leadership of a 'little mester'. These small groups were insular and proud of being autonomous and accountable to themselves. When the firm was taken over by C.D. fifteen years ago (it went public at the same time) this arrangement

EX. 6

The Positioning of CD Sheffield



continued. However, five years ago C.D. moved to a new, larger site to cope with an increasing emphasis on orthopaedic products and the space needed for machine engineering. The surgical instruments side of the work retained its hand-finished, quality tool image, looking back to the cutlery trade skills of former days. The tightly knit cellular structure was reproduced in the shop floor layout, where each group of workers was set together in small defined areas under the supervision of a foreman.

Although the overall structure was open plan, the men liked working unobserved, spending time on hand-finishing products, and in fact, in my first three months, they finally achieved approval for the building of walls to separate themselves further from each other – these were erected before my very eyes! In the words of one foreman: "This is a back-street craft and always will be." and another: "I preferred things under the little master system; we had more control, harder work, more pay, more feeling of togetherness. We were unique. Now my authority is being taken away."

Some men actually left to set up on their own again as sub-contractors to C.D. and other firms.

As well as this cellular split within the surgical instruments side there was a more defined split between surgical instruments (handskills) and orthopaedics (engineering skills) which displayed itself in feelings of antagonism about different personnel.

For instance, there was resentment of the fact that the Works Superintendent (WS) was primarily a forge worker and instruments man who "has no knowledge of orthopaedics".

The new Industrial Engineer (IE) brought in to build up a Production Services Department and attached to the orthopaedic side of production was resented as an outsider, a 'cowboy'; he was experienced in engineering but "they're supposed to have certain skills but it don't mean a thing when they get into a surgical instruments factory", was the expressed view of one worker. There was great fear of handskills being devalued and becoming redundant - of machines (equated with engineers) taking over - and a parallel intense interest in preserving the 'status quo'. The IE was aware of this - particularly of the WS being threatened by the expansion of the orthopaedic section. As he graphically put it: "I see it as part of my job to try and win them over, to be honest I know nothing about either really."

Other examples were:-

(i) a split in both directors and managers into what the Accountant (A) termed the old group and the new group: the old came <u>through</u> the ranks - the new came in <u>over</u> the ranks;

(ii) a tradition of bad feeling over appointments for jobs - and of wrong choices being made - had set the tone of fear of future expansion or change.

(iii) the WS was not in favour of proposals for computerised production control and would have nothing to do with it, but as A perceptively remarked:- "It's not that he feels threatened or that he is ignorant, but that he sees no <u>need</u> for it. He was not formally approached and talked with about production control: it was taken for granted that a manager would know about things."

(iv) the passivation area had set itself up as a little island in the middle of the works and had even put up notices to keep people out (this was only partly safety);

(v) the maintenance section felt undervalued - "we are ripped off in here - taken for granted."

(vi) the draughtsman felt isolated: "50% of the shop floor work to patterns and won't work from drawings: they can't see my job as having any use or relevance."

(vii) formal reporting systems that were set up were ignored - people continued to use their old informal systems.

This might seem a sorry tale of division and strife but it was not all so. Over the previous six months the workforce had been getting used to gradual changes in methods of working. Previously they had had near autonomy over what they did and when they did it - but this was proving too haphazard and they were collecting a very bad reputation for delivery dates etc. A more regularised method was introduced: foremen were given a set routine to follow - they now knew the schedules for the whole year and they soon became more formalised, optimising the production processes and planning ahead. One foreman expressed his satisfaction with this - he had a plan for each person in his section for the next three months - he had built up his section - he believed he had good working relationships in his section - he had respect from his workers and felt responsible for their well being.

More products, new products, using machines for differing purposes all upset the normalwoork patterns, but reorganisation in this way was also perceived as advantageous by some people. "At present we live hand to mouth: we need forward planning a more efficient flow of work." One of the shop stewards remarked: "CD keeps its market because it is adaptable enough to match specific orders - not like Browns." This was echoed by IE: "I think (the GM) is winning in that way, e.g. he takes on just about everything that it's possible to take on in terms of new work on the orthopaedic side. Sometimes it causes a lot of problems here because we can't easily fit it in to meet the deadline; but basically he's right, because he's going to end up with an efficient manufacturing unit that makes a wide range of the company's products - to that extent it's very interesting working here, but the <u>finer</u> points are wrong e.g. we ought to be better informed ..."

Also: "We are not stretched enough yet – but it's early days. I think it is a good thing because we're growing into the job – getting the foundations right for bigger things: that includes creating a team and support group. This releases me to do the things I really want to do – things I want to change: we're still going through a process of setting things up."

These comments show the kind of open perceptive people that were around, and the understanding they had of each other.

"The WS has got the company's interests at heart, but he is caught between the shop floor who know, like and respect him and management who represent change."

In amongst the criticisms were many warm appraisals of the company:

"I like CD – no-one interferes. I can get on by myself."

"The company have been 'magic' to me through my wife's illness."

"I would do anything for JB. If you have a good supervisor then everything is OK."

"The GM is a good listener and he knows his job – he goes around the shop floor every day."

Many people met socially at lunchtime for a drink even though they criticised each other at work to me. Management had informal lunchtime meetings – there were the usual football/darts team, outings and socials etc. It was small enough for people to know one another and many were related.

CD employed 140/150 people within a basic pyramid structure with four members of senior management. (It was interesting to see the GM's classification of these four:

WS: was the '<u>fixer</u>' – he gets the work done in the factory.

A: was the '<u>thinker</u>' – he can obtain any amount of information, but can't make a decision.

IE: was the '<u>Theorist</u>' he needs to come up with facts and figures, technical information. His department was the one from which ideas sprang.

GM: he declined to say what he was, and then went on to say it was a <u>one-man</u> show (!))

Structurally, CD could be shown to be 'mechanistic' in Burns & Stalker's terms with many highly differentiated units, and yet there was this increasing emphasis (from some organisational members at least) on the necessity to be able to adapt, to be dynamic and to be able to take on new product ideas. They were always on the look out for ways in which to increase profit and to remain competitive in an overall external state of recession. Being a labour intensive manufacturing unit, this meant that innovationswere mainly concerned with reducing unit costs of manufacture. This was achieved by emphasising labour saving, material saving, time saving and energy saving ideas. The firm was not so concerned with competing on a product innovation level as with incremental change in product and manufacturing technology. For any major investment the firm was reliant upon London HQ for capital: therefore innovations were mainly kept within existing manpower capabilities. They innovated for economic reasons – to remain competitive by reducing unit costs and increasing manufacturing speeds etc. – but also to retain specific customers (especially individual surgeons) by complying with their design changes. With all this emphasis on reducing costs and manning levels, it is remarkable that more effort was not given to reducing anxiety levels on the shop floor and any perceived resistance to innovation.

<u>Broad Innovation Areas</u>

My way into the company had been via a proposal to observe the possible innovations associated with the application of micro-processors on existing machinery. This was the subject of a feasibility study being carried out at that time by a firm of outside consultants as part of a government sponsored scheme: Quote Appendix 1, P8-9:-

"Background to the feasibility study

Meetings held in May 1979 between the consultants and the GM identified specific areas in their manufacturing processes which might benefit from the application of micro-processor technology. The company therefore looked for guidance under the Department of Industry's MAP Scheme in order to determine the best course of action to meet their initial and future requirements.

Terms of Reference

To evaluate the potential for using micro-processors within the company's operational areas of:-

(i) Double headed Hosan drill

(ii) Instrument Machine Shop

(iii) Spark erosion die making

The report comprised an appraisal of the major operation performed by each machine together with some reference to any peculiarites of the process. This was then followed by discussion of how improvements could be effected to the basic process by alteration in techniques of jigging (where applicable) together with those which could result from additional electrical/electronic control and/or monitoring.

Some observations were also made of the effects on the company of moving into electronic systems generally."

So the initial project of looking at the application of micro-processors on existing technology was delayed. However, during my time in the company other areas of innovation had emerged. These were documented in the report meeting of January, 1980 (Appendix 3) as (Quote P6-7) "(v) The final part of the meeting was concerned with my position, and research work on innovation and decision making.

It was decided that there were three main areas of innovation:-

(a) the data control system for planning production - headed by A;

(b) the relocation of machinery and plant space - headed by IE;

(c) the development of a forge on site - headed by WS.

Of these (a) and (b) seemed to be the areas for immediate work and it was agreed I should liaise with the project officers - A and IE respectively.

The 'nuts and bolts' innovations at shop floor level were not deemed particularly suitable for study as they were really outside of Sheffield control - they were prescribed by London. I would be able to collect and catalogue these though through contact with IE and the production engineer."

Contrary to the thoughts about 'nuts and bolts' innovations at shop floor level expressed in the last paragraph of the report on the management meeting, over the next few months I did concentrate on this level of innovation.

This was because the first macro level of innovation approached (that of a data control system for planning production) was initiated with a micro innovation, the introduction of a new process (route cards) forerunning the eventual application of computerised production control. As explained in the next chapter this was seen as an interim step while waiting for financial backing from London.

The route cards were studied as an innovation in their own right. It soon became apparent that within the macro levels of innovation were many micro areas of innovation which assumed just as much importance for the people involved. This supported my own early conception of large scale innovations being made up of small scale decisions and changes - rather like an onion. The encompassing term 'innovation' - like the skin of an onion - holds within it many other layers of innovation which may be interlinked, but can be poofitably peeled back and examined in their own right. Alternatively, you can start from the opposite perspective and (as with a set of Russian dolls) see that within each innovation implementation process lies the kernal of another implementation process which is always present and influential in the thinking and acting of those taking part.

As my research progressed these concepts were accepted by management as they broadened their own outlook on innovation to include areas not recognised before as being worthy of the name 'innovation'.

Four main areas of innovation emerged. These were:-

(i) an improved data control system for planning production: as intimated above this was initiated by a micro innovation - the introduction of route cards;

(ii) the use of on-going adaptive technology on existing machinery with a view to increasing productivity (arising out of the Mapcon report);

(iii) coping with design innovation required by surgeons; usually this was an adaptation of a standard product line, but sometimes meant a new product. (Quote Appendix 1. P5)

"Product development is usually instigated by surgeons; they are in close contact with some who came with ideas and drawings for ways of improving their technique with adapted products. This inevitably means that CD must be highly adaptive and ready to cope with change themselves. It also means that besides producing large batches of one particular item, e.g. an artificial hip joint, they are also producing small batches of the same item with variations for a particular suggeon. In large part they are user/customer dominated

- the NHS being another customer with specific legal obligations to comply with - e.g. the quality and type of raw material used. Developing new products often means clinical experiments using experimental items."

(Of importance here was the fact that Sheffield did not liaise directly with surgeons but went through the R & D department in London.)

(iv) organisational structure innovation e.g. the setting up of a requisition system for new tooling. This does not really fall inside the definition of technological innovation but does serve to illustrate some of the human factors which account for the bulk of variations in the innovation implementation process.

A summary of the main innovation areas shows these four categories:

(i) Process innovation - production control

(ii) Adapted technology

(iii) Adapted product (or new product)

(iv) Organisational structure - process innovation.

The next chapter examines one innovation within each of these categories in detail with particular emphasis on the process of implementation.

CHAPTER V

Innovation Profiles

Introduction

Analyses of innovation have frequently found it convenient to describe general stages or phases of the innovation process. Usually three separate stages are distinquished:

(i) invention - the generation of a new idea

(ii) adoption - the process of deciding to incorporate that idea (or someone else's) into your own organisation

(iii) implementation - the process of actually doing the innovating, making the idea a practical reality within your organisation.

This study focuses on the stage of implementation. It is suggested that once the fundamental decision to innovate has been taken, the stage of implementation consists of a sequence of smaller, incremental decisions and changes. This process is studied via four profiles illustrative of the main categories of innovation within the firm mentioned in the previous chapter.

(i) the introduction of batch route cards - production control, process innovation;

(ii) Smith-Petersen nail - adapted technology; process innovation;

(iii) Rings' hip joint - adapted product innovation;

(iv) Requisition system for new tooling - organisational structure; process innovation.

This chapter presents each profile historically (as it happened in real time) followed by an analysis of the implementation process with particular reference to:

- classification of innovation
- personalities involved
- interaction of personalities - results of interaction
- the research role
- recommendations - feedback and learning

From an analysis of this data emerges a framework of five mainline issues to do with innovation implementation which form the basis of the next chapter.

Innovation Profile 1

- the introduction of batch route cards - process innovation

The need for a proper production control system had been recognised since September 1978. The GM and A discussed the matter: their first throught was to use a small computer, but as A commented: "You look at these things, but you know you've got no power to buy them; it's over £30,000 for software." They next looked at using the services of a computer bureau: "we got as far as we could before we actually had to spend any money." (June 1979) This resulted in a meeting between GM, A, the Management Services Manager (London) and the computer bureau people. Following this it was proposed to purchase a ready made system and use it on London's computer. This would:-

(a) facilitate site production control

(b) solve the interface problem with London.

December 1979:

A - "We are still waiting for approval - money; nothing has happened yet; but we haven't left it completely; we're trying to put in one or two innovations as we go along - like route cards - something that we need now which won't be useless or upset us no matter what we take in the future."

Description:

Basically the route card removed control of work schedules from the individual section foremen to production control management (a relatively new post). It was mainly concerned with surgical instrument manufacturing where batches of work moved around the shop floor from section to section (Exhibit 7). Previously foremen had received a total annual schedule and could pick and choose at will the work they wanted to do. This resulted in a lack of order and sequence of work. Bottlenecks occurred in production, orders were not met and management had no knowledge of what was being done at any one particular time. There was increasing pressure on top management from London as their enquiries about orders became more specific through use of a computer.

The route card was designed so that:-

(i) foremen no longer had to requisition materials;

(ii) foremen no longer had to chase work batches around the shop floor;

(iii) at any one time management could find out what work was in progress and where it was;

(iv) reasons for delays should become apparent;

(v) where delays were happening should become apparent;

(vi) management could sequence work according to their production schedule;

(viii) a smoother work flow and greater efficiency should be promoted.

This brief description shows the hoped for improvements in production scheduling that management wanted to achieve. It seemed a fairly simple uncomplicated innovation on the surface, and so it was treated by the managers responsible for its introduction to the foremen. The process of implementation once again seemed to follow a straight-

EX. 7

Normal work route (x = section)

Blank ⟶ machine shop ⟶ fitting ⟶ heat treatment (hardening)

x hard set ⟶ wheel (glasing & polishing) ⟶ marking ⟶ x final set

⟶ warehouse ⟶ London

The route card would stay with a batch of work throughout its progress round the shop floor.

forward structured path. For clarity I give the sketal outline of the process of implementation first, as it happened step by step, and then go back to look at various issues arising out of each stage.

Process of implementation

(i) A formulated the card (Ex. 8 overleaf)

(ii) A proposed the experimental introduction to GM, WS, IE & PC

(iii) An explanatory meeting with A, Ws, PC and one foreman (SPI) showing the completed route card

(iv) Pilot experiment using the card for one month in one section (SPI): January 1980

(v) Two general meetings with foremen to inform them about route cards: 4 February 1980

(vi) General implementation: 5 February 1980

(vii) Feedback meeting of foremen: 29 February 1980

So the observable stages were:-

- Formulation of card
- Pilot experiment
- General explanatory meetings with foremen
- Implementation
- Feedback

It is interesting to examine each stage of the process carefully to give a fuller analysis of what happened and to draw out implications for the whole process of implementation.

A formulated the route card. He was meticulous in preparing an account of how the system was to work in theory - the mechanics of the system, what information each card should contain, how to record the information, what to do with each card, how the cards were to be used etc. - and in justifying their intoeduction. (See Ex. 9 Batch Identification System overleaf.)

oduct Group	BATCH CARD (Factory Copy)	Date must be delivered by

le Ref	Catalogue No.	DESCRIPTION	Quantity

AILS OF ANY ITEMS REMOVED

Reason	Qty	Initial

REMARKS

OUSE

uantity acked

Date

THIS DOCUMENT IS TO REMAIN WITH THE BATCH UNTIL IT IS PACKED

roduct Group	BATCH CARD (Office Copy)	Date Required By

ule Ref	Catalogue No.	DESCRIPTION	Quantity

HECK

Pattern	
Tools	
Materials	

REASON FOR DELAY

ESTIMATED NEW DELIVERY DATE

ATE WORK STARTED

REMARKS

EX. 9. PROPOSED EXPERIMENTAL BATCH SCHEME

BATCH IDENTIFICATION SYSTEM

How Planned System Works

1. Batch cards (in duplicate for all work on hand) prepared.

2. Filed in Period Order.
   In Catalogue order within each Period.
   As schedule amendments occur, cards are added/removed.

3. Use card to record availability of production requirements, e.g. Pattern, Material, and note any delays.
   Each month check through next month's cards.

4. Issue one copy to foreman when work is to commence, (i.e. month before delivery required?) give cards also for later batches of same product.

5. Check before issue that MATERIAL are all available.
   PATTERN
   TOOLING

6. Foreman withdraws material from stores and commences work.
   His copy of Batch Card goes into tin.

7. Any work not started, foreman returns card to Production Control - write on card the reason. Tie back to office copy.

8. Office copy of Batch Card of all work in progress shows date work started.

9. File in Production Control Office therefore shows:-

   All backlog items in order and reason;
   All work in progress and date started;
   The state of play on all future batches.

10. When work reaches warehouse, and is packed, batch card tied back to office copy.

    Then used for Delivery notes
    Invoices
    Up-date Main Schedule.

9.11.79

BATCH IDENTIFICATION SYSTEM

Objects

1. Simplicity. This is only an interim measure.

2. Means of identifying Batches "on the floor".

3. Means of indicating to foremen priority of work (to maintain date order).

4. Means of identifying to Production Control which batches are in progress.

5. Means of recording in Production Control all the facts about the batch. (To ease production reports and information, e.g. back order report).

6. To highlight delays to Production Control.

Plan

1. To run as an experiment in one section only - General/SPI - to "suck it and see".

Method of Implementation

1. Two copies of Batch Card (1 = Factory) prepared.
   (1 = Production Control)

   (Brief foreman - PC)

2. Take Production Schedule write up Batch Cards in Duplicate for all outstanding work, in SPI/GEN.

3. Place in a file, sectioned off for each period in Catalogue No. order in each period.

4. Obtain a list of W.I.P. from the foreman (including what is in Polishing and Finishing).

5. Take the factory copy of Batch Card for W.I.P. and place in ties, on the shop floor.

6. Call meeting of all foremen - explain details of experiment.

7. Proceed to use the system until say, Christmas, then review.

9.11.79

He also formulated a plan to run it as a pilot experiment in one section only " to suck it and see" and then to introduce it generally through calling a meeting of all foremen to explain the details of the experiment. The system would then proceed for four weeks when there would be a review of the situation.

A seemed to think that involvement with the innovation process by interested parties, i.e. the foremen, was essential:-

"I said it would be better to do it in one section because I didn't want any upsets and also I wanted to see if any changes came in which you don't know until you've started doing it. I was probably a bit too worried about what effect it would have, because they all seem to be in favour of it and they all say we want more communication. Barry (WS) and I saw them because obviously you know you can't put bits of paper out without saying to them otherwise they're going to draw wrong conclusions, and we told them what I said to you, that it's not going to be work study, or something like that they might fear - it's just for this description purpose.

"I tried to impress on them that none of this was taking away the real skill of their job which is dealing with their men, allocating to them the job, knowing what man can do what job and so on. I think it will come if it's done properly - only if you just swept in next week and started throwing these around I think they'd resist it."

However, although his heart was in the right place, he had not really thought through the implications of <u>how</u> he was going about the introduction of the route cards, or the real reasons for <u>why</u> he was introducing the route cards.

Perhaps I had better explain my own position here so that it is clear what part I played in the proceedings. I was relatively new to the company at that time having first stepped over the threshold in

October 1979 (it now being January 1980). From November 1979 I had moved from being an obvious outsider and had been working at getting to 'know' the company from the inside - the people, the systems, the official and unofficial groupings, the tasks, This had included interviewing and talking to people at all levels. I became involved with the route card innovation through talking to A in December 1979 about his hopes for a computerised production control system and the introduction of route cards was mentioned as an interim step.

So I joined the implementation process as an observer (trying to objectively record what happened) at the time of the pilot experiment. But I was also in quite close contact with a number of people throughout the company and was able to reflect the understanding I had gained of people, groups and relationships back into the implementation process. This afforded a number of insights particularly with regard to the underlying reasons for actions taken or not taken. So I was in a position to record two different kinds of data:

- observable acts or non-acts
- underlying intentions

Let me explain more explicitly. As I had gone about the company during the month of January I had had quite a few comments about the route cards from foremen who were not yet involved with it - it was still in the period of the pilot experiment. These indicated some feeling that they would have liked to have been involved in the design of the card - to be able to contribute ideas etc.

"We could have given our own ideas particularly if they'd had a preliminary meeting to discuss what it should be like."

A's idea of involvement was to have a meeting to explain about the card and to ask for comments about something already designed and formulated. It was not that he was not receptive to feedback or did not want it but rather that he managed the structure for receiving feedback clumsily.

The timing was wrong: it is hard to criticise something constructively when you have had no part in it up to that point. The foremen did not feel that it was part of them but something imposed from outside and so became defensive and slightly resentful.

"not necessary for this section, our own method is the best ..."

"only interested in increasing production. I cannot see how the route cards will improve production."

"The last time we had work in progress cards, after they left the fitters' departments they seemed to disappear. I wonder if these will do the same."

(Interestingly, this was the first time that A was aware that a similar system had been in operation before.)

At the general meeting these feelings were expressed as:

F/man: "It's a way you can get on to us and say we're holding work up."

A: "No, not at all."

F/man: "You think I've come off a monkey tree now."

Conversely then and perhaps this points to a greater involvement of people to ensure acceptance, the SPI foreman said:

"By using our section as a test, I could see I would benefit by it."

The pilot experiment too was mismanaged in a number of ways. A thought a gentle introduction was best:

"I said it would be better to do it in one section because I didn't want any upsets and also I wanted to see if any changes came in ..."

But the foremen thought in the main that it should have been introduced to all sections at the same time.

"Introducing route cards to one section without informing other sections what was being done was wrong. Bad communication."

"We all know what was going off anyway. You can't keep something like that hidden."

The important point to register is not that either party was right but that there was an unrecognised mis-match of expectation.

This occurs again later.

The choice of pilot section too was not made the most of. A had his reasons for choosing the SPI section.

"We chose SPI because Mike is a relatively new foreman and he was having problems anyway and he was always coming to Paul (Production Control) and saying what jobs we chose him – and he was agreeable to it."

PC (Production Control) had agreed with A's choice, but he was also newly promoted from stores and was a great friend of the foreman of SPI. He had talked to him unofficially about the system a long time ago – and the foreman had expressed great interest in "anything that makes my job easier."

All sorts of questions arise about the appropriateness of choosing a new inexperienced foreman instead of one who was well entrenched in the company and had influence over others; but the fundamental question arises – What was the innovation of route cards really about? – What was it supposed to achieve? Was it to ease one foreman's work? Was it a forerunner of a computerised system with the aim of familiarising the shop floor with paper work? Was it to promote a smoother more efficient work flow?

A would say that he had answered these questions already (see Ex 9) but it became apparent that he had not owned the real problem nor been able to bring it out into the open.

The real problem was embodied in the management of work in the wheel and grinding section. All work had to pass through this section for polishing and glazing. The foreman gave preference to bigger items of work as they arrived because this was then immediately reflected in their productivity bonus. Small items piled up on the side – some were left for weeks – disrupting the scheduled output and causing chaos with delivery dates. It was generally known throughout the factory where the problem lay; many individual foremen mentioned it to me privately as did PC and A but no-one wanted to say it out loud. This was partly because of the position and influence of the wheel foreman. He was a senior foreman, a previous 'little mester' who continually harked back to the good old days when he operated a unique group with his own authority and control over work. He formed a powerful triumvirate with his brother in Quality Control and the Works Superintendant who had grown up through the company to his present management position. No-one wanted to jeopardise his own position by speaking out uncompromisingly about the management of the wheel section.

With the introduction of route cards hints were made more explicitly about the core problem:

"I thought it's what they would want, and the GM thinks so too, but in talking to WS and at least one foreman, Dave, I don't think that that is what they want. They're quite happy with the system now; I mean Dave kept saying - all we want is a little bit of organisation - but he couldn't define what he meant by 'a little bit of organisation'." (A)

"Anyone who shouts about it, is one who isn't getting work through." (F/man)

And in the formal justification:-

"6. to highlight delays to Production Control" (Ex. 9)

This clouding of the real issue had its effect on the successful implementation of the cards. Success seemed to be measured in terms of physically keeping the cards with the batch tins. The foremen in general were willing to go along with the idea, but they could see that it had not been introduced primarily for their benefit - in effect it was not truly relevant for the majority of them. It was management's way of broaching an unmentionable subject; so they were either fairly casual and non-committal about using the cards or they joined forces with the wheel section because of old loyalties or because it was more in their interests to side with the wheel.

One foreman expressed keeness and this was made much of by A: "No comments were made at the time, but since then, this paper has been asked for by Dave and he's pushing, he really wants these cards."

But Dave's real reason was self-interest. He was taking the NEB Supervisory Studies course and wanted to use the route cards for his project. Also it was his output into the wheel section that was largely held up (because it was composed of cheap items) and he wanted his figures to reflect more accurately the work his section did and where the true bottleneck was.

In spite of the reasons for Dave's interests it would probably have been better to use his section for the pilot run: he was a more influential foreman than the SPI foreman, and whereas SPI work generally went straight through the wheel section, his was the work that was held up. (So the problem of delays was actually by-passed in the pilot run!)

In observing the meetings with the foremen to introduce them to the route cards, I was able to reflect back to A afterwards some points which might have helped the process.

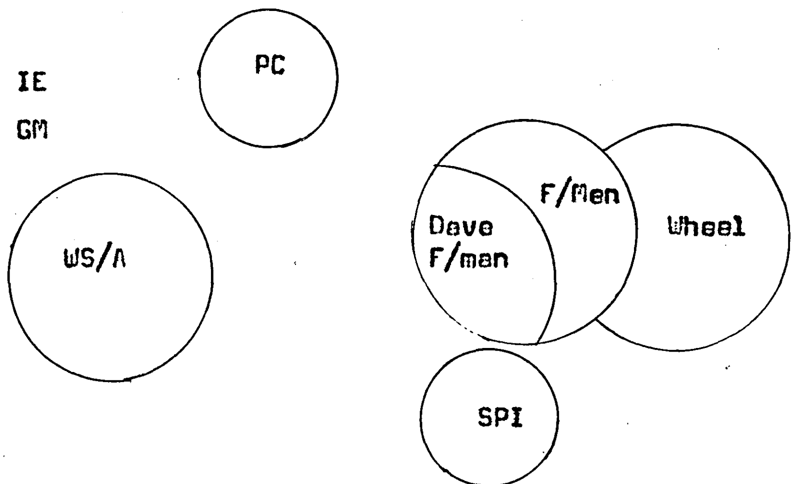
(i) the room was uncomfortable - the foremen just stood around the walls; it was not conducive to staying and talking it through; the expectation was that as soon as possible they would get back tp work, i.e. this meeting was not part of their work as foremen.

(ii) A and WS had not thought out which foremen to speak to together. It was an arbitrary split, but they had realised that group size was important and that is why they had two consecutive meetings.

(iii) They did not use the SPI foreman to help them present the cards. Their thinking was that he knew about the cards and so did not have to be involved.

(iv) All their communication was 'downwards'. They did not really anticipate any feedback or discussion. This exaggerated a feeling of 'them and us'.

In fact a diagram of the people involved helps to show the divisions that existed.



GM General Manager
IE Industrial Engineer
WS Works Superintendent
A Accountant
PC Production Control

The people A most wanted to reach were furthest away from him, and he tried to reach them by the most indirect route. He was also isolated from WS although he was jointly presenting the route cards with him. They had not worked out a satisfactory relationship so they were not able to present a united front. As he said:

"We is not very involved: he is not against it but he wouldn't do it himself."

So WS was left in an awkward position caught between his management role and his loyalties to his old mates in the wheel section. This was a general issue for him to sort out for himself as well. (At that time I did not feel able to open out these issues with A and WS - I did not feel close enough to them.)

As said before my principal role was one of observer, but I was also in a position to see and understand more than surface actions. However I was not party to any exclusive information. All the information I received about people and their relationships, about their motives and reasons for actions was shared in one way or another with other people in the organisation. The difference in my position was the way in which I could see the wholeness of the situation. This was because in one sense I was detached - I was not part of the politics of the situation. This also allowed me to reflect back to participants some of my understanding. The extent to which I could do this depended on our relationship - were they receptive to feedback, was I confident enough to give it.

The role of communicator/influencer developed over time as relationships of trust were built up. In this first innovation situation I acted as observer and partial reflector <u>at the time</u>, but later on could discuss other levels of understanding of the observable aspects of the process.

It was also possible to distill some learning from the situation for those involved. At this stage it took the form of relating practice (what happened) to theory. (This was also bound up with the initial problem of establishing my credibility in the eyes of organisational members.) For instance, Greiner's (1967) views on Group Problem Solving:-

> "... the foremen or the operators may have a more practical understanding of how to get daily production out of a group of men and machines.
>
> The experience of operating people frequently equips them to be of real help; (i) they are often able to spot practical production difficulties in the ideas of the specialist and iron out those difficulties before it is too late; (ii) they are often able to take advantage of their intimate acquaintance with the existing social arrangements for getting work done ..."

This made more sense when A could see the practical reality of the application of this passage to his own management of the meeting with the foremen.

Other learning from the route card situation was taken forward to indicate possible outcomes in a similar process of introducing computerised production control. The anticipated pressures and some suggested guidelines were documented in the July 1980 Quarterly Report to management (Appendix 5) and stated in an objective de-personalised way. Quote:

"4. <u>Looking Ahead</u>

The introduction of route cards was always seen as an interim step. Full computerised production control was always an ultimate aim. As this has become increasingly probable in the last couple of months, it might be right to try and anticipate some of the pressures that are likely to come with it.

4.1 <u>Anticipated Pressures</u>

(i) Pressure from outside concerning amount of capital and resources involved.

(ii) Resistance from inside the company because of perceived threat to their own jobs, fear of change, loss of control over aspects of their jobs, being 'watched'.

(iii) Pressures through lack of recognition of any personal benefit from implementing the innovation.

(iv) Resentment at the amount of work involved with no perception of any recognition or reward for that work.

(v) Confusion over new responsibilities and demarcation of areas of work.

(vi) Pressures from lack of involvement creating a 'them and us' situation.

4.2 <u>Suggested Guidelines for handling Innovation</u>

(i) Arrange for the innovation plan to be sponsored by a board member who will be seen to have influence and enthusiasm.

(ii) Tell employees of the plan so that they will know likely time-scale, probable risks and any radical changes that might follow.

(iii) Set up recognised lines of communication to employees and board.

(iv) Be aware of the need to graft the innovative group on to the existing organisation through effective communication and initiating procedures which clarify the manner in which responsibilities are shared among, or passed to, appropriate departments.

(v) Set up a steering committee for policy and a more grass-roots implementation committee.

(vi) Evaluate staff abilities and continue to make use of their full potential: provide opportunities for continual growth – specialist function? training?

(vii) Encourage enthusiasm in a learning situation: allow those involved to benefit from their participation: foster feedback of perception and information. "

After the meeting I was able to co-operate with A in exploring these points with particular reference to individuals and groups within CD – thereby again acting as practical interpretor.

My own learning on innovation arising out of this example was on two counts:-

(i) aspects of the process

(ii) an understanding of the progressive nature of my role.

(i) I was amazed at the complexity of the implementation process of what on the surface seemed to be a very simple matter. This was referred to at a much later date at a management meeting:- "Innovation doesn't have to be complicated: this was something very simple, but it's the other things that it pulls out with it."

The first seeds of the paramount importance of how the process was handled as opposed to what the innovation consisted of were sown in my mind. Also the fact that one innovation could be perceived in highly differing ways by different participants and that this had an inordinate effect on the outcome. A mis-match of expectations among the people involved could be at best counter-productive at worst disastrous (cf Eveland 1977).

Another conclusion was that the 'product champion' or promoter of the innovation has to be extremely clear and honest in his own mind about what he hopes to achieve with the innovation, and to be able to share this with other influential people. His plan of implementation should be well thought out time-wise and other key people consulted and involved. There should be a proper means of evaluation and review of actual outcome.

(ii) In observing this innovation situation I found a decision had to be taken about the role I assumed - either inside or outside the process. It seemed questionable whether I could allow myself purely to observe when my inclinations were to facilitate the process. I took the role of observer initially and then chose to be a reflector. In doing so I started on the path of increasing involvement with learning and change within the innovation implementation process.

Innovation Profile 2 - Smith Petersen nail - adapted process

The GM called a meeting of the IE, PE, WE in the first weeks of January 1980 to discuss a new order from Cuba. The order, based on a letter of credit expiring in March 1980, was held up in London due to an oversignt and now the pressure was on to fulfil their commitment. There were only 8-10 weeks to get the order through but the GM decided to take it on; this was in keeping with his general policy of establishing the Sheffield site as a factory which got work done in the eyes of London. As IE commented:-

"The group has been through a bad time – they were thinking of ditching the Sheffield site completely. GM is going through a process of getting their confidence back. I think he's winning in that way, e.g. he takes on just about everything that it's possible to take on in terms of new work. Sometimes it causes a lot of problems here because we can't easily fit it in to meet the deadline; but basically he's right, because he's going to end up with an efficient manufacturing unit that makes a wide range of the company's products."

The order was for:-

- 2,000 Smith Petersen nails
- 1,300 McClaughlan plates
- 5 hole brackets

Due to luck and the IE's foresight they had tooled up for the McClaughlan plate in November. There was no tooling for the SP nail. At the meeting the production process of the nail was looked at to try and identify blocks and snags in manufacturing. The Production Engineer was briefed to design a new fixture for the Brook Mill machine.

<u>Description</u>

The essential part of the production process was in the milling of the nail, and also in reducing the time spent in the wheel room glazing and polishing.

Blank ⟶ machine shop (milling) ⟶ wheel room (polishing)

The PE was to design a fixture for tri-fin milling which would:-

(a) produce c100 nails per day

(b) reduce chatter marks due to vibration and so cut down on polishing time

The sequence of events was as follows:-

(i) specific order January 1980 - 8 weeks to complete

(ii) design fixture for milling machine and make it in tool room

(iii) set the machine

(iv) make the first nails (6)

(v) take them through the production sequence

(vi) estimate time for polishing (1 minute)

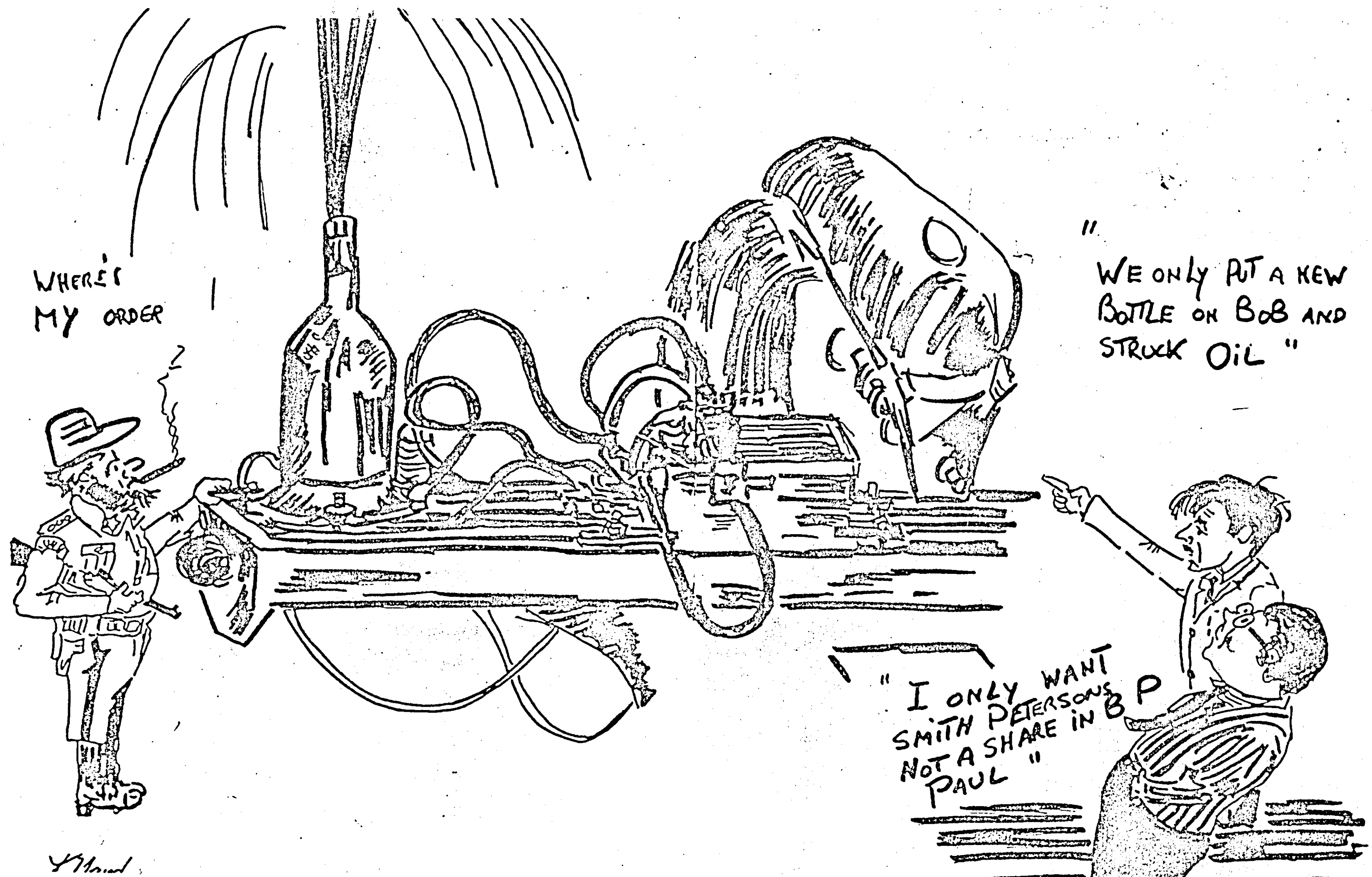
(vii) check standard with quality

(viii) produce 2,000 nails.

<u>Implementation Process</u>

It took the P.E. (a new employee) longer than he estimated to produce the fixture. A great deal of pressure was put on him to come up with something quickly - everyone in the works was aware and interested, as evidenced by the number of people continually buzzing around the milling machine, trying not to show their interest but obviously watching everything that was going on. (See cartoon.) Previously there had been some talk amongst management of the likelihood that the machine operator would be obstructive as he was opposed to any change. He was described as 'a frustrated tool maker' who relied on his ability in setting up machines to give him some importance and status. In the event there was no hitch at this point. It is my opinion that the reason for his co-operation was the interest being shown in him and his machine: the status of having an important order running through his machine and being responsible for getting it through. He was pleased to show me over - "You know about it as well, do you?"

Traditionally CD had always given a very highly polished mirror


WHERE'S MY ORDER
"WE ONLY PUT A NEW BOTTLE ON BOB AND STRUCK OIL"
"I ONLY WANT SMITH PETERSONS P NOT A SHARE IN B PAUL"

finish to all work done by

(i) glazing (12 minutes)

(ii) electro polishing (Quality control to show up any marks)

(iii) hand polishing (6 minutes)

The PE tried to design his fixture to cut down on glazing time - and estimated 1 minute to eradicate the $^5/_{1000}$" clime milling mark at the end of the cut; because of time pressure hand polishing was also cut resulting in a product which was substandard according to traditional CD's standards but on a par with competitor's products. It also achieved a considerable cost saving (see PE report, Appendix 7, A Review of Orthopaedic Machine Shop Prodedure).

However Ted, the glazer, was used to removing every mark and could not adapt for one order to not doing as usual. He was uncertain about the quality standard; so was the Quality Control manager, the person in charge of electro-polishing and the GM. All were working against each other - pulling in different directions.

It was compounded by the fact that in the pilot run the PE had naturally gone to the polishing foreman who had done the job in an estimated 1 minute: the worker actually assigned to the job (Ted) could not achieve this time, but the senior foreman of the wheel room was certainly not going to let a new PE in to his department to discuss work allocation. He kept very rigidly to the idea of being a master to himself (grown up out of the 'little mester' ideas). To the polishing foreman it was just another job; there was always pressure of time being put on their work - this was no exception; - there was no real reason to come forward and help.

As IE said:-

"It is an engineering success story, but it's shown up weaknesses in thepperformance of the rest of the manufacturing sequence; an improvement in machinery has had a detrimental effect down the line; an advancement in one area is thwarted in another."

The Process of Implementation

The actual operation of setting a new fixture on a machine and increasing production of the nail seemed fine. This was well within the technical capacity of the firm. However, outside pressure was brought to bear in two ways:-

(i) commercial pressure

(ii) time pressure

Commercial pressure was evident in that the company stood to lose a lot of money if the order was not carried through by the time stated in the letter of credit. This heightened the feelings of tension particularly amongst management resulting in phrases like "If it's not on tomorrow I'll de-pipe you."

The importance of meeting an early deadline however was not made immediately explicit by the GM even to his senior management team. Initially he said the expiry date was May 1980 (instead of March 1980) so that they would agreed with him to take on the work. Only later did they find out the true date. This was characteristic of the GM's style and generated much resentment amongst his management 'team'.

"The worst thing is not really knowing why - I am making suppositions all the time." - IE.

"We find out the truth in an outburst." - A.

But they in turn did not pass on the immediacy of the deadline to the shop floor, who interpreted the pressure being put on them to produce the nails as just another instance of management pressure. Only gradually did they become aware of the short time limit. There was also aggravation of the situation in that it was the hand skilled workers who were slowing down the process and not the machine operators (engineers) - this fed the felt divisions mentioned before between existing groups of workers.

However the real setback occurred later on in the cycle of production and seemed to be a combination of:-

(i) defining the quality standard

(ii) the actual people involved in quality.

The uncertainty generated by the lack of an objective quality standard reflected through the different participants in different ways. The GM in his interfacial position between London HQ and the shop floor pretty well abdicated all responsibility; he withdrew and left it to others to decide, but was very forceful and highhanded in the way he passed on that responsibility:

"Get this sorted by the time I get back on Wednesday or else ..."

The Quality Controller (QC) became overcautious in his response and annoyed the workers by continually rejecting the nails and sending them back for further polishing: this also annoyed the engineering department because it reduced the efficiency of the PE's fixture and only allowed c70 nails production per day (rather than the estimated 100).

Other significant points were:- (Quote Appendix 5)

"(i) those who made the policy were not those who had to carry it out; however there are ways of facilitating the implementation process. In this case the glazer who was to actually do the polishing could have been approached for the pilot run; the polishing foreman could have been involved in an explanation of the importance of this particular order.

(ii) As the implementation process became involved with more people, changes in programme shape were almost inevitable. Ideas and standards of quality were continually being re-defined by different people to suit their own purposes. In re-defining, the innovation moves away from being the property of a single individual or small group to being the property of a substantial group within the organisation, if not of the entire organisation. Essentially this is a process of communication - a process of adjustment, compromise and accommodation of different interests.

In this case, as the SP nail moved into production more emphasis could perhaps have been placed on re-thinking and re-defining the quality standard with all those concerned with quality. This would have meant re-thinking in terms relevant to parts of the organisation which had not yet been involved in the original planning: i.e. anticipating Ted's difficulties; bringing in someone more acceptable to the senior foreman of the wheel section (e.g. WS) to ensure his co-operation. It also points to the importance of feedback in the decision-making processes and also to the fact that the decision-making processes are not necessarily simple linear progressions but complex interactive patterns."

In the end, there was a meeting of GM, IE, QC, WS, to discuss the relaxing of standards more specifically and also a resolution to 'buy' more time from London by reducing the amount of time that London had allocated themselves for packing and distributing.

My principal role in this innovation situation was again one of observer - but tied to this was the role of listener and defuser. This was recognised by other people in remarks like:-

"It would be a good thing if you were there - it would make for a calmer atmosphere - more reasonable." IE.

People were able to 'blow their top' in front of me and voice their fears - PE,QC, Ted, IE - all, interestingly enough, except the GM who denied me access to the meeting when he first told management about the SP project, saying that he was 'in a funny mood and was going to be tight on the others - though they didn't know that yet.'

Later on I used this innovation episode as the substance of a report to management in which at their request I drew out points about the handling of the process. These were the points just mentioned (P21-22); I was assuming the role of communicator of ideas about the process and identifier of problem areas. At that meeting and in the ensuing discussion it was clear that they found the analysis of past siltations useful and that they were hoping to take their learning forward into other situations.

"It's useful to go over situations and get things in perspective." GM.

"It's good to oversee the whole project and pick out things to learn from to help you next time." IE.

A new concept of innovation seemed to arise - it was isolated as an actual event in organisational life which could be planned for:-

"Innovation is a continuous experience for the compapny and for thdiv-iduals. You learn to cope with innovations through cumulative responses to innovation situations."

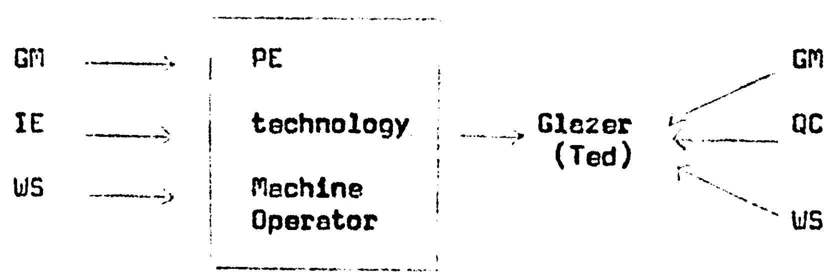
The significance of people in the process and of their own roles in the process was realised.

"We can do it all, but things still end up in a mess because people still havettheir own interpretatiions. If someone is determined to go his own way, he will."

"It's the process that matters; it's different people every time so you get different reactions: I'm the only one who is the same each time, so it's what I learn and do that matters." WS.

This last remark was really a break-through in self-awareness for WS and showed a new use of language and idea.

In observing this innovation situation my ideas about the importance of people involved in the innovation process and their interactions as opposed to the technology of the innovation were re-inforced. Once more the technical process seemed to be straightforward: the innovation was a minor alteration in process technology - adaptation rather than invention; an incremental innovation making better use of existing equipment. It should have generated very little uncertainty - and in fact did so, but sparked off greater uncertainty in another area. This was not foreseen because initially there was not an overview of the whole situation: the innovation was not to do with quality initially but with the addition of a new fixture to an existing machine. As the project progressed however the focus shifted and the quality standard became the important issue. However there was not a corresponding shift in taking into account all the interests of individuals <u>new</u> to the process. A diagram helps to make this clear.



Decisions about innovations and about how they are to be implemented within the organisation cannot be taken as purely separate entities but must be taken in the context of how the innovation can become part of the organisation. This means taking into account the dependent nature of what seems to be a separate isolated event, and would suggest an integrative team approach involving relevant personnel at different stages. In suggesting this approach it would be important for members to recognise and learn from the behavioural influences on the situation; - to be able to understand how and why they themselves behaved and what effect this had on others; to look at the nature of the interaction and be able to anticipate possible problem areas; to understand the different levels of communication and the central role that good communication plays in creating a climate of trust.

The third innovation profile highlights the dysfunctional effects of having several groups of people concerned with the innovation process all operating in their own individual spheres without much thought for the totality of the process. In this case the main stumbling block was in the interface between the London R & D depaftment and the Sheffield manufacturing unit, but it could equally well have been the interface between different departments within one company. The same lack of communication and integration can be seen between the group initially classed as the 'innovation' group, and other groups in the rest of the company who at different stages are more concerned with putting the innovation into operation.

Innovation Profile 3

Rings hip-joint - adapted product

Mr. Rings (surgeon) required a particular kind of hip-joint - one with the same stem but a different head, neck and collar. The total hip prosthesis is a two part appliance of a cup and a head on a stem, which fits into the cup. The Rings' appliances were designed for use without cement and this new addition to the range consisted of a femoral component on which was fixed a High Density Polyethylene Head, enabling the prosthesis to be inserted without the use of cement while retaining the low friction properties of HDP.

Mr. Rings liaised with the R & D department in London who produced a prototype - one, made by hand, - for the surgeon to look at. He liked the look of it so London sent the drawings and prototype to the draughtsman at CD Sheffield. He then had to redraw it to make it possible to produce it on their existing machinery in the quantities desired. When these drawings were resubmitted to the surgeon, he was not as pleased with them as with the 'fancy' ppototype. In the draughtsman's words:-

"He makes an aesthetic judgement; he does not look at it from the engineering/production viewpoint."

A similar instance occurred with another new product, the Gardener Kyphosis Distractor. Here the design drawings and prototype sent to the Sheffield site from London R & D did not always coincide in specification. The draughtsman redrew the design drawings, making certain assumptions about thread, screw end, thickness etc. The model was made according to his drawings and sent back to London with the new drawings. But he had made incorrect assumptions; the model was no good, a lot of time had been wasted, the draughtsman was in trouble and felt resentful because he thought that the fault did not lie with him but with the system. He cited examples when the product drawings he had sent to London for approval were altered and sent back to Sheffield, and yet he himself received no feedback - good or bad; he never heard their queries or saw the alterations made, merely felt that his position was being increasingly undermined.

The Ring's hip joint profile illustrates a very familiar innovation implementation process to the company, - in Simon's (1959) terms a 'non-programmed' decision making process which has become 'programmed' through habitual ways of response. However an analysis of the process showed habitual mishandling due to a lack of care in overseeing projects and trying to learn how to facilitate the next occasion in a more efficient way.

Once the product had been satisfactorily designed the production schedule went ahead using the appropriate established processes for that type of product. The hitch in implementation occurred earlier in the process, focusing on the link between R & D in London and designer/producer in Sheffield. According to the draughtsman, a knowledge of the machinery, the tooling, the manufacturing process as well as direct contact with the shop floor, was vital. He expressed this in his report on Product Design (Ex. 10 overleaf) - the essentials being that London was too far removed from engineering and production, and there was a need for an integrator. The IE's view was that:

"Sheffield ought to be in on the initial design."

The joining together of many little back street industries had resulted in an increased volume of work. The need now was to tie up R & D and production with possibly an integrated team of designers and engineers.

"People who have to manufacture parts are the furthest removed from the ordering situation or the discussion situation. This isn't an isolated instance. The chains of information and communication are too lengthy; it doesn't work; there are too many hitches and personalities involved; you have to piece together what information you can. Crucial people don't speak directly to each other: things get out of hand." IE.

This process has demonstrated the alienating effect that was had on one individual and the counter productive inter group conflicts that can arise. It can also be looked at from a political angle where the participants in the process assess their positions in terms of influence or power.

For organisational members who were directly affected by the change (in this case most particularly the draughtsman) the costs were seen in personal terms and the benefits in organisational terms. In other words his position and work were directly affected by the innovation but he had least power or influence; he was easily bypassed or ignored. While his suggestions may have had to have been adopted, it all happened at one remove from him - he felt himself to be helpless.

At present it would seem that not only the Sheffield plant but also other sections of the company are in need of some form of re-organisation with respect to products:- in initial design, product function, final design, manufacture, delivery date and any alterations needed to aid manufacture or function. A department needs to be set up to improve the present system, which would try and help on problems being met at present. This department would have to work on problems from the beginning, starting with the initial design.

Initial design

The first stage of the initial design could be drawings produced at the plant where the manufacture will take place. In order to achieve a successful design there should be close discussion with the production department - or any other department as required. This discussion should also include any outside source which could help. The person responsible should then be able to produce an initial design taking into account six main factors:-

- Function - Construction (design) - Materials
- Manufacturing process - Appearance (quality) - Cost

These can be grouped further into:-

(a) Those concerning the customer:

- mechanical loading, climatic and chemical influences, size, weight, maintenance, service life, reliability, delivery date, quantity required.

(b) Those concerning manufacture:

- design construction and assembly, material - its condition, finish and availability, method of manufacture - jigs, fixtures, tools and special machinery, quality - inspection and gauging, cost, scrap utilisation, delivery date, quantity required, production schedule.

If the intial design is approved, a prototype could then be made for approval by the customer. In the field of products made by this company consultation will be needed with the surgeon or hospital requiring the product.

Final Design

After approval, a final design drawing could be completed. From this stage drawings could be made for each step of manufacturing - this aiding quality control, the manufacture of jigs or fixtures needed, tooling and the operator making the product on his machine.

Manufacture

As the product is produced in batch quantities it will be found that some alterations may be needed. Once again the design department can check these, change drawings, notify the production department for any change to tooling etc: check quality is not affected or function of the product. Once again the outside help of the customer may be needed.

If a system such as this could be set up, I feel it could greatly improve the present manufacturing methods - that is if the system was used by everyone in the company. With all information on products at one source the department could be contacted for a quick answer on some of the problems being met at the moment - so reducing costs and helping with a quick delivery date.

Draughtsman

The innovator (the surgeon in this case) on the other hand sees the costs in organisational terms and the benefits in personal terms. He stands to gain a lot of professional kudos from his innovation. He possesses bargaining power: ultimately he can decide whether to withdraw or remain with the company. However, it is in his interests to build up a good relationship with one company and see his innovation idea become a practical reality. This gives the executive interface (in this case the contact in the R & D department) some bargaining power also. He sees both costs and benefits in personal terms; - the effort to adopt is inevitably his task and he must discover whether there is a meeting ground where the innovation idea can become a practical reality through successful implementation.

Because the R & D department was not an integral part of the manufacturing unit in CD Sheffield, the same task of finding a meeting ground also fell on the General Manager. In general, his role was an intermediary one between site and HQ. Most contacts had to be made through him: informal communication between other organisational members at Sheffield and personnel in London was not encouraged even though this would have been more expedient on many occasions. This system of interaction was seen as tortuous and unsuccessful.

"The GM doesn't like me to go direct like that - he wants a full run down on everything that has been said." IE.

On the other hand the GM was generally mistrusted because he withheld information as a means of control and of bolstering his own position.

"GM has got a thing about privileged information. There are several points we don't get informed about and we should. GM sees us as a team, that's why it's hard to accept that we can't be told that information." IE.

"GM knows the results he wants from meetings and so brow beats to get results. His tactics are to batter away until you agree or you resign;

he genuinely believes this is consultancy. He will use any means to get results - even wrong arguments, incomplete information, side issues. It causes mistrust: it's a basic mistake in him." A.

The temptation to use the same tactics in reverse whenever it lies in your power to do so becomes nearly irresistable. The WS used the system to his advantage when a message came from London asking for information on a certain type of machine to be used for Aneurysm Forceps. He gave GM wrong information purely to expose the GM's ignorance about machinery on the shop floor.

These examples describing the general level of mistrust show how important it is to build up relationships of trust and credibility particularly when dealing with something like innovation which involves risk-taking (personal and organisational) and change. In suggesting an integrative team approach I presuppose that time will be taken to build up the team and its relationships. It would be no good having an integrated team unless issues of power, authority, responsibility, role, were fully worked through or at least open for examination. This points again to a personal awareness and an awareness of group processes and interactions - understanding the behavioural influences and implications in each situation.

My own learning in observing this innovation process was to recognise more forcibly the importance of direct contact between relevant people and the building up of relationships of trust so that information can be relied upon. Where many seperate groups of people are involved an integrative team to oversee the whole project could be created. This team would have to spend time building themselves as a team, becoming aware of personal motivations and understanding each other in the pressures of their outside jobs.

Alternatively, it could be the responsibility of one person to oversee events and to ensure participation and integration. It was suggested in Chapter II (P 39) that managers are facing problems of integration which they are growing less competent to deal with. This innovation profile has shown a distillation of the implementation situation into particular needs for co-ordination, communication, involvement, motivation etc.

The role of integrator would incorporate these skills and also the skill of developing them in others through a high 'people-orientation' in the activities used. The implications of this will be studied more fully in Chapter VII through an analysis of the researcher's role as integrator.

As a postscript, from 1 April, 1980, the draughtsman was offered a change of boss - he was still to be based at Sheffield but working directly for the Technical Services Officer (TSO) in London, specifically on:-

(i) new product design (orthopaedics)

(ii) alteration of old designs.

(All tooling and remedial work was now done by an assistant in the Sheffield drawing office.)

This was an attempt to create better links between Sheffield and London, but it was unsuccessful on a number of counts:-

(i) The TSO was not perceived as the right person to liaise with by people at Sheffield.

"He has no engineering base: he is unaware of the pressures of a production environment: he is insensitive in his handling of people." IE.

Also he had no real authority or influence - was merely another cog in the wheel.

(ii) The Draughtsman had been given the impression that his job area was being expanded – that he would now be involved in design and fixing quality standards; but he found that nothing had changed materially – he still had no real influence.

(iii) The system started well with meetings between relevant personnel from London and Sheffield to go over new products: the draughtsman was given a two month schedule. But in three months the impetus had gone. The TSO was suddenly transferred to another position (no explanation given) and was not replaced.

(iv) This left the draughtsman feeling very sore about this off-hand treatment of him. He was also upset because he saw his link of communication and recognition gone. He felt disillusioned with the whole set-up: he felt he was back to the 'same old game of churning out work for Sheffield with no plan, oversight or recognition'.

The process of initiating and implementing this system gives many indications of reasons for its eventual failure. It is symptomatic of a 'plug-in' solution; one which seems good in theory but which did not actually achieve what was wanted. The need was for a better sense of co-operation and communication on product design and it would have seemed sensible to link in the Sheffield draughtsman more directly with London. However it transpired to be an artificial system with little meaning for those concerned because of a lack of time spent initially on clarifying people's expectations, roles, responsibilities, tasks or accountability. The system was soon seen as superfloous – a patch up job – because it had not been fully thought out in terms of those actually involved, nor had those people been consulted in any way about how they saw the situation.

There was no one obvious 'head' person to go to with on-going or emerging queries or suggestions. There was no emphasis on helping the people concerned to create a satisfactory working relationship or to service that relationship through giving time to the essential work of understanding the process of working together.

The result was a breakdown of the system and disillusionment for those concerned. An examination of this unsuccessful implementation has implications for the next innovation profile which also concerned the setting up of a system of working together.

Innovation Profile 4

The requisition system - process innovation

This system was set up in November/December 1979 by IE to improve the system of requests for new tooling. It was also seen by IE as a means of creating a co-operative team out of a group of individuals to ensure a better working together on projects of mutual interest.
"I think it's the only way to work - in a team of people. It was obvious that the people who were to work for me pulled in their own separate ways and there was a lot of ill feeling - no team spirit."
He also had personal motivation for accomplishing a team set-up:
"My time at CD is getting experience of dealing with people - that's how to get on - it's what they want in interviews now, and I think engineers need to be involved in running companies."

The team was to consist of the Works Engineer (WE), the Production Engineer (PE), Tool room foreman (TRF) and Draughtsman (Dr), and would meet once a month.

Prior to this requisition system, any foreman wanting a particular piece of tooling went straight to the tool room with his request. The tool room foreman would make his own drawing and then make the part. This meant that:-

(i) there was no compilation of proper tooling drawings;

(ii) shop floor workers were not using proper drawings;

(iii) the priority of work in progress in the tool room was disrupted;

(iv) the PE, WE and Dr. were uninformed of work in progress and of alterations made to existing tooling requirements.

The foremen used this system of going direct to the tool room out of habit and because they knew the TRF of old. They got things done as they wanted and their immediate need was satisfied more quickly. With a recent increase in the volume of work however and the beginnings of an expanded engineering department (with two new posts - that of IE and PE) there was an increasing mis-match of management needs for formal drawings for the record and shop floor requirements for immediate practical workable drawings. There was a need to clarify working systems and people's roles within them.

The requisition system initiated by IE required the individual foremen to go direct to either the TRF or PE or Dr. and consult with them; they (TRF, PE or DR.) would then pass on the requisition to the WE who would place them in an order of priority and order the work to be done.

The Process of Implementation

Initially IE concentrated on the task system - setting up the paperwork procedures and system of reporting. Then he suggested to WE that he and the other three (PE, Dr. and TRF) got together regularly to discuss any problems that were arising - though there was no restriction on what they talked about. He saw his own position as outside of this group of four - more as an overseer of the whole situation. He was also conscious that WE had been in the company long before him, and he did not wish to take away his feelings of position and responsibility. It was interesting to note that when I talked to WE about these meetings he referred to them as:-

"the meetings I set up."

He also said:-

"We discuss the work we've got on: the main reason is to try and open TRF up a bit - he tends to be introvert, won't communicate at all. He thinks he knows more than the rest of us, but he's got an inflated opinion of himself."

This was echoed by PE:-

"he's a bit of a loner: he's good, he knows his job but he needs bringing in. He probably regards me and Dr. as superfluous. He's tied up making things."

This shows an awareness of the importance of good relationships for making the system work - focusing not only on task but on process.

At first it was the TRF who resisted the implementation of the requisition system. This was understandable in that it seemed to remove some of his status in the eyes of other foremen; also he was used to working on his own and being in charge of his own work. He was ambitious and saw no real need for bringing in new people (such as PE) to staff an expanding engineering department. (He had wanted the job of PE himself.) He resisted by attempting to (and succeeding in) by-passing the system altogether - in effect ignoring it. Then gradually as the monthly meetings came into operation he became more co-operative; he started to be more open about what was happening in the tool room; although he still did not like being told what to do he began to accept it as part of his job in relation to the others.

In January 1980 the GM suddenly announced that he now wanted the requisition system to go through him - he would sign all tooling requests. His reasons were never made explicit but IE thought that it was as a result of pressure from London to explain tooling costs. He supposed that someone in London had seen an increase in tooling costs (because two more people had been set on), and because they (London) paid for all the cost of tooling they wanted to know why.

"London do not fully understand the tremendous pay-off that good tool-

ing provides, therefore they put pressure on GM who in turn is keeping a tighter rein on tooling. But he doesn't discuss his motives, just announces the change. We have no knowledge of the background."
The WE saw it as the GM obtaining more information for himself, but "We are not considered grown-up enough to be told."
His intervention had a bad effect however on TRF who interpreted it as removing further some of his power and status. His reaction was:- "doesn't he trust me?"
The whole affair was arguably a contributory factor to the TRF leaving the company in mid-February 1980. In fact the GM's intervention had a disproportionate effect which could have been foreseeable. He only wanted 'to be seen to be keeping an eye on things'.

The care which had been spent on building up a team of workers and ensuring co-operation was lost at one stroke through a basic lack of communication and disclosure of motive.

However, in spite of this experience, the IE was still committed to the idea of working within an integrated team concept and he saw an increasing need for this kind of organisation for new product development (NPD). This was because:-

(i) 'one-offs' were becoming increasingly standard;

(ii) the growing importance of orthopaedic products and the fact that Sheffield would probably become the main (if not only) orthopaedic production site;

(iii) he wanted to encapsulate learning from previous instances and re-organise jobs and job descriptions into a proper group to deal with NPD.

I liaised with the IE in helping to set up a NPD Group. Formerly new products had been given to specific foremen to make on existing tooling. If they found that their tooling was not adequate they had gone to the tool room to sort it out. In effect their problem was passed back along the line to the tool room causing disruption of work schedules in the tool room and on the shop floor. The requisition system had been an attempt to help alleviate this problem. The aim of the NPDG was to iron out tooling problems and technical hitches before production. With this in mind the IE and I developed a basic structure for a NPDG and an Alternative Technology Group (ATG). See Ex. 11 overleaf.

The emphasis was on a proper means of consultation and participation for personnel at times relevant to their contribution, plus a viewing of the process as an inter-related, inter-dependent whole. This meant emphasising the importance of consultation and working together, respecting each other's contribution, meeting expectations of involvement, opening up two-way information flows, giving responsibility and accountability to different people at different stages, helping people to understand the contextual nature of their task - to appreciate other people's roles, and letting one person take responsibility for maintaining an overall view of the project and helping the process of integration.

Before each production run there was a meeting to discuss practical questions, e.g.

(i) how to make the new product;

(ii) was new tooling required?

(iii) the level of tooling required;

(iv) when was the product wanted?

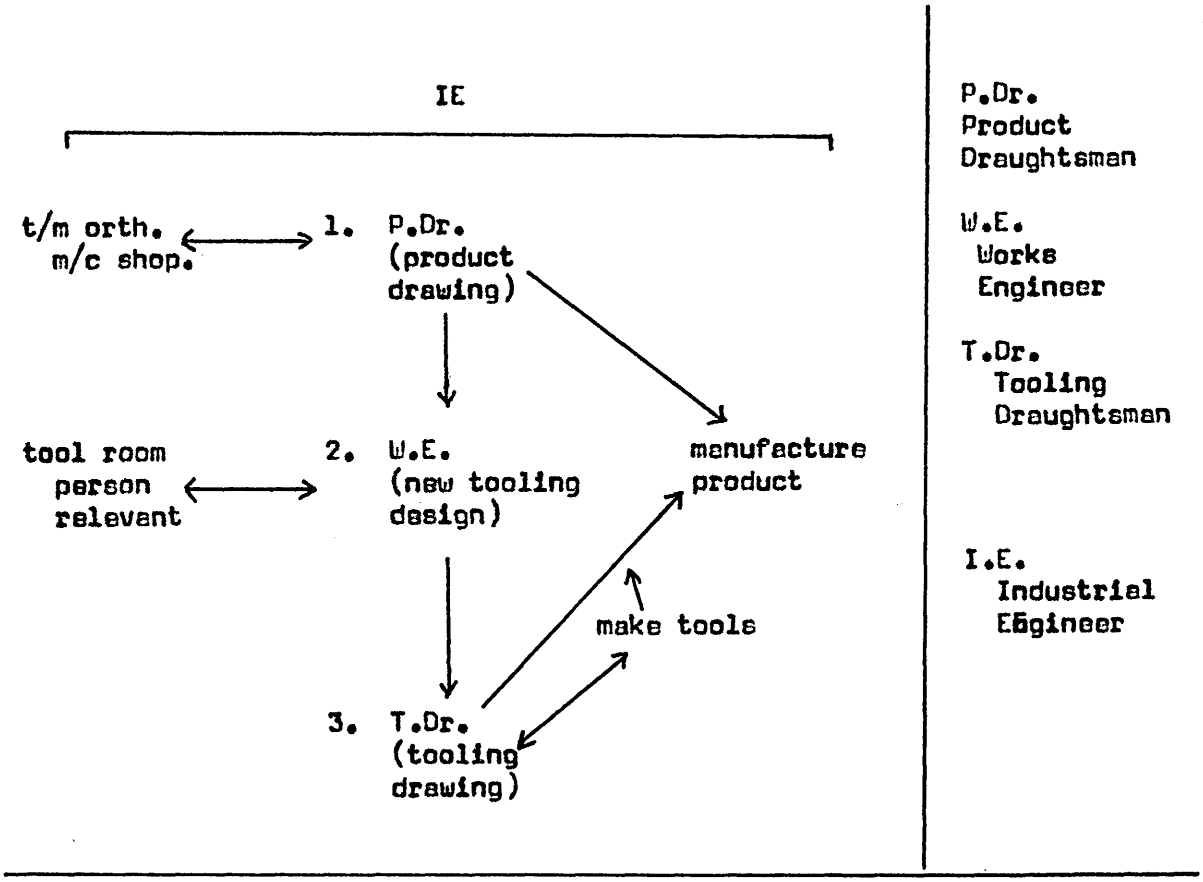
(v) how would it fit into the tool room schedule?

(vi) what quantities were needed in the first instance?

Tasks and responsibilities were discussed and allocated. The relevant behavioural concepts underlying a team approach were also developed as time went on.

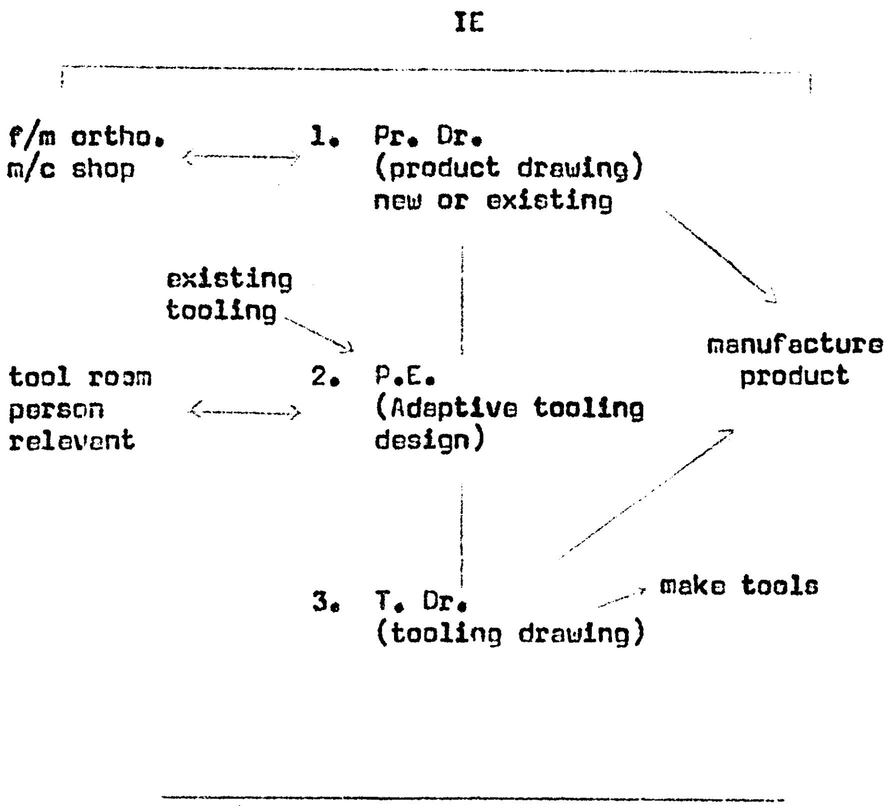
The system was in operation and working well by mid April 1980.

EX. 11. NEW PRODUCT DEVELOPMENT GROUP (NPDG)



- The central core of the NPDG would remain the same, i.e. the Product Draughtsman, Works Engineer, Tooling Draughtsman. They work as a team.
- However, at each stage (1,2,3,) a relevant person is brought in for advice and consultation. e.g. 1. – the advice of the foreman, (or other machinist) in the orthopaedic machine shop. 2. – a relevant person in the tool room. 3. – the tool room manufacturer.
- Tooling and product drawing having been prepared production can begin in the machine shop.
- Any queries revert to the specific NPDG member.
- IE has general oversight of NPDG.

ADAPTIVE TECHNOLOGY GROUP (ATG)



Pr. Dr.
Product
Draughtsman

P.E.
Production
Engineer

T. Dr.
Tooling
Draughtsman

I.E.
Industrial
Engineer

- The same process applies as for NPDG.
- W.E. & P.E. work closely together on tooling design.

Participants expressed their satisfaction:-

"good communication is building up."

"it's the right progression."

"we're pulling together more."

"it's a good way of communicating so nothing is forgotten or lost."

However it was felt important not to be perceived as a separatist isolated group - thereby furthering the cause of differentiation. The very nature of the system of bring in relevant others from the organisation for consultation at specific times of need helped to reduce this threat and to promote the idea that the NPDG was an integral part of the whole organisation, rooted in its tasks and systems and people. As a further means of extending its 'open' nature, the development of the NPDG was made the subject of the April Quarterly Report to senior management. This opened up a discussion on the dependent, inter-linked nature of innovation, and also the concept of innovation being a continuous experience from which participants could learn to enable future implementation situations.

A further development from the NPDG was the reviewing of the structure and place of the Industrial Engineering Department within the company, with the aim of clarifying roles, responsibilities and the network of communications. (See Appendix 6) In considering a draft report needs were expressed for:-

(i) a different name and emphasis for the toolroom - more on the experimental/developmental aspect of their work - a reworking of the tool room identity;

(ii) summaries of areas of responsibilities for IE, WE, PE;

(iii) details of declared project programmes for separate individuals.

There was also a concern to draw in more positively personnel from Production Control, Quality Control and particularly the WS (in his ambivalent position of belonging to both management and shop floor). The concern sprang from a meeting between IE and WE. I was used as a 'process' consultant in talking through the ways of including people – how to reduce threat, how to minimise the risks (what were the risks for him), how to phrase requests, how to listen, build, value. The document produced by IE on a review of the IE department (Appendix 6) reflects in part this increased understanding of the importance of 'process' issues as opposed to 'content' issues:– <u>how</u> to do it has become as important as <u>what</u> to do.

My role changed throughout these phases in structural innovation – requisition system – NPDG – IE department. I began as observer/reflector and then moved to a more participative position liaising with IE in helping to set up a NPDG. I was used here as someone who could talk through ideas, help communicate those ideas, identify possible problem areas, formulate and enable structures, involve people and enable feedback. My main role seemed to be that of communicator with increasing influence over <u>how</u> people managed the process of implementation. In looking at the review of the IE department my chief role was one of integrator, with again the emphasis being on <u>how</u> to achieve integration. This was tied in very forcibly with my own learning from these situations on the increasing need for integration and for one person to assume responsibility for ensuring good communications and oversight of the whole project. I was also made aware of the need for on-going surveillance and a constant care for 'process' issues. These issues were not the prerogative of any one individual but became increasingly a group concern with each member responsible and able to play their part and to develop these skills as time went on.

<u>Summary</u>

The four innovation profiles serve to reflect five increasingly important 'mainline' issues in the process of implementing innovations.

These are:-

(i) implementing technological innovations is a human process;

(ii) implementing innovations is a continuous experience;

(iii) the process of implementation necessitates a holistic overview and a recognition of its interrelated interdependent nature;

(iv) implementing innovations requires the application of skills of integration;

(v) implementing innovations implies learning of new organisational behaviour.

These five issues form the basis of the findings on implementing innovations which are detailed in the next chapter.

CHAPTER VI

Findings on Implementing Innovations

Introduction

When looking at the process of implementing innovations it became apparent that there was a clear framework of 'mainline' issues binding each implementation situation into a whole and also providing a common linking thread between different implementation situations. These were summarised at the end of Chapter V and for clarity are reproduced here:-

(i) implementing technological innovations is a human process;

(ii) implementing innovations is a continuous experience;

(iii) the process of implementation necessitates a holistic overview and a recognition of its interrelated interdependent nature;

(iv) implementing innovations requires the application of skills of integration;

(v) implementing innovations implies learning of new organisational behaviour.

This chapter examines each statement in turn.

Issue One

Implementing technological innovations is a human process

In reviewing the literature relevant to innovation it was noted how many writers made passing reference to the importance of human (often exclusively managerial) attitudes in influencing the innovation situation but yet how little was known in any depth of the real part this factor had to play in the process. Much emphasis was placed on technology per se and the hard economic criteria associated with it and little on the actual process of introducing and implementing technological innovation and change.

A major misconception about technological innovation is that those words - 'technological innovation' - imply a concentration on technology. In fact the actual technology is usually the simplest part of the implementation process. More important was the finding that technology primarily determines who the people in the process are to be.

Individuals and groups of individuals enter and leave the process of implementation at different times relevant to their skills, expertise and knowledge. The process of implementation is a progression of different actors involved in increasing or diminishing interaction at different stages and levels, so the importance of individuals or groups and their ability to advance or retard the process becomes paramount.

At the beginning of the research programme it was thought that the type of innovation studied would have an important bearing on the implementation process. This was because of technical characteristics (following Hayward & Allen 1976) such as relative advantage, compatibility, complexity, divisibility, communicability etc. The mistake was in assuming that these attributes related to the technology of the innovation, whereas in fact they relate more to the people in the process. Characteristics such as 'relative advantage' assume different meanings for different people: the product champion may perceive great advantages whereas the shop floor worker may perceive negligible advantages because it puts his job in jeopardy. This was borne out in looking at the introduction of route cards where an improved flow of work was interpreted as the first signs of a shortage of work by the shop floor, in spite of the fact that managers had introduced route cards to cope with an increasing work load.

Other characteristics as well can be perceived and interpreted in different ways: 'compatability' becomes 'how radical an innovation is it – or is it incremental?' – and to a large extent this depends on an individual's position within the firm and whether he is personally affected. A minor change in quality to facilitate the implementation process was seen as slight from an outside position, but assumed greater magnitude in the eyes (and feelings) of the worker actually responsible in the Smith-Petersen profile. 'Complexity' becomes 'how much uncertainty does this generate?' and so on.

The first seeds of the paramount importance of how the process was handled as opposed to what the innovation consisted of were sown in my mind during the observation of the first innovation profile – the introduction of route cards.

At this stage I had developed a tentative model of the implementation process from an existing model (see Ex. 12 overleaf) of Collier's 1974.). Innovations were classified by the degree to which they departed from the present operations of the company through three variables – product, technology and market. Seven categories were defined: (7a was linked to 7 where new technology was seen as structural rather than technical – as in the route cards.) Each category was tied in with a suitable structural change to formally represent the relevant people concerned with the innovation and a suggested decision-making mode to facilitate the on-going implementation process.

EX. 12. (First) Model of the Innovation Implementation Process

Classification of Innovations by the degree to which they depart from the present operations of the established company: tying this in with suggested appropriate organisational mechanisms to facilitate innovation process, and the θ/m - diffusion process.

Group	Degree of I	Suggested Org. change	d/m process
1	p t m	existing org.	traditional
2	p t m	new eng. proj. team	M
3	p t M	new sales team	traditional
4	P t M	new prod. gp / sales + MF	M
5	P T m	new prod. gp / eng + mf	P/C
6	P T M	new venture company	C
7	p T m	new eng. proj. team	P/C
7 a	p S m	new mgt. team	P/C

p = present product   P = new product

t = present technology   T = new technology

m = present market   M = new market

S = new technology is structural rather than technical

Decision making spectrum:

A	M	C	P
Authorative:	Marketed:	Consultative:	Participative

The model arose out of the evident need to see the implementation process as a whole. This had been graphically displayed in the introduction of route cards which had represented a lot of different happenings which had not been linked together as part of the same process. This had resulted in a lack of formal recognition of different work patterns, different responsibilities, different communication and reporting channels. There was no sense of re-arranging groups of people to work together on the one project - no overall 'team' concept - resulting in a situation of divided loyalties and unclear purpose.

As a model it lacks sophistication and depth. It was found that categories of innovation cannot so easily be defined - nothing was entirely 'new' or using 'new' processes - there were adaptations and a blurring of the edges. Neither could the model be 'forced' onto innovation situations: innovations and people connected with innovations could not be squeezed into shape and then left: it was too prescriptive and inflexible. Another piece of learning was that the existence of a pattern does not necessarily pre-suppose effective application.

But in spite of these weaknesses the model has some value in its emphasis on the totality of the process and the need for a broad overall view. For instance in its application to the Smith-Petersen profile the implementation process would seem to fall into category 7 demanding a new engineering project team and a participative consultative approach. The Rings' Hip Joint profile falls into category 5 suggesting a link up in a new production group involving both engineers <u>and</u> manufacturers in a participative way. A lack of co-operation between these two groups resulted in large part in the breakdown of this implementation process.

Also, within this total overview, the model allows for different components of the process - the innovation, the necessary structural changes to implement the innovation and the manner in which the process could be facilitated - and recognises the need to plan for innovation implementation. It also suggests that innovation can be seen as a recurring phenomenon which can be increasingly competently handled. For these reasons the model still has relevance for understanding the elements that make up the implementation process, but as research progressed it became largely redundant. It was found that a classification of innovation was not as important as first assumed, but rather it was the interaction of the people involved in the process that was of prime importance almost regardless of the type of innovation being implemented.

Thinking about the model and attempting to apply it in implementation situations resulted in an awareness that an assessment of technology really meant an assessment of the people to be involved, with careful planning for new groupings, work patterns and demarcation of responsibilities via effective communication links that were seen to work. This meant on-going 'servicing' of the process and the people in the process - their relationships and the local structures of decision-making and communication - with an emphasis on collaboration and integration within the context of innovation. A logical development of this was to ensure feedback and learning via final and on-going review meetings to assist in future innovation situations.

The learning drawn out of considering the application of the model can be seen in the establishing of the NPDG. Here participants were already aware of the importance of good relationships for making the system work by focusing not only on task but also on process (see the Innovation Profile 4).

The aim of the NPDG was to iron out tooling problems and technical hitches before production runs. The basic structure drawn up by IE and myself illustrates the shift in emphasis from the major 'hard' variables concentrated on in the first implementation model to a focusing on the 'how' of the process and a clarifying of the different roles and relationships within this framework. (See Ex. 11). I quote from Chapter V, p 133

"The emphasis was on a proper means of consultation and the participation for personnel at times relevant to their contribution, plus a viewing of the process as an inter-related, inter-dependant whole. This meant emphasising the importance of consultation and working together, respecting each others' contribution, meeting expectations of involvement, opening up two-way information flows, giving responsibility and accountability to different people at different stages, helping people to understand the contextual nature of their task - to appreciate other people's roles, and letting one person take responsibility for maintaining an overall view of the project and helping the process of integration."

The overriding emphasis on understanding the process brings with it all the issues involved where people are involved - political manoeuvrings, conflicting goals of individuals and groups, power struggles, personal risk and investment, differing perceptions, issues of trust and co-operation, involvement, adjustment, communication. All these have been amply illustrated in the Innovation Profiles - but again it is not providing solutions to these problems that is warranted, more an identification of these 'people' issues as typical ingredients of the implementation situation - and a recognition that the process of technological innovation and implementation is a human process and has to be planned for and overseen as such.

Issue Two

Implementing innovations is a continuous experience

In my search for a suitable company to work with I had of necessity to have some image in my mind of what innovation consisted. I had formulated a general statement that innovation consisted of anything that was 'new' to the company concerned – whether it was an entirely new generation of an idea (invented) or an incorporation into the company of someone else's idea (adopted). The process of making the idea a practical reality within the firm was implementation.

In exploring the concept of innovation with potential collaborating organisations I found that managers tended to concentrate exclusively on what I would term 'macro' innovations – very large scale projects such as total computerisation or the application of micro processors.

At first I thought this was mainly to impress: after all innovation is still equated with 'a good thing' in many minds, with corresponding associations of 'forward', 'progressive','dynamic', 'leader', 'break-through'. Often it transpired that these areas of innovation were hazy ideals of future years, to be attempted 'when we have the capital'.

My own earlier conception of innovation was rather more mundane. I recognised large scale innovations as being composed of much smaller areas of innovation and change. As said before, the encompassing term 'innovation' could be likened to the skin of an onion. Contained within it are many other layers of innovation which may be closely knit and interlinked, but which can profitably be peeled back and examined in their own right; and in doing so a greater understanding and facilitation of the complex whole is possible.

This was gradually borne out as research progressed – however initially I had to start where the company was. My first area of innovation was via the feasibility study concerned with the application of micro-electronics for improved productivity. On the completion of the study it was decided not to invest immediately in micro-electronic additions to machinery, but to reserve judgement, meanwhile improving existing machinery through the more traditional methods of new jigs and fixtures. This then, in the eyes of management, removed this area out of the compartment labelled 'innovation'.

At the first Quarterly Meeting in January 1980 three other main areas of innovation were agreed upon - again all rather 'macro' in character.

(i) a data control system for planning production;

(ii) the relocation of machinery and plant space;

(iii) the development of a forge on site;

(interestingly, two years later only a small part of (i) and (ii) has been achieved.)

It was agreed that I should liaise with the project officers directly responsible for each innovation area. My interest in focusing on smaller scale innovations - the 'nuts and bolts' innovations at shop floor level - was dismissed; they 'were not deemed suitable for study as they were really outside of Sheffield control - they were prescribed by London. I would be able to collect and catalogue these though, through contact with IE and PE.'

In actual fact the first innovation area that opened up was the data control system for production planning and control necessitating liaison with A. As explained before (Chapter V, P100) the introduction of route cards was seen as an interim measure - a small preparatory step within the hoped for framework of full computerised production control - or alternatively a micro innovation within the full macro level of innovation.

I studied this as an innovation implementation process in its own right and this led the way to considering other micro levels of innovation which had not previously been regarded by management as innovations. The different concepts of innovation were highlighted and discussed in the April Quarterly Report (Appendix 4) where the larger innovation areas were seen to be composed of smaller incremental innovation and change; that in effect everything was interlinked and interdependent although it may not always seem so on the surface.

This expansion of ideas and broadening of outlook on innovation led to the experience of innovation as a recurring phenomena - one that was an integral part of organisational life. This was in direct contrast to the popular belief that innovation was a 'one-off' event often unpredictable and crisis-ridden.

"Interest was also expressed in the 'knock-on' effect of innovation. Innovation is a result of pressures from both outside and inside the company, but pressures are also created in different departments by the innovation or the act of innovating. A request was made for me to explore further the separation/dependency issue." (Quote July Quarterly Report. Appendix 5)

One of the reasons the IE gave for wanting to set up a NPDG was that:

"one-offs are becoming increasingly standard."

This represented an advance on the previously held views by other management members that:-

"I run innovation by reacting to happenings as they happen: as they go 'crunch'. It all depends on how quickly you can react to things."

and:-

"The pressure builds up - bang - you have to do something."

Innovation implementation here seems to be connected with thoughts of crisis, things going wrong and adapting to reacting to them. But can innovation implementation ever be a totally planned controlled affair?"

In fact innovation situations can be regarded as specific instances of the management of change, and in allowing this, predictability becomes a nonsense, in the sense that anything predictable is so because of its fixed unchanging nature. In innovation implementation situations where people are an essential part of the process then the very nature of the game is change and flexibility, adaptation and development. Innovation implementation is not something that can be pinned down and dealt with in a prescriptive fashion with a pre-determined pattern or solution.

Patterns have value however in helping to identify the innovation situation and the people involved as an area of potential change: what is then needed is an understanding of the human processes that lie behind change and skills in enabling that change to take place. This was made evident to me through attempts to apply the implementation model (Ex. 12). The existence of the model was useful in encapsulating the different elements that made up the implementation process but was not useful in enabling the process - (lending some justification to managers' rather sceptical views about the value of models). The static pattern had to be actively interpreted, and that necessitated skills of understanding and communication.
"We can do it all, but things still end up in a mess because people still have their own interpretations." was one manager's view.

However the fact that innovation was beginning to be recognised as a continuous experience within the life of the firm meant that people could learn to cope with the implementation process through cumulative responses to innovation situations.

The analogy of the Russian doll was used earlier to illustrate this - where within each innovation implementation process lies the kernal of another implementation process which is always present and influential in the thinking and acting of those taking part. Conversely any learning from one implementation process can be consciously taken forward to illuminate the implementation process of another innovation, even though technically it may be unrelated to the previous instance.

Success in managing the innovation process requires accompanying planned organisation change - or at least the ability to recognise change and learn from it.

Issue Three

The process of implementation necessitates a holistic overview and a recognition of its interrelated interdependent nature.

In seeing the innovation implementation process as a continuous experience of organisation life, it is also essential to be able to see the whole episode as a separate entity with a beginning and an end (albeit with blurred edges) and so to be able to set it in context. This is important for developing an awareness of the dependent nature of innovation - dependent in the sense that it does not occur in isolation - and also a sense of completion - that innovation implementation is related to a 'real' outcome.

Innovation implementation is a process involving high levels of co-operative activity at different levels and stages; as said before the technology of the innovation will determine who is involved in the process and when. For people to work effectively together in a process of change it is essential that they understand the total context of the situation and are able to see their contribution in terms of the whole; in innovation implementation situations that means especially being able to relate their creative contribution to a real outcome. This would entail a more global view of the organisation and the specific innovation project within the organisation.

An inherent weakness revealed in the Smith Petersen innovation situation was the lack of oversight of the whole situation. Initially the innovation was to do with a minor alteration in process technology

- the addition of a new fixture to an existing machine; however as the project progressed the focus shifted, and determining the quality standard became the important issue. This necessitated a corresponding shift in the personnel involved and disclosed a failure on the part of management to understand the priorities of others, and the pressures they suddenly felt subjected to - in this case the limelight switched suddenly from PE to the glazer. He (the glazer) only gradually became aware of the centrality of his role and by then it was almost too late for him to cope effectively with the change. Basically the problem was concerned with a mismatch of expectation evinced as demanding too much or the wrong thing from each other. I highlighted these issues in the July Quarterly Report to management (Appendix 5, P5) pointing out the importance of a greater oversight of the whole project and a taking into account of all the relevant people. Other divisive elements were noted as:-

(i) policy makers were not the practical implementers in the situation, (but still had an important role in enabling the process through a concern for the people involved);

(ii) the uncertainty generated through partial knowledge due to a lack of briefing on the whole project (particularly with reference to the urgency of the delivery deadline);

(iii) the inflexibility of the process in not allowing for compromise and the accommodation of different interests;

(iv) the lack of anticipation of potential problem areas - e.g. quality.

This might seem to indicate a more participative approach to managing the implementation process with a clarifying of goals and objectives, a more effective climate of communication and a valueing of different roles and contributions. Participation has a part to play in reducing resistance to planned change but should not only be seen in the negative light of eliminating <u>dis</u>-incentives; just as important is the search to find positive incentives for those involved – and this again emphasises the importance of viewing the situation as a whole.

This was evidenced by the way IE set up the requisition system for new tooling. He was concerned to improve the system and to create a co-operative team out of a group of individuals to ensure better working together on projects of mutual interest. He saw his own position as outside of this team – more as an overseer of the whole situation – and was also sensitive to the needs of the WE in retaining a position of responsibility. So the WE was the designated 'team leader' if not verbally then by common consent – it was in his interests to make the system work and to search for incentives for the other participants to work as members of the team. The TRF was the one dissenting member in that he saw personal loss of status in being a team member. As time went on however he saw his job expanding and his area of influence increasing through the way in which WE encouraged his participation in the monthly meetings. His incentive for remaining an active team member became increased feelings of responsibility and trust. When this was destroyed by the GM's intervention he saw no reason to continue and left.

This experience influenced the establishing of the NPDG: not only was there an emphasis on participation, involving relevant people in a participative manner with a proper means of consultation and feedback, but also there was an emphasis on creating an integrated team approach. This represented a development from participation in that people were not only actively involved but could also view the process as a whole – could see where their contribution fitted in with others' contributions – could understand this in relation to the whole project and could relate that whole to the organisational context.

The dysfunctional effects of having several groups of people all participating in the innovation implementation process without a regard for the totality of the whole or how it was to be grafted onto the on-going function of the organisation was illustrated in the case of the Rings' Hip Joint. The importance of grafting the innovative group onto the existing organisation is fundamental for implementation, both present and future. An integrated team which was perceived by others as separist or an isolated elite would be furthering the cause of differentiation rather than facilitating implementation. The implementation model focused on the totality of the innovation process and its contextual nature but it was also mentioned that a recognition of these elements did not necessarily enable application. We are back to the old divide between idea and practice - between what is essentially 'out there' and what is 'in here' and relevant to me and my organisation. The concepts embodied in models need interpreting and applying, and this brings me on to the next key element in the process of innovation implementation, that of integration.

Issue Four

Implementing innovation requires the application of skills of integration

It has been noted that although innovation implmentation can be seen as a continuous experience within the life of the organisation yet it is composed of highly discontinuous elements - different combinations of people needing to co-operate at different times and places in differing degrees of relationship - different contributions and responsibilities involving a change from normal work patterns - perhaps different control and communication networks - a turning upside down of everyday routine involving risk and uncertainty.

The innovation implementation situation takes place over some time and clearly depends upon a range of contingencies - organisational, socio/technical, human - such that any one 'solution' would be impracticable and severely limited. All sorts of recommendations can be found to work in one particular isolated instance but cannot readily be repeated: there is no blueprint because, by definition, there is no identical repeat of an innovation situation.

The transcending force that seemed to arise out of disparate innovation situations, however, was that of integration - but integration based on individuals' perceptions and understanding both of themselves and others.

Structural devices, such as the creation of a new unit to deal specifically with innovation, or processual devices, such as temporary project teams or cross-functional committees - can be devised to aid the process of planning and co-operation so necessary for innovation implementation, but do not of themselves constitute integration. As said before, the existence of a cohesive pattern does not automatically ensure integration - integration implies understanding and communication - the pattern needs to be actively interpreted.

This was graphically illustrated in the Rings' Hip Joint profile. Dissatisfaction had been voiced for a long time over the difficulty of working on innovative product design when there were so many groups of people concerned with the process all operating more or less independently with no thought for the whole process. An attempt was made to provide for better communication and integration between London (responsible for R & D) and Sheffield (the manufacturing unit) by:-

(i) Structurally changing the draughtsman's job so that he was placed in a different line of accountability: he was still to be based at Sheffield but working and reporting directly to the Technical Services Officer in London.

(ii) Having planning meetings involving the draughtsman (with his on-site knowledge of machinery) in initial design.

The initiation and implementation of the system however gives many indications of its eventual failure. First of all it was a solution devised and instigated by London and bestowed upon the Sheffield unit, in spite of the fact that most (if not all) the dissatisfaction had been voiced at the Sheffield site, i.e. they (Sheffield) owned the problem and someone else (London) 'sent' the solution. There was no consultation or provision for a two-way flow of ideas. It was also typical of a structural solution that seemed good in theory but because of a lack of care for putting the theory into practice failed to achieve what was wanted and in its failure left people feeling worse off than before.

The fault lay in thinking that the existence of an integrative device ensured integration. There was no sense of nurturing the system through the people involved to provide for present and changing needs: there was no emphasis on helping the people involved to create an on-going flexible system that continued to achieve personal and organisational goals.

Structures can only change effectively where there is a corresponding change in attitude of all those involved. This was seen in the setting up of the NPDG - again a structural innovation to aid integration in the process of technological innovation. As much attention was paid to the 'process' issue of working together - roles, expectations, communication, feedback etc. - as to the 'content' issues of tasks and responsibilities. The system worked well and participants expressed their satisfaction with it. Another concern was to see that the group, though integrated in itself, was not hindering the process of implementation by being separatist and non-integrated in its wider organisational context, - but that other people were informed and consulted about the process at relevant times - and that it was seen to be a normal functioning part of the whole organisation. A danger is that integrative devices are seen to be divisive in themselves thereby creating a 'them and us' attitude. The key element seems to lie in how application of any integrative device is carried out: this presupposes the questions - 'what are the skills of integration needed and who should apply them?'

Because the skills of the integrator are discussed more fully in Chapter VII through an examination of the researcher's role I shall only touch briefly on them here. When I entered the company to research innovation implementation situations a very evident constraining factor on the process of implementation was a lack of overall purpose and direction evinced by different groups and individuals pursuing their own ends without regard for any common objective. The common objective should have been to get the innovation into operation - to move the idea through to reality, - but conflicting loyalties, personal motivations, misunderstandings, confusion of tasks, all got in the way. There was a need to see the project as a whole, to plan a sequence of events, to tap the right resources at the right times and to ensure co-operation, to make sure that everyone knew what the project was and to see it through to the end.

Being an outsider I was able to see these issues more clearly within the total context, and having no personal invested interest was able to help people see that wholeness themselves and their interactions as part of it. I took on the role of communicator/integrator and became involved in innovation implementation processes even although I had no technological contribution to make. The skills involved were mainly those concerned with good commuoication, such that any 'process& consultant would promote:-

- establishing a working relationship of trust and openness;
- providing a good communications network of information and feedback (more direct contact, fewer links in the chain, two way interaction);
- emphasising the importance of listening - giving recognition to the importance of perceptions and feeling;
- helping to identify underlying motivations and reasons for actions;
- establishing a sense of credibility and neutrality.

As research progressed these skills were no longer seen as belonging to one outside person but were developed and extended to people within the process. (This was at my initiative to begin with, as it was always part of my intention to leave behind at the end of my research time, participants who were capable of managing their own process.) It became legitimate and valid to recognise 'process' issues as being of as much importance as 'content' issues: i.e. <u>how</u> a situation was handled had as far reaching consequences as <u>what</u> it was all about.

Where different people were involved on a project an integrative team concept was evolved where it was part of their business to spend time building themselves as a team and using the skills of integration themselves (see NPDG). These skills were not seen to belong as of any right to any one set of people but more an essential area of learning for anyone concerned with the innovation implementation process. The skills also had to be directed outwards to the process of communicating and promoting the innovation in other parts of the organisation not directly involved (the steps of redefining and interconnecting.) The process of learning these skills forms the substance of the next section.

Issue Five

Implementing innovations implies learning of new organisational behaviour

There are two aspects to this statement:-

(i) how do people learn?

(ii) what new organisational behaviour needs to be learnt?

In suggesting an integrative team approach it becomes apparent that part of being a team member is recognising and learning from the behavioural influences on the situation; being able to understand how and why they themselves behave and what effect this has on others; to look at the nature of the interaction and be able to anticipate possible problem areas; to understand the different levels of communication and the central role that good communication plays in creating a climate of trust.

This is what is meant by 'implementing innovation implies learning of new organisational behaviour'; the new behaviour is new ways of relating and communicating, and understanding underlying reasons for actions.

This is made more explicit by looking at the implementation situations studied and seeing what was learnt by participants in the process.

Firstly there were the obvious practical points which were extended knowledge about innovation implementation such as:-

(i) new concepts of innovation, where macro levels of innovation are seen to be composed of equally important smaller incremental innovations;

(ii) the value of reviewing and evaluating the complete innovation process;

(iii) the dependent contextual nature of innovation implementation;

(iv) the pressures to innovate and the pressures that innovation itself creates;

(v) anticipating and planning for innovation;

(vi) the continuous nature of innovation and the implications this has for future innovation situations -

and so on.

The second area of learning was less tangible and more to do with understanding the process. Points such as:-

(i) innovation implies change which can be anticipated and planned for, but as more and different people are included a process of adjustment and compromise begins: cf Smith Petersen profile.

(ii) change assumes different proportions for different people - it is necessary to get beneath surface transactions to understand what effect change, in this case innovatory change, is having, and the consequences for the success of implementation. A good example here is the way a minor change in the introduction of route cards was seen by management as making shop floor work easier, but which was perceived as threatening by the foremen.

(iii) Structural innovation, which often goes hand in hand with technological innovation, can only be effective if attitudes change. Again the route card innovation illustrates this, where meetings were set up to ostensibly permit an open discussion about the introduction of route cards, but where in fact there was little two way interaction or feedback because management did not really expect or want this. The structure for feedback was there but not activated because of a lack of parallel change in attitude.

(iv) Integrative procedures and devices do not of themselves create integration: they have to be implemented with understanding and skill - and these integrative skills can be learnt by anyone taking part in the process: they <u>are</u> specialist skills but not exclusive to any one person or grapp.

(v) learning these skills is an on-going committment which spills over into all aspects of organisational life.

People learn through experiencing; in the sphere of human relations this means receiving feedback from other people on how they perceive you and your actions. The more you understand about yourself the more you are likely to understand about other people. Going back to questions of an epistemological nature, an expansion of inner knowledge leads to a similar opening out of outer knowledge. The skills of integration, and all process skills, operate within this human relations field.

The sequence of learning during the research programme started gradually, beginning with content issues - relating theory to practice (as with the application of Greiner's (1967) views on Group Problem Solving in the introduction of route cards.)

Then the Quarterly Report meetings provided not only for exploring content issues (such as different concepts of innovation) but also for 'safe' confrontation between managers. Here I operated in a process role helping managers to express their feelings and perceptions and translating them into more easily accepted general understandings and behaviours.

The talks I had with IE on the requisition system resulted in a combined setting up of NPDG and the introduction of the concepts behind it at the April Quarterly Report meeting. These were concepts of integration and learning about relevant behavioural factors - how decisions are taken, how problems are solved, how to work in a group etc. In setting up the NPDG great emphasis was laid on how we were going about it (See Chapter V, P133). Initially this was at my instigation, but as the group developed members took on process functions themselves, giving recognition and weight to the equal and complementary role of the process observer in the team.

This seemed to be the key element in facilitating the innovation implementation process. Different ways of managing the process are dependent on different contingencies of the situation, but an underlying understanding of how the process and the people in the process fit together, and an understanding of one's own position within the process, seems to be the overriding integrating force in managing the innovation situation; and this also has application for further innovation situations.

Summary

The five issues described provide a framework within which to view the innovation implementation situation. Although by definition innovation is non repeatable and therefore discontinuous, it does have a continuous aspect in the way it can be anticipated and planned for by focussing on the way the process is to be handled rather than what the innovation consists of. Prescribed solutions are not possible because of the nature of innovation and the involvement of different people at different times; what is possible is an identification of potential areas of change and a thinking ahead of who will be involved - their contribution to the process and how and where they will fit in. A planned sequence of events for the whole process can be anticipated ensuring oversight of the whole project. Skills of integration are needed to ensure co-operation and communication among disparate groups associated with the process. These skills can be learnt and developed by those taking part and used to facilitate further innovation situations.

CHAPTER VII

Findings on the Researcher's Role of Integrator within the Innovation Implementation Process

Introduction

This chapter begins with a brief resume of the changing research role (documented more fully in Chapter III) as a historical background providing the antecedents for the role of integrator assumed during the innovation implementation process. The integration skills required to facilitate the process are distilled through my own interventions in this role and through a comparison of the specialist role of integrator with other interventionist and organisational roles. A consideration of the type of skills, knowledge and character needed by the integrator or innovation consultant as revealed by this research is developed.

This culminates in an understanding of two core activities of integration of central importance in facilitating the innovation implementation process.

How the concept of Integration evolved

The role of integrator within the innovation implementation process was assumed gradually through a combination of increasing involvement in the innovation process and a recognition that, although not technically expert, I had skills that could facilitate this process.

It is interesting to document the roles I have performed over time together with the influence exerted over time. (See EX. 13 overleaf) Of course there are overlaps in the times and categories but in the main they seem to follow a progression similar to Mahgham's thoughts

EX. 13 ROLES

Phase	Changing role over time	Influence over time	Mangham's categories
One Detached Observer	Student/researcher/ Observer		Audience/out Scripted part
Two Participant Observer	Listener/reflector/helper/ identifier/interpreter	Language/suggestions/ concepts of innovation	
Three Action Researcher	Defuser/communicator/ influencer/process oriented	Seeking out/talk/ideas/ action	Advance part
Four Co-researcher	Participator/adviser/ father-confessor/innovator Learner/teacher	Catalyst/integrator /evaluator	Actor/in

on starting out as the audience and ending up within the play as an actor. As the relationship between myself and the organisation changed so my role and level of intervention changed. Increasingly there came a feeling of belonging - of being part of the organisation, and a parallel progression also occurred - a transferrence of attention from the innovation situation per se to the people in the organisation and then to the people in the innovation situation. Amongst those people in the innovation situation I had to include myself - I was part of the system under study. I became increasingly aware of the significant way I was being used as part of the innovation process by members of the firm - as an identifier of problems, as communicator, integrator and innovator. In this sense I became more fully part of the data. I was not merely observing (with all the reactive effects implied with this method) but essential to the process.

There seemed to be four progressive stages roughly paralleling the four methodological phases; these can be summarised as:-

(i) observer/identifier

(ii) reflector/communicator

(iii) process/integrator

(iv) innovator/learner

Of the four, it was stage three - that of integrator - that assumed most significance for the innovation implementation process. The first two stages were concerned with opening out the issues of innovation and identifying areas of implementation within the firm. The last stage was more to do with my own learning for research purposes (although it will be referred to again as assuming more importance through developing integration skills within the implementation team itself.)

The third stage, however, encapsulates these skills of integration in a readily available form through an examination of my own interventions and behaviour. In observing innovation situations one of the most noticeable features was the conflict existing between unco-ordinated groups and individuals - all connected with the implementation process in one way or another but all with different motives, aims, expectations and loyalties. The overriding need seemed to be that of integration, so that people and process became a purposive whole.

The concept of integration emerged gradually as did the conceptualisation of the role of integrator. Initially I operated consciously within a process role in creating effective communication networks, establishing an atmosphere of openness and trust, recognising and legitimising data concerned with feelings and perceptions, surfacing problem areas, trying to foster understanding of underlying reasons and motives for action etc. The process-oriented behaviour of the innovation consultant has been noted by Buijs (1981) as being the most appropriate kind of intervention to aid innovation, particularly in mature organisations.

As I became increasingly involved in innovation implementation situations however this process role took on a further dimension of consciously trying to integrate and co-ordinate groups of people important to a particular stage in the process. This was seen in the establishing of a NPDG where I was sought out to advise and assist in building up a team to deal with new products and processes. The neutrality of the role was important in enabling me to cross departments and enable interfacial barriers to be lifted. For instance, the block that was evident between the Production Department and the Industrial Engineering Department was eroded through helping IE and WS co-operate on a restructuring of the IE department. This interactive method of designing improved strategies helped to provide a smoother more acceptable implementation process.

Aspects of integration were taken even further when it was seen as important not only to co-ordinate participants in the immediate process in hand but also to extend feelings of integration across the whole spectrum of those involved. This was to create a total view of the situation and enable them to see the relevance and meaning of their particular contribution. It also gave members a more global view of the organisation's aims and helped to increase feelings of involvement rather than feelings of isolation. This was explored particularly in the co-research phase with A in thinking and planning for the implementation of computerised production control. The emphasis on anticipated pressures and suggested facilitating guidelines for innovation was another example of helping to co-ordinate not only technical factors but human factors as well, with the stress on active learning from working situations.

The Specialist Role of Integrator

Having described how the concept of integration emerged as an essential feature of the innovation implementation process I now propose to examine in more detail the characteristics of the role of integrator - what is specific to the role? - what distinquishes it from other organisational roles?

The integrator can be seen as belonging to a broad band of organisational 'interventionists' which would also include people such as behavioural scientists, OD consultants, change agents. These roles all have distinctive traits and different emphases but are all concerned generally speaking with organisations and change (that is within the organisational context). It is not within the brief of this thesis to dicuss the differences between them individually but it is useful to compare and contrast them with my role of integrator as revealed in this research. This provides one way of trying to assess of what exactly the integrator's role consists.

Planned organisational change is a way of helping organisations solve problems via social technology (Bennis 1964). In the same way OD is about helping organisations evolve new systems, prodedures and methods of organising work to cope with changing situations through the use of a consultant. It is based upon the disciplines of the behavioural sciences and emphasises a joint involvement of consultant and client with joint determination and regulation of the situation to establish credibility and acceptance of findings to all parties. Bennis stresses that the consultant and client are in a 'collaborative' relationship in order to make a deliberate and systematic application of 'operable knowledge' to the client's problems. (Clark 1972)

From this common starting ground springs an immediate area of difference between my role of integrator and the role of an OD consultant. It concerns problem definition and goal setting. Typically for the OD consultant all change efforts follow a similar circular pattern - diagnosis (what is the problem/whose is it) - data gathering - interpretation - decisions on action - implementation - feedback/evaluation - renewed action. These are joint activities between consultant and client with the aim of developing new and creative organisational solutions and developing the organisation's own self-renewing capacity. (Beer 1980)

Some of the more commonly used strategies are:-

- teambuilding, where the need for collaboration and collective working has been identified
- creating better awareness of intergroup relationships to reduce conflict
- goal setting and planning - systematic goal setting activities are seen as important in building effective organisations.

For me as integrator however the task was one that was less concerned with problems and solutions: the 'problem' was to facilitate the innovation implementation process. This required the same skills of diagnosis, data gathering, interpretation etc. but all within a specific task situation. Initially this task situation was futuristic - it was not so much a present problem that needed solving as an anticipation of the changes that new technology would make in human terms and a parallel anticipation of changes that could be implemented to facilitate the innovation process: a pre-empting of problems rather than a remedying of a situation. I discovered that innovation implementation situations that were handled in a present problem solving way had all the counter productive hallmarks of 'crisis' management. This was seen particularly in the first two innovation implementation situations where I was operating mainly in the role of observer. Recommendations for future innovation implementation situations could be made after a post mortem on why that particular innovation had not been effectively implemented, <u>but it was too late for that innovation</u>. In effect retrogressive work of that nature only had implications for the future. (I also became aware that I, as researcher into innovation implementation, gave the impetus for some sort of evaluation of the process which previously had not been carried out.) Building up a file of case studies of the innovation implementation process had value only if they were seen as part of an on-going series where each study had learning implications for the next situation and a contribution to make to the development of competency in handling future innovation implementation situations. This pointed to a strategy for continuity in change rather than disconnected change, based on a learning cycle for those involved.

It might be that the root causes of unsuccessful implementation lie in perennial problems such as a basic lack of communication which can be approached on a separate basis similar to that of an OD consultant. In part this was evidenced by the felt need in my host company for change and innovation in ways of communicating which were focused on in the first Quarterly Report (Appendix 2): witness the rather wry comment by A:

"It didn't really matter what you wrote in that report did it? We'd have ended up talking about this anyway."

Primarily, however, the concern of the integrator is potential problem identification and a drawing out of different ways of considering the innovation implementation process rather than problem solution. This may seem a negligable point of difference to make, but it does have implications for the way an integrator approaches her task and this presents a further distinquishing factor.

There is an increasing belief that change can be structured, co-ordinated and controlled in a systematic and planned way (Jones 1969). Consultants called in to facilitate change are often required to implement pre-determined goals e.g. set up an MBO system. 'Package' solutions have often emerged from widespread research studies done on a particular problem with the results amalgamated into a general programme for solving the problem or achieving a specific objective. The utilisation of a package solution or a particular OD technique should properly be upon the findings of specific data in the organisation concerned. In practice however packages are often implemented regardless of the appropriateness for that particular situation (Bennis 1969).

The contingent nature of the innovation implementation process has been noted such that a general theory or set of techniques for implementation has proved to be impracticable. The very nature of innovation is change - the 'problem' is not a static one to be solved, but a dynamic situation requiring constant change and flexibility in approach according to the immediate contingent factors. This is seen most readily in the way different people assume different roles and relationships according to their individual technical contributions at different times in the process: as integrator I had to be able to adapt and change my approach and techniques to accommodate that particular instant and those particular people, involving a continuing dynamic interaction. Of course this statement rather simplifies very complex patterns of interaction which, on looking back, were fed by some feelings of insecurity on my part – in knowing that the organisation could quite well continue operating without me. (cf Child 1977)

It was obvious to me very soon that the GM considered himself outside of any change or innovation situation: his role was that of outside director. I recognised my lack of power to involve him directly and my aim became, not to change him and what he wanted to do, but rather to help him clarify and extend what he thought via a supportive questioning role. There was a delicate balance to be achieved between colluding and judging. One of my mistakes was in letting this relationship with the GM slide into one of non-involvement with the innovation implementation process. He was content to let me work with IE and A and I exerted no real pressure to involve him more deeply; he became more of a reference figure whom we politely kept informed about what was going on. This was short-sighted on my part in not anticipating changes in personnel, so that when key figures such as A and IE left there was no-one remaining in a sufficiently influential position to continue with the new structures and processes introduced. As these new structures (such as NPDG) were informal rather than formal – i.e. they crossed the normal bureaucratic boundaries of roles and relationships and were not 'written in' to the formal organisational chart – they disappeared in time, leaving no real impact on the organisation. This lends credence to the importance of the 'top-man phenomena'; arguably, if the GM had been involved and committed to these structures they would still be operating.

Goodge (1975) has warned about the dangers of love/trust assumptions which locate organisational problems in the informal organisation and so often leave the formal structure and power relations untouched. The dichotomy is that values of 'love and trust' are often needed for initial acceptance into an organisation but then can seriously restrict any further progression and work apertaining to key variables such as power and role structures.

Some impact was made however on the GM as evidenced by an interview with him some 12 months after the main body of field work had been completed. In response to the question:-

"What innovation are you concerned with at the moment?"

his reply incorporated a number of concepts which had not been present in my initial interview with him. These were:-

(i) innovation is an on-going situation

(ii) innovation is an integral part of the organisation

(iii) adaptation of products is mainline innovation (although he was still concerned with innovations at a macro level i.e. computerisation)

(iv) changing organisational structures is innovation

This showed a considerable broadening of his initial understanding of innovation and the innovation implementation situation, BUT he also showed an immoveable stance in saying:-

(i) communication does not mean innovation

(ii) doing is innovation, not sitting and talking

There was little reference to any self-learning (in fact I don't believe he thought his understanding of innovation had moved at all) and still very much a feeling of 'management-by-crisis' culture.

He referred to integration as being a major part of his role and described how he had re-organised the site into three autonomous units

– surgical instruments, orthopaedics and forge – each headed up by a manager responsible for innovation and integration in his unit. When pressed further about structures for integration – particularly between the three units – these seemed to be lodged in his own person: i.e. he was the one person who knew what was going on and could co-ordinate activities. Unfortunately his idea of integration was rooted in a personal power base: he was interested in integration as a means of enhancing his own position and re-inforcing his own knowledge and not as a wider organisational means of helping to facilitate the innovation implementation process. The integrator's role is however very much concerned with issues of power, which I will refer to again later.

This leads on to a further understanding of the term 'problem solution'. The integrator has to be catalytic rather than direct in her approach – helping people to change themselves rather than imposing solutions. This is also true of onging OD work within an organisation where typical objectives are to increase people's problem solving capacities and to generate long term opportunities for personal growth of people in organisations. B basic common value assumption here is that improved competency in interpersonal and intergroup relationships will result in a more effective organisation. As integrator I shared this value assumption but was caught between long term and short term objectives. My work context was much more task oriented, and initially the objectives of increasing people's problem-solving capacities and providing for personal growth and development were not ends in themselves but a means to achieving successful innovation implementation. Generally speaking, it will all depend on the individual integrator's inclination and situation in the end, but I would suggest that initially the onus of establishing credibility with organisational members is dependent on whether the change methods used have any visible bearing on the implementation process, i.e. do they achieve an identifiable influence on the process which can be measured, – in terms of increased economies for instance?

This brings us on to the thorny problem of measurement which will be discussed more fully later. For the moment suffice it to say that there is increasing consideration of 'economies of co-ordination' as being a major means of reducing unit costs rather than 'economies of scale'. O'Connel (1968) As Clark (1972) says this impliesz–

"the existence within enterprises of experts who possess an ability to make a precise conceptualisation of the methods of co-ordination as currently used, and to decide whether these can be improved."

Although I did not attempt to do this, it could be usefully applied to the role of integrator within the innovation implementation process in both establishing credibility and in justifying her position.

In fact the introduction of route cards was an innovation designed to improve methods of co-ordination in the production process. A major failure in the whole implementation process was this lack of any definite attempt at measuring productivity both before and after the introduction of route cards. (I have already mentioned the integrator's role in prociding the impetus for some means of evaluation.) This resulted in an inability to assess the validity of the innovation against any 'hard' economic criteria, and also led to a dissatisfied feeling of incompletion on the shop floor. The whole affair just drifted into habitual work patterns (or non-work patterns). There was no feeling of achievement or of success in implementing a new worth-while system with a tangibly more effective result. In fact success was largely recognised as a matter of physically keeping the cards with the batches of work – a manifestation of:

"managers' rights to tell workers what to do"

in the eyes of the shop floor.

As integrator I was concerned with the 'task' of implementation and an important part of the task for the people concerned was a sense of completion with a real outcome – an idea which has become reality. The integrator is in a position to provide an oversight of the whole situation and can aid a sense of completion through briefing relevent individuals on the whole project, enabling them to see when and how their contribution fits into the whole, and assessing the final position at the end of the implementation process when the innovation has become part of the routinised operation of the organisation.

The importance of enabling participants to see a real tangible end result to innovation implementation is emphasised as a means of making innovation and change relevant and meaningful to their situation.

Unfortunately behavioural science practitioners have become associated in many people's minds with competence in reducing resistance to change. In the area of innovation the focus has often been upon smoothing the introduction of technical change – installing new technologies and practices with the minimum of opposition by first measuring and then increasing participation and involvement of organisational members in work activities. Many 'before and after' studies have been compiled with general advice to practitioners on helpful areas to concentrate on in order to reduce resistance to change (e.g. Katz and Kahn 1966). The little meaningfulness of this kind of data for practising managers has already been commented on. The integrator is of course also concerned with reducing resistance to technical change, but more than that she is also concerned to provide positive incentives for accepting change. It is not possible to assume that work is a 'central life interest' for organisational members (Bennis) and that greater involvement in organisational affairs will provide its own reward.

As integrator I had to grapple with the question 'what's in it for me? Why should I co-operate, participate, become more involved? These questions could not only be answered in organisational terms but had to be seen in a personal light. This highlighted a dichotomy that runs through other spheres of organisational activity – that between task achievement and personal achievement. In part the integrator can answer these questions with an emphasis on learning and self-development (personal achievements which also contribute to task achievements) but it would be foolish again to assume that organisational members automatically shared this view of learning providing its own reward.

In a sense as integrator my hands were tied, in that, unlike someone in organisational design for instance, I did not question the appropriateness or otherwise of the new technology or practice in a total design sense but rather entered the field of play in the next act. The introduction of the innovation had already been decided upon – my job was to ensure implementation usually within the organisational framework given. But as Bessant (1978) commented:-

> "we have been used to accepting structures as largely 'given' frameworks in which we 'muddle through', coping with changes on a heuristic basis. This may not be the most effective way of organising."

One of my functions as integrator was to focus upon the human/organisational aspect and to advise on facilitating structures or changes in work patterns and relationships relevant to the innovation implementation process – also to represent these factors as a functional equivalent to the engineers on the technical side. This was most easily seen in the recommendations for the NPDG devised and implemented in conjunction with IE. It posed problems however in determining how often individuals could leave and enter temporary systems without being disadvantaged –

> "how much uncertainty can a human being cope with?"
> (Vansina 1976)

Again this highlights an essential paradox in the innovation implementation process - that processes and structures of integration to facilitate the change process of innovation implementation are in themselves change-full. In part this was tackled by having a permanent core group of people in the NPDG with initiative to draw in at appropriate times on a one-to-one basis those who could contribute relevant skills or knowledge:- in effect trying to harness the resources that were there rather than changing what was there. I also had to recognise the importance of being able to make local processes work within the existing overall organisational structure - as it was these processes that assumed greater significance for the innovation implementation process.

It is not within the brief of this thesis to go deep into the process/structure debate but Friedlander and Brown (1974) have made a distinction that I find useful:

> "both process and structure are concerned with authority communication, decision-making, goal setting and conflict resolution. But process implies the implementation of these as dynamic behavioural events and interactions, whereas structure describes these as on-going sets of durable roles and relationships."

For me as integrator this meant a recognition of both the overall more static structure of the organisation and also the local permanent and non-permanent processes of interaction - and specifically those created to facilitate innovation implementation. (This poses strange questions such as: 'When does a permanent local process assume the characteristics of structure?' Perhaps the two can not be divided, or it is not essential to do so.) However, my role was to help overcome overall structural barriers (e.g. statutory roles, status, hierarchical positions, power and influence) to local processes of interaction designed to aid innovation implementation.

The aim was to be both analytical and creative in approach possibly involving an interdisciplinary design.

Of importance here is Gregory's (1978) notion of a 'contingent decision sequence' which relates to the development of individual strategies for changing and uncertain situations with a corresponding need to develop sophisticated strategies for problem solving and decision making. The trick here was not to be committed to one stance or definition but to be able to adapt and change. I adopted a stance similar to that of 'creative problem solver'. Innovations contain many of the characteristics of 'open' problems e.g.

- boundaries may change during problem solving
- the process involves the introduction of novel ideas
- there is no one correct solution

(Rickards 1974)

These necessitate characteristics of creative thinking, risk-taking and willingness to consider new ideas on the part of the integrator. Techniques to aid creative problem solving include non-rational elements such as brainstorming, wildest idea, non logical stimuli etc., and legitimise data such as feelings, impressions, perceptions, As integrator I recognised the value of this kind of data in aiding diagnosis of integration needs and its potential influence in implementing change. The main difference between the role of creative problem solver and my role of integrator, was that of necessity, I was part of the process or 'problem' under consideration: my activities in facilitating the implementation process were an essential part of this process, whereas creative problem solving does not necessarily actively include the person of the problem solver in the implementation of an idea.

However, in spite of this involvement in the innovation situation the neutral role of the integrator is of vital importance. I had to be able to collect data from all sources and be free to come and go in all areas – accepted with a high level of trust by all concerned. But this relationship of trust did not just 'happen' – it had to be worked at and maintained. I was aware that if I had been seen to be grinding a particular axe I would have lost credibility: there was a delicate balance to be achieved between neutrality and involvement.

Nevertheless I found it hard to maintain sufficient rapport with the many different sections of people in the company without maintaining a very heavy time committment. This was aggravated over time as I worked more with A and IE than with the shop floor for instance. A set-back also occurred when I was taken on as temporary Purchase Invoice Clerk. It seemed a good idea at the time to gain more knowledge and and insight into the workings of the company and to increase a sense of being part of the organisation. However it also proved counter-productive in a number of ways.

First of all I became an employee of the organisation (albeit temporary) and this altered my status with other organisational members – particularly those on the shop floor. While not denying that I had been part of the political scene before, I had now more overtly joined the politics of the organisation and became identified with one particular set of people, I was now, not just task-oriented but task bound – my position dictating more or less who I communicated with and the type of information I received – and restricting my accessibility to previously 'open' parts of the organisation.

Although the time spent as PI clerk afforded fresh insights into the way the organisation operated, I was unable to operate within the integrator role at the same time. It supported the view that the integrator only exists through the innovation implementation process; that is what gives her a working identity – and it is through that process that validity and credibility have to be established.

Credibility is also bound up with being able to interpret the data collected. Initially the interpretative role necessitated a depersonalisation of information so that organisational members did not fear reprisal or feel threatened. This meant reflecting back generalised understandings of behaviour (as for instance in the first Quarterly Report of this research — Appendix 2) This aided a constructive examination of problem areas and helped to look at previously unvoiced (and therefore unperceived?) problems. Another interpretative aid in promoting integration was the ability to translate the problem into more easily understood language. The collection and interpretation of data extended into a co-operative activity and the development of improvement strategies also became an interactive process. While being task-oriented, implicit in the integrative approach is the belief that major contributions to the efficiency and effectiveness of the organisation in innovation implementation processes is made through having a high 'people orientation' in the activities used.

In connection with the depersonalised reflection of information back to the organisation, the integrator is acting in a way similar to that of the social scientist.

> "Social science can describe the activities of a working organisation, for example, in terms of roles rather than of individuals and so enable us to see beyond the apparent reasons for people's actions, including our own, and to take a less egocentric view of the situation. Or it may describe the actual operations of a company in such a way as to show that the allocation of tasks or functions to component units fails to match the changing realities of the situation and for this reason leads to conflict and delay." (Cherns 1971)

This often results in a model of the operating system under study to enable an accurate definition of the problem. But any model embodies a set of concepts which must be understood if it is to be used effectively. This was exemplified in the tentative application of a model for innovation implementation proposed in this research programme. The model had value in encapsulating the innovation implementation situation as an event which could be responded to on an objective level but it defied application on an equally objective, static, predetermined level. It was found that the model had to be actively interpreted to be of any use, and this was part of my role as integrator - not merely to supply models as a means of distilling experience and capturing knowledge but to apply that knowledge in a flexible manner.

Action research has developed along similar lines of evolving methods capable of reflecting process and change as well as static behavioural forms, and enabling development and testing of hypothesis within the context of the organisation. The difficulty for both action researcher and integrator is in evaluating the outcomes of action taken and in identifying which aspects have contributed most to the gains or losses experienced by the organisation.

In post-field work interviews on what lasting effect, if any, I had had in the company, the GM indicated that my first Quarterly Report which focused mainly on patterns of communication was a contributory factor to A leaving the company. He also mentioned the NPDG as a useful working structure which had dissolved because IE had been unable to service and maintain it alone.

The IE said that he had found me useful to talk to (he was unable to talk to GM) - I brought a different perspective; he could concentrate on the task instead of the politics - but it also made him realise that he was not going to get what he wanted from remaining in the company - that the GM was fixed and would never change. He had tried to maintain the NPDG but due to a ban on recruitment and increasing work being given to him (oversight of the computerised production control project when A left) he had not been able to. It was a way of working that had appealed to him and he had seen the benefits in increased committment and greater efficiency amongst members.

However it still remains difficult to measure the success of planned change in terms of tangible criteria like increased productivity. Another difficulty I found was in assessing an appropriate time span over which to relate changes in organisation and changes in productivity; - and how to know whether planned organisational change was related anyway to an increase in productivity - or was it something else (cf the Hawthorne experiments)?

The integrator is commonly concerned with relatively short term projects within the life of the organisation, and one way to aid an evaluation of action taken would be to build up a collection of case studies in innovation implementation to assess both the immediate short term effects and the longer term influences. This would mean helping to set up within the organisation some function or system with this longer term perspective. As integrator I was concerned with the anticipation of future innovation implementation situations via a cross-functional learning system. It has already been noted that people of different disciplines and at different levels could be effectively integrated into the implementation process at times appropriate to their skills and knowledge to facilitate the process. Part of my role was to generate a learning/teaching environment within the innovation implementation process - again with a dual function: to promote learning about concepts of innovation and also self-learning via an examination and understanding of the human processes necessary for implementation.

It had been thought in the mid-60's, that training and development <u>within</u> organisations would automatically remove the 'transferrance of learning' problem, whereby however effective the training given to an individual outside his organisation, when he re-entered his everyday work surroundings he resumed his previous role bound by long standing expectations of attitudes and behaviour from his colleagues. Systems such as the Managerial Grid developed by Blake and Mouton (1964) – a five year programme involving the whole organisation – were utilised as a response to the understanding that human attitudes and relationships are structured and can therefore be changed by a structural systematic approach. However this again proved to be insufficient and created conflicting roles of loyalty, responsibility and accountability. A delegation of duties and roles does not necessarily ensure smooth implementation. Similarly I found that to delegate responsibility for the task of integration to others, or to keep the role exclusive to myself did not really solve the problem – there was a need to build up the organisation's (i.e. people's) own facility to learn adapt and change.

An allied concept in the area of developing learning abilities is that of Action Learning (Revans 1977). The Action Learning programme can be full or part-time, in-company or outside company, where managers come together as a group on a regular basis to use their own individual work problems as opportunities for learning. There are many areas of similarity between Action Learning and the learning that takes place in innovation implementation situations:

- the problem is generally an 'open one' with no readily available 'solution'
- the learning is task oriented and necessitates action
- the task gives meaning to learning and enables ownership of the problem: it also bridges the gap between individual learning and transferrence of that learning to the organisational context
- action and learning are constantly being redefined in the light of real time feedback
- group processes of help, support and information sharing are important

- it leads to ways of thinking and behaving of a very fundamental kind
- people are enabled to take responsibility for their own learning
- the set adviser and integrator operate in similar ways - particularly in their emphasis that participants learn to manage themselves.

These attitudes to learning are strikingly similar, however a major difference is that in innovation implementation all participants, and the integrator/facilitator, are involved in the one task - implementation; they may all have specific problems within that task but essentially they are all working towards the same desired (or undesired) change. The innovation implementation situation is also less formally structured as a learning situation; initially at any rate learning opportunities have to be seized when appropriate and gradually developed as an integral part of the process.

The importance of the learner/teacher role for the integrator cannot be underestimated however. It is her task to isolate individual blocks to learning - poor or inadeqaate perception of events or problems, emotional blocks arising from insecurity and a fear of making mistakes, rigidity of thinking resulting in prejudices and preferences (often associated with the cultural norms of the organisation, real or imagined), poor communication skills, inability to adapt to certain situations, possession of a limited range of strategies for solving problems etc.
- and to help people identify and understand them for themselves.

Dale and Payne (1976) offer a useful model to help evaluate learning and development. They propose three key dimensions along which development at various levels can take place - awareness, resources and will:-

<u>awareness</u> - developing self concepts, then self in relation to others, moving towards self direction

<u>resources</u> - developing new skills and techniques, then expansion of role, moving towards creative exploration

will - moving from passive existence to self determination and self enactment.

The model relates an individual's development to his performance and is of use to the integrator in assessing the appropriateness and level of on-going learning in cumulative innovation implementation situations.

On reflection, a large part of what I would consider my effective actions were broadly to do with learning. They incorporated such diverse aspects as:-

- fusing work systems and learning systems; (NPDG:IE dept)
- talking through an innovation implementation situation and jointly deciding on future action; (IP.1)
- providing the impetus for some kind of evaluation; (IP. 1 & 2)
- clarifying and extending concepts of innovation; (IP.2)
- developing self concepts and awareness; (NPDG)
- abstracting concepts and theory for possible re-application or testing; (IP.2)
- importing ideas and ways of thinking; (IP. 1 & 3)
- understanding/learning about process interactions; (NPDG) (QR meetings)
- storing up relevant data for later discussion (IP.2)

Partly of course this emphasis on learning came about because of who I was and my research position of belonging to two definite worlds: the world of ideas - the Polytechnic (where initially I was most at home) and the world of practicalities - the organisation. I remember distinct feelings of the seduction of organisational life - the comlexities, the intricacies, the realities, the fascination of the organisational jig-saw; it seemed teeming with life as opposed to the 'ivory tower' of the Polytechnic. No doubt this initial euphoria coloured my initial perceptions and made me anxious to belong. And yet my contribution to the organisation was in joining the two worlds - importing ideas and ways of thinking into the organisation - acting as ideas gatekeeper (as opposed to Lewin's technological gatekeeper) and making idea associations available to organisational members while being rooted in the practicalities of their situation. And at the same time attempting to provide for continuity of this experience through learning both about innovation implementation and about self.

Why, you may ask, is all this specific to integrator? Why is learning and self-development not part of the Personnel and Training function? The answer is that of course it could be part of the Personnel function (and often is) but that learning of this type is also essential for integration. The innovation implementation situation presents a ready made vehicle for this type of learning but also would be dis-functional without it. Integration implies co-ordination of roles and activities which in turn effectively means understanding of behaviour (both self and group) and an opportunity for an acting out of new be-haviour patterns.

For instance I usually found it was profitable to explore partici-pants' differing perception of the innovation implementation process and to show how their different 'root definitions' (Checkland 1981) caused different ways of operating. This also provided a systematic way for getting at the politics of the situation and the expectation of statutory roles and positions. Learning of this sort also counter-acted what Back (1973) called one of the essential tragedies of man, the 'paradox of permanence and change' - where man is always searching for an unchanging structure on which to rely without acknowledging that he himself is always changing - so that nothing can ever be permanent and unchanging. Learning can provide a certain stability through the ability of the person to learn and cope with change - and perhaps do it better next time. This cumulative learning approach in the context of the innovation implementation situation was a fundamental in my role as integrator.

A consideration of the role of integrator must always weigh up where she should stand in the organisation's structure. Could she be part of an internal department (such as Personnel) or would this too greatly jeopardise her position of independence and neutrality? There are conflicting views on this.

Bessant (1978) suggested that the integrator needed to be fully participant in the organisation:

> "He will be internally based, part of the system which he is involved in changing. One of the major criticisms of many consultancy operations is that they diagnose and implement without an awareness of the history and other contextual dynamics associated with an organisation."

I believe this to be a partial view of the role of integrator especially if she is specifically employed by the company to fulfil this role. Implicit in my interpretation of the role is that it is <u>temporary</u>. An in-depth knowledge of the organisation has to be assimilated for the integrator to be effective, but part of her work is also to pass on her integrative skills to members of the organisation who are associated with the implementation process, so that they can manage their own processes more effectively independent of any outside 'prop'. A full-time integrator as a formal member of the organisation would merely provide a disincentive for other members to learn and use these skills for themselves. It would also be extremely difficult to be seen as neutral and unbiased in approach.

Alternatively, the integrator role can be recognised by management as an essential function of the innovation implementation team and so be consciously filled by an existing participant member of the team.

One of the advantages I found in operating in the integrator role, was that of being an 'outsider'. I was stateless and rootless and yet attached to the organisation. I worked hard to demonstrate that I had no invested interest in any one set of people in my initial period in the company, slowly building up relations of trust. I was not task bound and so to a certain extent could create my own role. Most of all I had time, time to be interested and listen. This was I think a luxury not tenable in conjunction with being a full time paid up member of the organisation (as my time as PI clerk demonstrated). It was a temporary attribute - and one which over time I mistakenly let slide. I say mistakenly because it became increasingly apparent that the tools and resources of the integrator were those of information, communication, co-ordination, understanding and learning, dealing with data not generally accessible through normal channels. As integrator I supplied many of the deficiencies of the formal system of communication, dealing with a different type of data, but data that was equally important for facilitating the innovation implementation process.

The major disadvantage of being an outsider was that I had no recognised status and lacked formal power. Any formal power that I gained was really a measure of how much others decided to allow me: so in answer to the question 'what power belongs to the role of integrator? - i.e. what resources does she control? I could only say initially 'myself' - my knowledge, skills, ideas, ability to gain access etc. Later on this became amplified by group support, assessed stature etc. and the ability to communicate effectively with power promoters such as A and IE.

The Dutch experiment in innovation consultancy (1982) advocates an outside consultant position. Their report comments:

> "The know how of the process of innovation is transferred from the consultant to the organisation through the process of innovation consultancy. The first objective of the project is to learn the participating companies how to innovatate. They learn this through the consultation work of the consultant. His interventions should fade away and at the same time the organi-

sation is more and more taking over the control of the process of innovating."

This echoes a former proposition by Ross (1974) that the logical outcome would be to create an agency outside the target organisation whose special role would be to introduce innovations, usually through consultative practices or in accordance with the requirements of law or other regulations.

There are pros and cons on both sides: what is undisputed is that technological development brings with it a growth of specialist staff and increased specialisation of skills and functions. It would seem necessary to have a parallel development in new roles to promote increased lateral and vertical communication, co-ordination and integration.

In this way the integrator would be distinquished from other roles allied to the innovation process - executive, product champion, business innovator, technical innovator. The executive role incorporates studying present and future products and markets and comparing the organisation's competitive standing with other enterprises; he seeks to use new technological methods as they become appropriate and feasible for the organisation:-

"To meet these changes he must continuously modify the functions, tasks and working groups of his unit. At one extreme this process involves restructuring his organisation, and at the other, altering the job contents and job relations of individual employees - men and women whose needs, interests, skills, attitudes and aspirations are themselves in constant movement."
(Wilson 1971)

The executive represents in Witte's (1976) terms the 'mach promoter' or power promoter, being in a key position of power and influence and able to generate resources, facilitate decisions and generally push forward schemes of innovation and change. But he may lack fundamental technical flair and ideas necessary for innovation; his role has to be complemented by the 'fach promoter' or technical promoter - similar in role to the product champion who can supply the technical push to the innovation but may not have enough power or status to overcome organisational resistance on his own.

The idea of a duality of purpose working through complementary roles is an attractive one. Individuals possessing a combination of the two roles are less common (seen most easily I suppose in the self-made entrepreneur but not so often in members of larger scale organisations).

For the purposes of innovation implementation however, there seems to be a missing factor: the power promoter (e.g. the executive) ensures that the decision to innovate is taken and puts resources and influence behind that decision: the technical promoter (e.g. the IE) works out the technology relevant to the innovation idea and the potential task structures for implementation: but then the idea still has to be put into action. It is here that the integrator can fulfil a vital role as the human promoter within the task of innovation implementation.

Both the technical promoter and the integrator would be concerned to identify the human tasks to be performed to operate the innovation implementation system, but whereas the technical promoter would be interested in size of task and timing of events, including such activities as diagnosis, design, installation, commissioning operation and observation of symptoms (Gregory 1978), the integrator would be more concerned with relating tasks to roles in order to optimise performance criteria and human satisfaction. Her integration activities would have the objective of improving overall task performance, involving a basic recognition that with technical problems, political problems need to be addressed at the same time; that in organising for the technical function there is a knock-on effect which is part political, part technical and part process.

While technical competence might be an asset in establishing a rapport and a common language with participants I did not find it strictly necessary for the integrator's role. I had to be a specialist in the field of management and interpersonal skills rather than a 'task' specialist. This enabled me to stand back from the task and view the process in an unbiased light. As integrator I was interested in co-ordinating activities rather than controlling them, acting as a bridge (in so far as they can be separated) between personal and organisational goals, between motives and task, between means and ends. Whereas the technical promoter often acts in the role of technological gate-keeper, the integrator acts in the role of 'ideas' gate-keeper, keeping in touch with ideas and concepts relevant to process issues developed in research institutions or other external sources.

Conclusions

In developing the specialist role of integrator in the innovation implementation process two core activities of integration have emerged – (i) abstraction (ii) communication

(i) Abstraction

	TECHNICAL/POLITICAL		CHANGE/STABILITY
Ideas gatekeeper (ways of thinking) →	a) about innov/impl. process		a) about innov/impl. process
	→	learning	
→	b) about human interaction		b) about self

EX. 14

As shown in Ex. 14 abstraction is concerned with two key determinents of successful innovation implementation - the technicalities (task) of innovation and the process of implementation. In practice they hardly can be separated as technology can be seen to be rooted and defined in terms of the motivations, interests and goals of the people concerned and of the culture of the organisation in general. While being task oriented the integrator is not task bound and must recognise that when organising for the technical function of innovation implementation, political and processual issues have to be addressed at the same time. This necessitates skills both in organisational understanding and analysis and the processual skills of interaction and intervention.

The integrator only exists through the innovation implementation process and it is her task to facilitate this process. One of the hallmarks of innovation is uncertainty - and this is certainly integral to the innovation implementation process. Its partial resolution lies in learning over time. In facing situations of innovation and change part of the integrator's role is to provide for some sort of stability, rooted in the continuity of learning for those involved:

- learning about concepts of innovation, the process of implementation and essentially, learning about self.

Innovation implementation is not a replicable set of events but rather is governed by cumulative change. The learning strategy should focus on understanding and planning change - developing internal competencies which can be relied upon in future innovation implementation situations, rather than on planned change.

(ii) Communication

The integrator assumes identity through the innovation implementation process, helping in patterning the system to introduce a new technology or process. As such she operates in the role of key communicator or communication gatekeeper, often supplying many of the deficiencies of the formal communication system, i.e. in:-

(a) crossing bureaucratic boundaries

(b) recognising a different order of data – qualitative, rich, often expressed through a personal, one to one, collaboration.

(c) being able to communicate at all levels, and, particularly for the task of innovation implementation, to communicate effectively with power promoters.

(d) helping overcome formal structural barriers to local processes of interaction

(e) opening up 'forbiddens' – raising questions about public and private property.

The integrator has to be able to recognise the two worlds of the organisation – the 'formal' expressed through tangibles such as technology, structure, role prescriptions, and the 'informal' expressed through intangibles such as loyalty, role expectations, power – and be able to demonstrate and use their interrelated interdependent nature for instance in showing how one person's perceptions or root definition results in a particular way of operating. Communicating understandings of this nature is essential for being able to see the innovation implementation process as an observable whole and yet as part of the on-going life of the organisation. Innovation implementation is a process involving high levels of co-operative activity at different levels and stages and communication has a major part to play in its success.

This poses certain problems of course in that the integrator must have mobility and access to all parts of the organisation and a neutral 'detached' aspect to her role while also inevitably being part of the situation: the conflict of 'acting upon nature and being part of it' (Back 1973)

A three dimensional time perspective of the integrator's role helps to counteract this conflict. The integrator operates in three time zones (though these are not necessarily sequential) :-

(i)	<u>In</u> the situation	-	observing, diagnosing, helping
(ii)	<u>After</u> the situation	-	abstracting, reflecting, learning
(iii)	In an <u>on-going</u> capacity	-	pre-empting, planning, servicing

Although I have indicated some of the integrator's activities for each time situation these are by no means mutually exclusive. The emphasis is always on understanding and planning change and innovation, not so much on planned change.

CHAPTER VIII

Summary & Conclusions:

The Contribution of the Research

This chapter is the culmination of the thesis. It gives a summary of the research undertaken and attempts to show how all aspects have been woven into an integral whole. These aspects include:-

- identifying the area of research
- the contribution made in understanding the implementation process
- the conceptualisation and development of the role of integrator
- my dual role of integrator and researcher
- extending the research process by writing the thesis in a manner likely to bridge the divide between academic and management.

Some unanswered questions uncovered by the research are put forward together with some indication of possible areas for further research within the innovation implementation process.

New Aspects of the Research

In examining related fields of literature it was found that there had been a great variety of work done on innovation and the adoption of innovations - why a particular innovation was or was not adopted, success and failure rates of adoption etc, - but little on the process of innovation implementation - i.e. what happens to the innovation after adoption. This seemed to be a major gap in our knowledge and understanding of innovation, and one where investigation would benefit and be of central interest to both academic theory and practical management. I also found that innovation implementation was regarded as a hotch potch of various theoretical ingredients - such as decision making, problem solving, communication etc. - all presented with varying degrees of emphasis and detail according to the interests of the writer. These areas are, of course, essential components of the implementation process, but I found it hard to pick out from such piecemeal presentations any underlying concepts or understandings of the process of implementation per se. The focus had become distorted and diluted, moving away from the process of innovation implementation and on to compartments of knowledge to do with the process. I felt this provided a patchy, incomplete understanding, and, while it was necessary for me to read widely around the subject of innovation, much of it fell outside the scope of the literature review, because of the material being non-specific to innovation implementation.

Managers too faced this problem: I felt there was a need to bind these areas together into a study which had Innovation Implementation as the focus - where Innovation Implementation provided the rationale for the inclusion or exclusion of other elements - and where this was made explicit through direct reference to real data taken from specific studies of the process.

So the overall major aim was to study innovation implementation in its own right.

In early survey work to find a suitable company that would be prepared to agree a contract for my working on this research, I found that managers in the six firms approached had a very impoverished vocabulary to deal with innovation, and limited perceptions of the effect innovation, and particularly innovation implementation had within their organisations.

The research involved an examination of specific examples of innovation implementation within one organisation, with which I felt there would be some possibility of mutual communication, with the aim of drawing out key factors in facilitating the process.

Unfortunately managers who had taken the trouble to read some of the literature on innovation only had reinforced in their minds the popular stereotyping of innovation as being a bright technical idea making good financial sense which would therefore be acceptable to the company.

This research, written in rather an unconventional way is intended to break down the unwitting reinforcement of this obvious fallacy by the academic community! - and has managers as much as examiners in mind.

Initially an atheoretical approach was taken. Descriptive work helped to identify innovation implementation situations and provided a useful background of data from which theories and issues for further investigation and development arose. Some of this data was surprising in its simplicity and yet provided significant pointers for the direction of the research.

A major discovery here was managers' inadequate perception of 'innovation' as a single isolated event in the life of the firm, and the ensuing lack of oversight of the whole process of implementation. This led me on to examine ways of looking at technological innovation and change which had previously been unrecognised within the firm.

Innovation implementation was regarded as a specific instance of the management of change within the boundaries of technology; the people involved were technicians and very much task-centred and task-bound, yet for effective implementation there had to be a broadening of task issues into a complementary understanding of the political and process issues that were inevitably part of the whole. It was too easy and too detrimental to put the shutters down and concentrate purely on the task in hand.

This broadening of concepts of innovation implementation (Chapter VI) was a starting point, which provides a contribution to understanding in its own right, but which also provided a springboard for further research work. Early fieldwork generated theories and concepts arising out of real experiences which were then tested and refined and applied collaboratively. Significant conclusions so far were:-

(i) Each innovation needed a different facilitating structure made up of the individuals actively involved in the process and decision making.

(ii) There was a need for one person to occupy a key role in overseeing the whole implementation process and provide for needs of integration.

(iii) Also necessary was some means of increasing the learning of those involved to ensure increased competency in dealing with future innovation implementation situations.

In broadening <u>my</u> understanding of innovation implementation, the problem posed was how to develop and extend this understanding to relevant others in the process. (This was in keeping with my concern that the research was of practical value and help to the firm where work was undertaken.) Extension demanded 'inner' work so that concepts could be owned, taken on board, <u>used</u> rather than outwardly acknowledged but actually effecting little or nothing.

A new approach was taken because of dissatisfaction with the existing stance of viewing innovation implementation as a technical event unrelated to behavioural factors - this not only within the firm but also, by default, in much of the related literature on innovation. Little systematic work had been done prior to this research in relating new technology to the people involved in the implementation process and the effect their patterns of communication and interaction had on the process.

Through this behavioural emphasis came the relation between learning about concepts of innovation, learning about the implementation process and learning about self. Later innovation implementation situations studied exemplify this. My involvement added to the information gained in the initial research work particularly through my learning about myself as integrator and extending this to heightening the learning and self-knowledge of others involved. Of necessity this has some implications for the research role particularly in the areas of objectivity versus involvement, theory versus practice. While being aware of these issues I have not seen them as opposites. Rather, I perceive that a fusion of academic theory and practical reality in me and my involvement gives the research insights that might otherwise have been overlooked. This is particularly so as a concern to develop the necessary skills of integration in organisational members themselves, through an emphasis on joint learning, emerged, giving the research an interactive collaborative intention.

The Role of Integrator

A contribution to existing theoretical perspectives of innovation implementation has been made through a conceptualisation and delineation of the role of integrator within the implementation process.

Integration as a major determinant of performance in uncertain activities such as innovation had been advocated, but little done on specifying the actual role of the integrator. Contrary to previous expectations (cf 1st Model of Innovation Implementation, Ex. 12), I found that integration could not be planned and imposed. True integration demanded inner activity and knowledge and it was the integrator's task to promote this within the innovation implementation process via an adaptive learning approach.

This research uncovered two major core activities of the integrator role - (i) abstraction (ii) communication - as being of paramount importance (Chapter VII). Both activities, while rooted in a tangible task situation, focus on the 'intangibles' of ideas and behaviour, and their significance in influencing what is normally considered a technical process. It is a crucial part of the integrator's task to represent these factors as a functional equivalent to new technology and to demonstrate the inseparability of the technicalities of innovation and the process of implementation. The need to implement an innovation idea is self-evident but successful implementation is not so evident.

The integrator has a central role in facilitating the implementation process through having a high people orientation in activities used. The real learning, and therefore adaptation, goes on as the integrator enables individuals in the organisation to capture what they are doing to one another in the present moment of implementation. She needs to be able to diagnose integration needs, develop and implement suitable strategies to cope with those needs, and also build up the ability and desire to learn from the situation for those involved, - thus enabling them to cope more effectively with the next innovation implementation process.

A good example of this occurs in the suggested guidelines for handling innovation arising out of the introduction of route cards. The research graphically demonstrates the on-going nature of innovation implementation and the significant effect that participants' learning has on the process and on wider organisational structures. In the first innovation implementation situations studied where I operated in the role of observer a lack of understanding of the whole process and a lack of co-ordination and integration resulted in a crisis-ridden sequence of events. Later these innovation implementation situations were used as the basis for case studies in broadening participants' understanding of the process. This resulted in requests to jointly set up a NPDG where integration and learning played an equal and complementary role to that of new technology. This in turn created a demand for new roles and patterns of working within the IE department as a whole.

Certain pertinent questions are highlighted through the research undertaken. Among the most fundamental of these is:- 'Does the organisation recognise the role of integrator as a needed and essential part of the innovation implementation process?' i.e. would the powers that be want to engage (and pay for) the services of an integrator?

In the end this often boils down to economic criteria: to put it crudely - does the integrator pay her way? - can she justify her position in terms of increased innovative activity - more 'successful' implementation and therefore an increase in economic health (evinced through reduced costs, greater efficiency and productivity?). This is not to say the the onus for proof of economic viability lies solely with the integrator, nor should she feel constrained to collude with the view that economic criteria are the only ruling force or the prime 'conditions of service'; but an emphasis on task and 'hard' facts should be recognised as an importvalidifying factor of her role especially as seen from the organisation's point of view.

The problem of evaluation and measurement in this way has already been noted. In the first place the relationship is not a direct equation with straightforward ratios. The 'economies of co-ordination' are hard to pin down and realise in facts and figures. Part of the problem lies in being able to define clearly the desired efficiency objectives of innovation. As intimated before, the integrator's role would include a raising of awareness of the economies associated with human factors and a handling of innovation implementation in a less haphazard crisis-ridden way. However, this is not to minimise the problems of economic considerations for managers.

Secondly the integrator's skills are relevant to both the short term project and the longer term perspective of the on-going life of the organisation. The wider-reaching influence of integration is a continuing 'hidden' process likely to emerge at varying and unspecified times.

Increasingly there is the view amongst management writers and researchers that skills of integration are a necessary part of a new management approach to cope with increasing complexity, diversity, innovation and change. The question is, do managers of organisations see integration as a necessary approach, and more specifically, do they see innovation implementation as a 'problem' requiring the skills of integration? When I returned to the company after an interim period of a year the GM very definitely had incorporated into his thinking different and wider concepts of innovation (see Chapter VII) and regarded integration as an essential element of the implementation process. Unfortunately he had embodied the concept of integration in his own person so that it fed his need to be kept informed but did not actually permeate through to enhancing the implementation process itself. Consequently, even though he regarded integration as essential, those most involved in implementation were being denied its benefits.

The question arises as to whether it is enough to incorporate integration skills into mainline jobs - making integration part of the normal organisational perspective - or whether there is a specific need for an integrator to initiate these skills. And if, as suggested, the integrator is seen to occupy a temporary 'consultant' role what happens upon withdrawal? The 'open' problem of innovation implementation does not have a fixed solution: would the initiating phase of the integrator be sufficient to sustain the useful application of integration skills, or would she be needed on a part-time basis for instance in a 'servicing' capacity - similar in human terms to the annual visit by auditors for financial reasons.

Some organisations would wish to recruit a full time integrator with skills and job description to match, others may choose to ensure that someone within the management or implementing team is occupying the role of integrator at any giventime. The research demonstrates however, that for successful implementation in the present time and a greater ability to cope with innovation implementation in the future, the role of integrator must be found within the implementation team.

The Writing of the Thesis

Innovation requires an integrative approach and it was decided to use an integrative approach in the writing. The challenge for me in writing about innovation implementation was how to present my findings in an integrative way. As suspected (see Chapter II) the binding together of different strands of literature, experience, data, learning, feelings, observations, to create a unified integrated whole has proved difficult. It is easier to separate out compartments of knowledge and present them in an apparently logical and instructive form. But the very core of my findings hits out at the engineer or accountant or technical innovator who is so schooled in finding his sense of worth in the organisation by producing logically his area of expertise that he cannot take down those barriers and allow himself to play a real part in the whole process of innovation implementation. (I suspect that the person occupying the role of integrator within an organisation will be constantly open to similar demands requiring her to become more compartmentalised.) This was amply illustrated in each Innovation Profile where participants' needs to retain the security of their own job boundaries and responsibilities caused the implementation process to founder.

In addition to presenting my research in a way consistent with its subject there is the previously referred to aim of trying to provide a contribution to breaking down the stereotyping of innovation in the minds of managers, by producing a document which is more likely to speak to the manager in his own environment - making the literature more accessible and obviously applicable: and to abandon functional boundaries that would restrict and limit the value of my contribution.

So at each stage of the research and in each chapter of writing I have bound together relevant literature with my own theories and ideas, drawn from my own experiences, and the practicalities of the situations faced within the organisation. The pressures I have felt in doing this may be akin to the pressures on an integrator in an organisation viz. - the demand to separate and compartmentalise.

The three organising principles of the research which focus on:

- the 'how' of the process
- the specificity of the approach and outcomes
- the understanding and learning about the innovation process for the people involved

underpin the writing of the thesis and drew together the different aspects of the research into a comprehensive whole.

Further Research

Some interesting areas for further research have emerged from this study.

(i) The development of an internal learning capacity within the organisation. A more detailed analysis is needed of the influence the development of learning abilities in participants has on the process and on the wider organisation. This could also contribute further knowledge on the nature of the collaborative relationship in research of this kind, allowing for participants' own definitions of reality and the meaning of the situation.

(ii) More research of the case study type providing detailed information about specific innovation implementation processes. This would be:

(a) to counteract the possibility of the emphasis on integration being an outcome of the researcher's own inclinations and style;

(b) to assess the most effective balance between driving forces for innovation and the forces of resistance to change. Can there be too much integration providing the counter productive situation of stasis?

(iii) More effective methods of measurement and evaluation of the integrator's role in economic terms. This would include case studies where efficiency objectives in terms of time span, reduced unit costs, staff deployment, sales etc. were clearly defined in advance and used to assist an evaluation of the process used.

(iv) <u>Matching integrator and organisation</u>

Is there a need to match the integrator and organisation in terms of style so that there is a shared common ground of values from which to initiate work? As was seen in the research programme an attempt was made to investigate the prevailing organisational climate of different firms and to select an organisation that was compatible in certain key areas with researcher's style.

Do certain types of organisations require certain types of consultants - and if so what are the criteria for selection? Would it be personal selection or could it be objective and done for instance through the services of an agency? (Some work on this aspect is being done in the TNO project in the Netherlands.)

(v) <u>Training for Integration</u>: this would be on two counts:

(a) training of the integrator - not only in the process type skills mentioned but also in knowledge of concepts of innovation and the innovation implementation process.

(b) motiving small firms to accept the need for integration and the necessary provision of training whether as an individual or as a functional role within the management team.

The Contribution of the Research e A Summary

A major gap was identified in the literature on innovation - namely implementing innovations. The ensuing research into implementation has produced a contribution to understanding on a number of counts:-

(i) a theoretical framework underlying the totality of the innovation process. (Ex. 12)

(ii) a distillation of five mainline issues binding each innovation implementation situation into a whole and providing a common linking thread between different implementation situations:

(a) implementing technological innovations is a human process

(b) implementing innovations is a continuous experience

(c) the process of implementation necessitates a holistic overview and a recognition of its interrelated interdependent nature

(d) implementing innovations requires application of the skills of integration

(e) implementing innovations implies learning of new organisational behaviour.

(iii) the conceptualisation of the role of integrator underlying the understanding of the innovation process

(iv) a new perspective on coping with innovation implementation through a combination of these elements, providing for learning from the experience of taking part in the implementation process for the people (organisation) involved.

Clearly the subject of the research determines the nature of the research process (method and task are inextricably bound together) and a further contribution has been made by:-

(i) examining and including the implications of the person and biography of the researcher herself

(ii) developing a changing research design based on a changing research role according to the type of data sought

(iii) this culminating in an interactive collaborative relationship to aid in making the research relevant to the host organisation and to aid in a fusion of academic idea and practical reality

(iv) creating an action frame of reference rooted in a task situation while confronting existing ways of thinking – changing 'stock' knowledge and utilising 'new' knowledge

(v) writing the thesis in an integrative way to make ideas and ways of managing innovation implementation accessible and relevant to managers in their working environment.

POSTSCRIPT

As a piece of research this work extends and develops theories of integration in the innovation implementation process, but it was also unavoidably a vehicle for my own development and awareness, both as a person and as a researcher. I feel that the two areas of research and self-development make uneasy bedfellows, but I also believe that they are inextricably bound together.

One fundamental difficulty that I found hard to cope with was that of assessing what were the ultimate aims of the research. There was the obvious aim of obtaining a further degree, but how far did this fit in with me and my learning? How much should I toe the academic line, how much should I persue interesting self-developmental side-lines? There was the organisation I was working with; how much could I let feelings of responsibility to them take precedence over my own interests? What about particular individuals in the organisation and their pre-occupations?

The whole thing was a gigantic juggling act with me trying to keep a balance between the pull of many divided loyalties: a common trap I suspect:-

> "As a person, (Man), a being with the power of self-awareness, he is generally so poorly integrated that he experiences himself as an assembly of many different personalities, each saying 'I'."
> (Schumacher)

trying to hard to get everything right and pleasing nonone, least of all myself. Part of my learning in doing research has been to become more self-reliant, more able to stand alone - but I find this difficult to do. (Yes, standing alone and writing this is part of the same process – and equally difficult: 'to thine own self be true!)

On looking back, any feelings of achievement or satisfaction or pleasure were to do with whether I was learning from the situation or action or relationship, and this often seemed related to others' learning. Situations could be as diverse as doing a literature search by myself, to contracting work with a manager, or talking to someone on the shop floor. Failures were apparent when I blocked learning, my own or someone else's for one reason or another. For example:

(i) After the first Quarterly Meeting (January 1980) WS said he would like to discuss further his own team set-up with the foreman. I didn't follow this up immediately, (though I said I would at the time,) feeling it not quite to fit in with what I wanted to do. I pushed it to one side; later on, feeling guilty, I tried to remedy the situation with WS, but it was too late – I had lost his confidence. That incident really spoilt any further co-operation with WS. I never felt as easy with him as with some of the others.

(ii) When the company decided to go ahead and use computers for production control, I decided, in the interests of research (for comparison purposes) to withdraw and observe only. I tried to explain this to A, but I sensed his feeling of being let down. In the end I found it impossible to do: (whether this was from ethical reasons: –

> "Experimentation is a valid and legitimate method of study only when it does not destroy the object under investigation."

or my own inability to sit back, I'm not sure.) I back-tracked heavily, but the relationship with A was not the same.

In both these instances there was also an element of trust being lost.

Other failures were apparent in my feelings of inadequacy and lack of self-confidence. I overcompensated by being more direct and forceful - not being able to admit to ignorance. I think this was tied up with being young (ish!) and female: what I was really saying was 'take me seriously' - and I could never quite believe that they did. I was always aware of vaguely 'gallante' overtones!

There are other things also that I believe have made a difference to me as a researcher because I am a woman. (I can only write as I feel - I'm not really in a position to judge whether men feel similar constraints.)

The first constraint is again a duality - this time a duality of role: the role of wife and mother and the role of 'worker'. There are real pulls on either side and again I find it difficult to create a balance. The good aspects of having a dual role were in always having a 'Caring Other' to talk to, bounce ideas off, and generally keep me motivated; and also the enforced 'putting on ice' of ideas (or all aspects of research work) while turning my mind to other demands, often helped to clarify my thoughts. (The same process I suppose as positively not trying to remember someone's name and then it surfaces in your mind.) This is close to Jung's concept of 'controversion' where people tend to react against over-elaboration of some aspect of their development and pull back to the healthy central line of further growth by attending to another aspect. In my case it was enforced!

On the other side there were feelings of frustration at compromise - especially time-wise; feelings of lack of value in the eyes of others because of family commitments - 'How can they take me seriously when I've got to go now and collect the children from school?' captures the essence of this, or 'the wife's got a little job'; and all the time the struggle goes on in me because I can't even sort out what is important to me. Questions like 'what should I do? ...' are strange questions because they relate to ends not simply to means. No technical answer will do, such as 'Tell me precisely what you want and I shall tell you how to get it.' The whole point is that I do not know what I want.

There were real feelings too of being 'pandered' to, which fed my lack of self-confidence. Thoughts such as 'they wouldn't tell me to get lost if they wanted to,' made me work harder to establish some sort of credibility.

I made use of my femininity too. People asked how it was that I found it comparatively easy to gain access to firms. Part of it was that I was always well prepared: part of it too was that I was a fairly presentable woman (though I've only just managed to own that!) and still something of a novelty to the small engineering firms in and about Sheffield. The firm that I worked with for 18 months was 90% male employees: initially I had to establish myself as a woman going back to work after marriage and children - that was understandable and put me on a level with their own mothers (mostly) and wives. It was interesting to note in the firm's Xmas pub outing that the women machine operators all stayed together as a group while I, as I attempted to join them, was diverted off to talk with a small group of men: so I wasn't classed in quite the same way.

With the managers of the firm I found that I was used sometimes as a confidante, sometimes to boost their morale (or ego!) and generally on a friendly companionable level. Perhaps you feel I am too self-conscious of being female - that it doesn't make that much difference: all I can say is, that it is real to me, it makes a difference to me and affects how I operate. To emphasise this point I quote Juch's extension of Friedlander's Parable. (For the full parable see JABS 1976 Vol. 12 no. 1, P7-21), Juch ends up with one of today's promising adolescents - Pede, short for Personal Development: Quote:-

> "My conclusion is expressed in the description of the energetic strapping youth named 'Pede'; that is: the learning process based on rationalism (Thinking) and pragmatism (Doing) should be completed into a personal development model by incorporating the

existentialistic Inner-Self."

I agree - but I would give him a sibling named 'Bedef' - F for female - as I believe that creates a new being whose inner-self is essentially different because of her sex and the roles and expectations put upon her.

Jung points to the reality of conflict in life:-

"The discrepancy between intellect (what you know you should do) and feeling (what you want to do) which get in each other's way at the best of times is a particularly painful chapter in the history of the human psyche."

(My brackets)

and this has relevence for my approach to research. Polarities are a fact of life. viz:-

feeling /	intellect	
irrational /	rational	
doing /	thinking	
unconscious /	conscious	
inner self /	outer self	etc.

"Everywhere there are opposites, and we find it always difficult to keep two opposites in our mind at the same time."

(Schumacher)

"Contradictions are the space in which we live."

(John Cage)

Why seek to reduce conflict or tension and create an even balance? Why try to tie up all the ends - know all the answers? Why not admit incompleteness, messiness, greyness as a real valid state of affairs? Is it something to do with academic humbug? - or rather my collusion with imagined academia? Certainly I set out on the research path with the idea that I would come up with a neat parcel of knowledge at the end. But what I understand now is very different. Perhaps what matters more is the recognition of the state and a determination of what is most important in given circumstances. But what I recognise in a situation and how I determine what is most important in given circumstances is unique to me - a product of my being - the outcome of my conscious rational self and my unconscious intuitive self - and, as I found out in doing research, this is always changing.

APPENDIX 1

RESEARCH PROJECT

Sept 1979 - Jan 1980

ANNE ROOF

Entry and Contracting — Sept – Nov 1979

Sept 1979 - Nov 1979

1. Introduction

1.1 Search Process

To find a suitable company to work with I approached the Industrial Liaison Centre in Sheffield (part of the Sheffield Centre for Innovation and Productivity) and spoke to the manager, Mr. K. W. Bell. It was agreed that I could send out a memo with his next circulation to the 1,500 small firms on his mailing list.

From the replies I received, and from some personal contacts of my own, I investigated the possibilities of working in six different companies. This involved arranging initial interviews and follow-up interviews in an effort to assess which company would prove to be most profitable to work within the first instance.

Preparation

My approach to these first meetings was, first, to think through as thoroughly as possible all the things which might happen and be said. Secondly, to consider how to structure the interaction, in order to come out with an agreement to proceed if I felt that the innovation situation and the company 'climate' were suitable. And, third, if the company were not suitable for an initial investigation how to negotiate for a situation where I could come back at a later date after some preparatory research work had been done. In reading through O.D. literature on making entries into organisations a lot of emphasis is put on the relationship formed. So I set the

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1. Schein, E., Process Consultation, Addison-Wesley, 1969

following aims for the first meeting:-

(i) to get a background knowledge of the company, emphasising the exploratory nature of the meeting;

(ii) to define my ideas on innovation and decision-making;

(iii) to discover how far my perceptions were shared;

(iv) to get the contact to realise that data collection within the company would create expectations among employees;

(v) to get the contact to commit time to the project so that he would feel involved in it and give me authority in the eyes of others;

(vi) to get a feel for the climate of the company through observing management style;

(vii) to establish myself as a person of competence;

(viii) to establish client expectations about the project and agree on how I would proceed.

I aimed to keep the initial investigations to a short time span so that this could be reviewed as the company learnt more about me and saw the potential and benefit to them in the project (and so that I could withdraw if need be). The first meeting was to be essentially exploratory on both sides to test out whether:-

(a) the company was innovative and 'right' for me, and

(b) whether management would be willing for their company to be used to aid the research project.

Results

Of the six companies visited:

(i) R.C. was very 'extreme' in its rigid structure and formal procedures: it was doubtful whether I would be allowed much access or freedom of data collection.

(ii) BCD was willing to co-operate, but it seemed difficult to pinpoint situations in which decisions about innovation were being made. Most of our discussions seemed to be about technical specifications around an already decided innovation: the possibility of working with them at a later date remains open.

(iii) BE was a service industry - and while being fairly innovative - was becoming increasingly involved with an external company and the possibility of merging.

(iv) GD was the smallest firm - eight members in all and had a very informal 'round the drawing board' style. I would have practically had to 'live in' to catch them at it.

(v) AP were in a specialised field and highly innovative I approached them through the Technical Director and some hitch in communication occurred between him and the Managing Director. However the possibility of working with them at a later date remains open.

(vi) CD seemed the most suitable company to work with and so I shall describe my meeting with them in more detail.

2. Meeting

I phoned up and arranged a meeting with the General Manager on 1 October, 1979.

2.1 Background to Company

C.D. Sheffield is part of a group with headquarters in London. It is solely concerned with production as London HQ are responsible for sales, marketing and distribution. As such there needs to be close links with London who to some extent control the purse strings, though on a production basis CD is financially autonomous and self-accountable.

CD makes surgical instruments and orthopaedic products: they have a catalogue of 16,000 lines but these are not all operational at the same time, nor do they always manufacture everything on the premises - they buy in certain requirements.

The two main divisions in the work are surgical instruments and orthopaedic products. Surgical instruments have five main departments - (i) scissors (ii) retractors (iii) specials bows (iv) general tools (v) cheap end - numbers of expendable items e.g. towel clips. The Orthopaedic department is relatively small, especially in relation to the profit it brings in, and is due for expansion. There are also other allied departments whose functions cross the main product divisions, e.g. forge, tool room, finishing, polishing, passivation, warehouse.

CD employs 140/150 people within a basic pyramid structure (formal organisation chart reproduced as Ex. 1). Each section has a foreman who is responsible to the departmental manager. Senior management consists of:-

(i) the Works Superintendent
(ii) the Industrial Engineer
(iii) the Accountant
(iv) the General Manager.

2.2 Innovation Background

CD is always on the look out for ways in which to increase profit; they feel they must be dynamic, not static. Product development is usually instigated by surgeons; they are in close contact with some who come with ideas and drawings for ways of improving their technique with adapted products. This inevitably means that CD must be highly adaptive and ready to cope with change themselves. It also means that besides producing large batches of one particular item e.gg an artificial hip joint, they are also producing small batches of the same item with variations for a particular suggeon. In large part they are user/customer dominated – the NHS being another customer with specific legal obligations to comply with – e.g. the quality and type of raw material used. Developing new products often means clinical experiments using experimental items.

A recent innovation was a re-laying of existing machinery within the orthopaedic section achieving a 50% improvement in production, but this resulted in a more rigid range of product. OD is now waiting for board approval for expanding the orthopaedic section, involving looking more closely at the ways things are being produced and re-vamping ways of working to make for continuous production.

2.3 <u>Present State</u>

There are a number of on-going or future innovations within CD:-

(i) development of the forge area by buying fast striking forging presses and expanding the site; setting up a forge on a profit basis and selling its products as well as making components for CD;

(ii) creating a more effective production control system with the possible use of micro-processors for data collection and feedback;

(iii) the use of micro-processors on existing machinery ;

(iv) the use of on-going adaptive technology on existing machines;

(v) coping with design innovation required by surgeons.

In connection with item (iii) CD was taking advantage of a Department of Industry grant for £2,000 to conduct a feasibility study for assessing the application of micro-processes within the company. They were using the services of a team of consultants - Sheffield Micro Information Systems Ltd.

2.4 Climate

We spent some time discussing decision-making especially the GM's personal style. I was left with the impressions:-

(i) he was aware of the importance of involving other people and paid lip-service to that but in fact was fairly autocratic in style: he actually said this.

(ii) He enjoyed his position of power - his ambition had created this situation.

(iii) He was aware of human motives and politics but was unsure of how to handle them.

(iv) He had a policy of expansion - of bringing in new people and ideas - of creating a wider management perspective.

(v) He tried to foster a spirit of delegation and transferral of decision-making down the line and yet made fairly heavy use of withholding information as a control system.

There seemed to be a struggle going on between two opposing views. On the one hand a fairly open progressive management style and on the other a more rigorous tightly controlled style. The feeling was that externally the GM recognised and wanted to implement newer styles of management - team work, consultation, etc. but had not yet managed to internalise that for himself in terms of change of style, increased delegation. His policies of expansion were bringing with them a need to re-assess his role and the roles of others in an attempt to cope with the inevitable changes in the system structure and lines of authority. CD seemed to be poised at a time of fundamental change.

This led on to the fact that if I were to come into the company from outside and start interviewing people and collecting data, this in itself would create change.

2.5. Contracting

It was agreed that CD was a suitable company to study for the purposes of looking at innovation and decision-making. As item (iii) - using micro-processes on existing machinery - was the subject of a feasibility study at that time, it was suggested that a useful way in would be to liaise with the Industrial Engineer on this project.

3. Initial Entry

3.1 Innovation, Feasibility Study

Over the next month I liaised closely with the Industrial Engineer and the consultants, attending formal meetings and also informal meetings with the people concerned. The Industrial Engineer had been appointed in May 1979 and this project had been given to him to oversee, as part of a programme of expansion, in the process of which a new department of Production Engineering would be set up, headed by the Industrial Engineer. The Proposal for the feasibility study is reproduced as Ex. 2.

Background to the feasibility study

Meetings held in May 1979 between the consultants and the GM identified specific areas in their manufacturing process which might benefit from the application of micro-processor technology.

The company therefore looked for guidance under the Department of Industry's MAP Scheme in order to determine the best course of action to meet their initial and future requirements.

Terms of Reference

To evaluate the potential for using micro-processors within the company's operational areas of:-

(i) Double headed Hosan drill

(ii) Instrument Machine Shop

(iii) Spark erosion die making

The report comprised an appraisal of the major operation performed by each machine together with some reference to any peculiarities of the process. This was then followed by discussion of how improvements could be effected to the basic process by alteration in techniques of jigging (where applicable) together with those which could result from additional electrical/electronic control and/or monitoring.

Some observations were also made of the effects on the company of moving into electronic systems generally. (see Ex. 3)

Following this report it was decided to use intermediate technology - i.e. adapting existing machinery by means of jigs and fixtures, on the recommendations laid down in the report. This was to be a phased programme of events running from January 1980 - April 1980, and was the responsibility of the Industrial Engineer. In the new financial year the possibility of using micro technology for new systems of production planning and control was to be investigated.

3.2 Re-negotiation

At this point I felt I needed to re-negotiate my contract with the company. I wanted to gain more understanding of the workings of CD - the tasks, the people, the products, lines of communication etc. With this in mind I arranged a meeting for 12 November, 1979 with the General Manager.

My aims were:-

(i) to clarify my position and role

(ii) to get the go-ahead for building up my understanding of the company as a background for my work on innovation and decision-making.

I found the GM receptive to these proposals; my first aim was to build up a realistic picture of the organisation as seen by an outsider and I undertook to reflect this back to senior management. I said that I would take a 'critical' view but would not criticise individuals, as the development of relationships of trust was necessary for me to get an accurate picture.

The principal role problem I foresaw was to maintain the right degree of independence. In the entry phase, involving initial contacts and the development of relationships with other personnel, a prime concern would be to gain people's trust and confidence. It would consequently be difficult to be the carrier of dissonant messages when I might later have to give critical feedback on the company's functioning. The concern with developing relationships might distract me from getting an 'objective' view of the company and its problems. This suggested to me that the best way of giving feedback was not to do so piecemeal, but to make a report at specified intervals which dealt with problems in an 'objective' fashion.

This was agreed upon – the first report to be at the end of three months – the first in a series of quarterly reports. I was also given complete freedom and access to all personnel as well as being invited to more formal management meetings etc.

3.3 Summary

(i) I had taken a decision to work from 'observables' rather than from theory or generalisations, while realising the risk involved both for me and the company.

(ii) I had achieved a number of successful interactions to date which involved:

(a) developing a better understanding of my role;

(b) obtaining valuable information;

(c) developing friendly personal relationships.

(iii) I was building up data from which to go forward into the main research project.

4. First Quarterly Report

4.1 The Writing of a Report

In writing a Report I had to try to balance a number of considerations. What should go into it. Who is going to receive it? What, if anything, did I want to come out of it?

I decided to write the report and submit it to each of the senior managers with a date fixed to discuss the report after a few days.

In keeping with my brief of acting as an organisation 'mirror' I needed to present some of the key issues and areas of concern that had emerged. It would be difficult to avoid a sense of personal criticism or confrontation on management style; and it would also be difficult to present a convincing case without being specific about what people had said and without implicating other individuals. At the same time, I felt the need to justify my own expertise and show a depth of understanding of the situation backed by 'facts'.

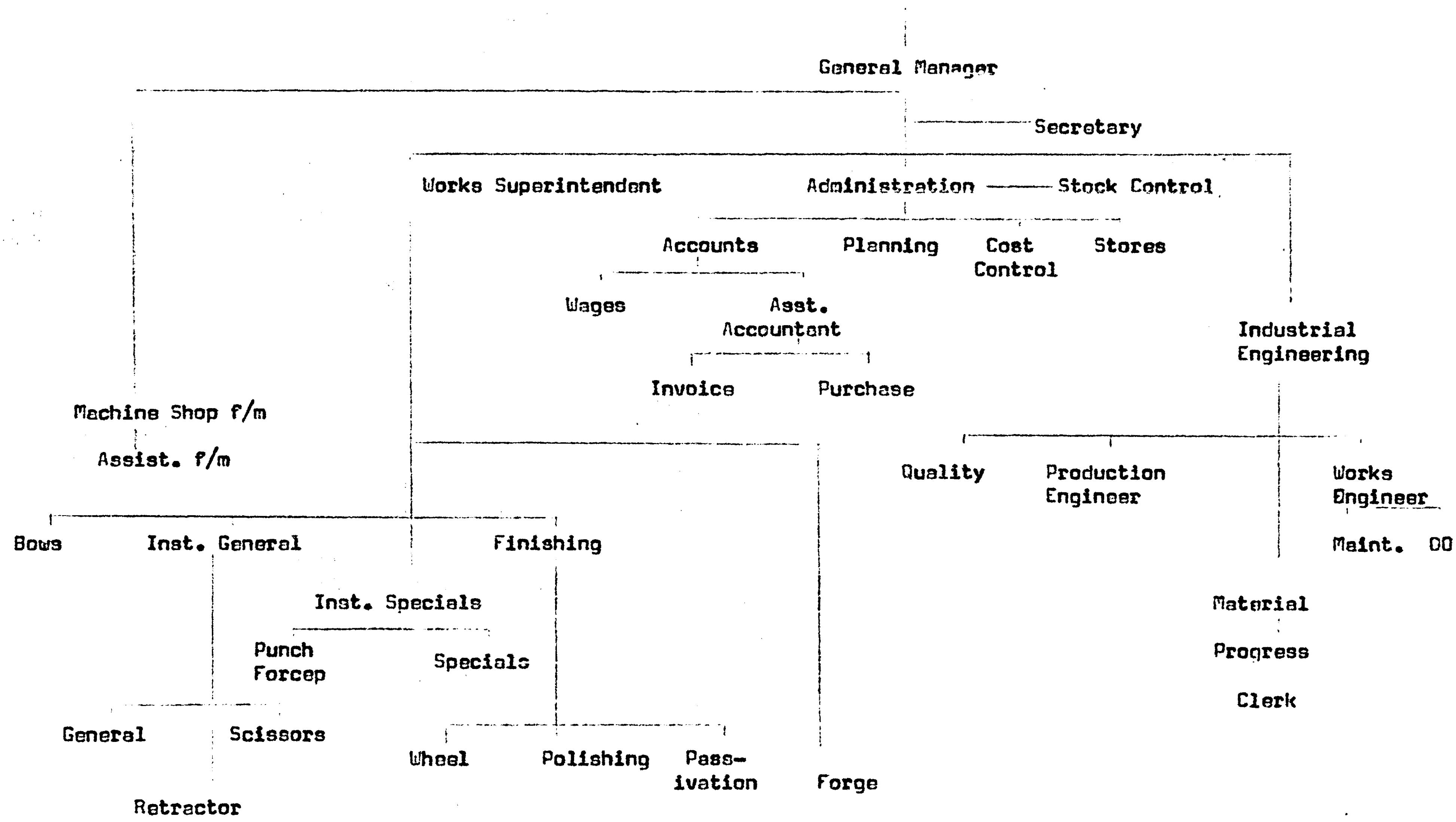
Finally, I had to remember that they might want to do something about the situation so it would not be enough to create a lot of dissonance without offering some constructive way of dealing with problems.

I decided therefore to mix the 'raw' data with interpretations and more generalised theory enabling them to understand their situation in more objective terms; and to suggest ways of turning their understanding into action through a reporting of needs expressed by various personnel at differing times.

I also wanted to focus on structural issues rather than on personality ones because people can work on structural issues more easily. It also reduces the threat in the situation. I toned down whatever might antagonise and tried to present people's behaviour in the context of the pressures on them. Hopefully, this would leave room for people to constructively work on issues if they wanted to.

EX. 1

FORMAL ORGANISATION CHART



EX. 2

Proposal for a Feasibility Study

(Under the Department of Industry's MAPCON Scheme)

On behalf of: C.D. (SHEEFIELD) LIMITED

By: SHEFFIELD MICRO INFORMATION SYSTEMS LIMITED (Con. 463)

1. THE NATURE OF THE MICROPROGESSOR APPLICATIONS

Discussions with the Production Director revealed that the company is achieving a high growth in producing orthopaedic implant and high quality surgical instruments, (the increased production was approximately 40% last year). However the company are facing a shortage of skilled staff which they are attempting to overcome by an intensive training programme involving 20% of the workforce, together with an increase in technical and managerial staff.

The company are looking towards microprocessor technology to improve their productivity by higher automation of their machining procedures and closer monitoring of the expensive stock and work in progress. It is intended that the feasibility study will be undertaken together with the company's Industrial Engineer in order that the expertise gained can be projected into further developments within the company.

A subsequent investigation of the company's shopfloor with the Industrial Engineer revealed two particular areas which they would like to be investigated with a view to taking advantage of microprocessor technology, namely:

APPLICATION (1) - Improving Machine Operations

The work centres which warrant investigation include:

(i) Doubled headed Hosan drill - which is required to drill approximately 80% of the orthopaedic products but one of the problems facing the company is the machining of new stainless steels which become work hardened when drilled. This state may become detectable by increased machine load and hence corrective action may be possible. Another detectable state could be an indication as to when the drilling process is completed.

(ii) Instrument machine shop - this large machine shop is being investigated with a view to developing more sophiscated jigging facilities and automating the process. There appears to be a potential use of microprocessors to control the sequence control of feeding, clamping and monitoring slot depth.

(iii) Die making through spark erosion requires hard finishing to obtain the required finish. An investigation into the possibilities of developing more sophiscated die making and ultimately pressing by cold forming.

APPLICATION (2) - Improved Shop Floor Production Monitoring

The company's production use very expensive materials - Cobalt, Titanium and Orthopaedic stainless steel. The increase in production being achieved requires the company production management to develop more sophisticated shop floor planning and control procedures.

The study would identify the type of facilities required in order to:-

(i) control stocks of raw material.

(ii) monitor the flow of production batches through the work centres to enable standard costs to be more clearly identified and hence give more direction to the profitability of the different company's product range.

(iii) allow clearer identification of departmental and work centre utilisation.

(iv) develop a production planning system which would allow work to be scheduled, work in progress tracked and production costs to be controlled.

This would allow the company to identify areas where manufacturing processes require increased capacity or development.

2. C.D. LIMITED

The company has operated for 100 years based upon the local cutlery skills.

As stated previously a high production growth is being achieved, by approximately 40% last year, producing high quality engineering in the orthopaedic implant and surgical instrument makkets.

The company are successful in both the U.K. and export markets, exporting approximately 50% of its sales. The company has a wide product range of approximately 16,000 products.

The company's success reflects the progressive attitudes of the management, which shows in:

- the company growth
- the workfooce training programme (for new manufacturing processes)
- the new Sheffield factory siting
- They are keen to investigate the potential for using microprocessors within their company's production machinery and management activities.

3. TERMS OF REFERENCE OF THE FEASIBILITY STUDIES

APPLICATION (1)

To evaluate the potential for using microprocessors within the company's machine operations indicated in Section 1 in order to:

(i) improve the production output without an increase in workforce, due to the lack of skilled operatives.

(ii) improve the quality control of the products being manufactured.

APPLICATION (2)

To evaluate the potential for using microprocessors with the company's stock and production monitoring in order to:

(i) control stocks of expensive materials.

(ii) allow more control over the production planning and monitoring of work in progress.

(iii) allow the product profitability to be identified more clearly instead of using the existing estimated standard costs.

4. CONDITIONS FOR THE FEASIBILITY STUDY

APPLICATION (1)

(i) Ten man days will be required in order to carry out:

- (a) a detailed investigation into the drilling, fitting, die making and cold pressing operations. This will be undertaken in consultation with the company's Industrial Engineer.
- (b) an investigation into the hardware and software architectures necessary for development.
- (c) the production of a feasibility report.

(ii) The feasibility study will be undertaken by two consultants.

(iii) The cost of the study will be approximately £1800 plus VAT.

APPLICATION (2)

(i) Ten man days will be required in order to carry out:

- (a) a detailed investigation into the company's production flow routes and stock requirements together with the necessary production planning and monitoring reporting requirements.

(b) an investigation into the cost of suitable hardware and software requirements together with the necessary organisational considerations.

(c) the production of a feasibility report.

(ii) The feasibility study will be undertaken by two consultants.

(iii) The cost of the study will be approximately £1800 plus VAT.

SECTION 6: General Remarks Concerning Provision of Electronic Equipment

The remarks made on each of the machines around which this investigation has centred have all alluddd in some way or other to the additional provision of electrical/electronic control and monitoring equipment. In some cases such equipment will incorporate a microcomputer controller. The level at which the company would want to become involved with this provision warrants some comment.

(i) Electronic expertise as such does not presently exist within the company.

(ii) Electrical and mechanical maintenance of most existing machines is, however, undertaken.

(iii) Wiring and control panel modifications or additions would be well within the compass of existing staff.

(iv) Installation of more sophisticated electronic equipment could be undertaken provided such equipment was designed as a package with such installation in mind; the need to 'tune' instruments to suit a machine is best avoided.

(v) Any equipment employing microcompters would be best designed such that acquisition of (expensive) programming ability is avoided.

SECTION 7: Conclusions

This report has attempted to provide an appraisal of where largely low-cost, excursions into electrical and electronic aids may be profitable on machining. It has not been considered realistic to imply that microelectronics the "obvious" improvement to any process. Rather, it is suggested that significant returns could be achieved as a result of quite modest electronic and electromechanical additions to jigs and machine controls in many cases. The exception to this would be the gains to be realised if a data logging facility were acquired to monitor machine performance. Although this would be initially concerned with the cannulation process only it could well be usefully deployed onto other machines also. The philosophy behind all recommendations made in this report has been that of minimising operator intervention in machining processes.

APPENDIX 2

C. D.

Quarterly Report to Senior Management

Anne Roff

January 1980

CONTENTS

1.1 Background to the Project

My first contact with the Company was a visit to the General Manager on 1 October 1979. We discussed the possibility of my looking at how technological innovation was initiated and implemented within the company and at the decision making processes involved. Following this discussion, I was introduced to the Industrial Engineer and was kept in touch with the formal procedures to do with one specific innovation.

In a subsequent interview with the G.M. on 12 November, 1979 it was recognised that it was important for me to have more of a 'feel' for the organisation - to understand more fully the tasks, products and people of C.D. as a background for work on innovation and decision-making.

It was agreed that I should present a report to senior management after three months on the picture I had built up of formal and informal systems, attitudes and relationships. This was to be the first of a series of quarterly reports.

1.2 Data Collection

This has been carried out over the period from 21 November 1979 to 11 January 1980. I began by holding fairly formal interviews with members of the senior management team, interspersed with more informal discussions with personnel at all levels. This was supplemented by occasional conversations and with observations of the daily activities in the factory. I felt it important to make as many contacts as possible and to assure people that what they said to me was confidential in that individuals would not be quoted but that I would generalise what they said as I built up an overall picture; that I was not here to be judgemental but to act as a mirror for the organisation, reflecting back to them any key issues that emerged.

1.3 The Purpose and Form of this Report

(i) to show how an outsider sees the organisation;

(ii) to identify key issues that have emerged.

I hope to report on issues which have become apparent to me through my interviews, discussions and observations by continually reflecting back to generalised understandings of behaviour in organisations. This is important, because people tend to see problems in terms of the particular personalities involved, but I hope to make clear that there are characteristics in the organisation and development of accompany which influence the way people act. Comments made about individuals should, therefore, be taken in this light, and not as personal criticisms.

Part I - The Report

2.1 Old and New - stages in the development of an organisation

The ways in which a company grows are many and varied; in part its development will depend on how it copes and responds to crises. C.D. has had a long period of unsettlement and management change and now seems to be entering a phase of expansion. Many managers see that for their site to prosper and continue to move forward they must develop new forms of relationship. Companies invariably begin life as the creation of one strong leader (or they are rejuvenated at a time of crisis or stagnation by such a man). As they grow, they become too big for one man to control single-handedly, and it becomes necessary to create a system of roles to deal with all the work. When a company is dominated by one man, it is characterised as having a 'power culture'. With increase in size and complexity of business, development of a system of specialised roles becomes necessary. Authority is delegated to the individuals in these roles and, although power ultimately derives from the man at the top, it is more dispersed than in a 'power culture'. This kind or organisation is characterised as having a 'role culture'.

Typically, in a 'power culture' the leader is closely involved in all affairs, either personally or through his lieutenants, and has a close hand in all decisions. His word is regarded as law, and the organisation carries his stamp. However, the very success of such a form of organisation leads eventually to pressure for change as it grows in size and is forced to take on specialists. The larger organisation makes greater demands on co-ordination, and specialists bring with them different backgrounds, styles and expectations which clash with prevailing norms.

The organisation which emerges relies on clearly defined roles, separate functions, clearly understood procedures for communications, and rules (governing, for example, the settlement of disputes).

Each type of organisation has particular strengths and weaknesses, and is successful in particular environments. The recent history of C.D. exemplifies this process of coping with expansion. Thus, the creation of professional functions such as Industrial Engineer, the recognition of the need for rationalising planning and control systems, represent an attempt to develop more rigorous and systematic methods in planning organising and evaluating work. There is also the creation of additional levels of management below top level to provide a broader management capability. A process of moving from a 'power culture' to a 'role culture' can, therefore, be observed throughout the company. Several issues relating to this phase of transition have been observed:-

(i) the prevailing management style is characteristic of a 'power culture' although the emergence of an effective organisation based on properly defined roles and adequate differentiated authority is being encouraged.

(ii) there is a lack of understanding about new personnel connected with expansion which is expressed as resentment of outsiders (cowboys) coming in and taking over staff positions; this, in turn, gives rise to the feeling that shop floor ability is not recognised or promoted.

(iii) there is a general fear of change - a fear of anything or anyone new expressed through lack of co-operation and a withholding of information: this is also an attempt to gain management recognition of shop floor ability, although withholding information is not solely a shop floor phenomenon; it seems to be a general strategy for getting noticed.

Needs have been expressed for:-

(i) clearer role definitions;

(ii) more knowledge about new positions and management functions;

(iii) regular team meetings of management at all levels with joint consultation, openness and decisions that are acted on. (A movement towards this has begun in the last few weeks, particularly at middle management level).

2.2. Individual and Group Identities

There are a number of felt groups within C.D. with significant importance: these are

(i) senior management - GM; IE; A; WS;

(ii) middle management - WE; PE; T/Fm; Dr; M/cs;

(iii) the tool room.

(iv) surgical instrument workers.

(v) orthopaedics.

Because of the number of definable groups, the chains of command are tortuous and confused - staff at either end are remote from one another. This increases the likelihood of breakdowns in communication and leads to overlap between roles. Because of this staff tend to encroach on one another's authority, or to bypass one another in order to shorten the chain of command and communication. The effect of this on the individual is to create uncertainty about his role and anxiety about what authority he has. He may try to overcome this in two ways - by avoiding taking decisions and not accepting responsibility, or by taking authority away from others. The persons most affected by this are inevitably the men in the middle. A few examples will illustrate this.

(i) The Works Superintendent's authority is undermine when the G.M. takes decisions unilaterally to change production schedules. He feels a lack of proper consultation.

(ii) He, in turn, encourages his subordinates to bypass the recognised system of reporting and consultation.

(iii) This creates tension in the Works Engineer who responds by withdrawing. Each person off-loads his stress onto another.

Role relationships and reporting relationships seem to be in a state of flux; new systems are harder for some to accept than others. There seems to be a clash between older existing roles and new initiatives. This is seen in:

(i) the rapid rise in status of the tool room.

(ii) the increased importance of the orthopaedics department in terms of profit.

(iii) individuals who are selected for promotion without consultation.

(iv) outsiders brought in to fill roles which have not been explained – and, therefore, seeming to be irrelevant to the majority of those in the organisation.

Needs have been expressed for a systematic review of role relationships with the aim of clarifying what each should be doing. There are signs that the problem is already in part recognised – with the on-going attempt to write proper job descriptions – but it also means people saying how they are hindered and helped by the things other peopleddo, andcooming to arrangements which suit both.

2.3 Information and Communication

Communication is concerned with how information and instructions are passed between personnel having different duties, responsibilitíes and power. A system of communication, however, does notddepend solely on logically devised procedures. It depends as much, if not more, on the underlying structure of roles – on personnel having adequate authority to carry out their duties and clearly understood areas of responsibility. Good communications also involves <u>how</u> people communicate with one another. This includes skill in listening and talking, and the general climate within the company which fosters or impedes communication. Thus, personal relationships between staff are as important as functional relationships.

The climate of communications in C.D. reveals several areas of tension:

(i) those who do not appreciate the GM'S style are demoralised by his abrasiveness.

(ii) the old system of fight and confrontation with managers prevails because people are clear that they know howto manage this system.

(iii) withholding of information is used as a control device or as a means of increasing outward power and authority.

(iv) 'People get lost trying to reach top management' - this tends to perpetuate the view that management does not know or is not interested in what is really going on at shop floor level.

(v) Communication flows are mainly downward - in the form of commands; there is little lateral communication across quite insular departments. This leads to mistrust and bad working relations.

(vi) Communication with London seems to be fraught with misunderstandings; there are too many personalities involved; too many hitches; not enough information is passed through at the right times.

Needs have been expressed for:-

(i) more integration between departments.

(ii) a 'system of recognition' where a true record is compiled of a man's ability over time, with opportunities for promotion.

(iii) senior management showing more knowledge of shop floor workings, and conversely shop floor receiving more information and explanations about things that affect them, e.g. overtime cut-backs.

(iv) a better system of consultation and decision making for senior management - formal and informal.

(v) more definite corporate planning instead of all pulling in different directions.

(vi) a better system of communication between London and Sheffield.

The value of open communication is neglected. Communication is predominantly downward. Management tends not to consult, and neglects the value of keeping subordinates informed, to encourage identification with the aims of the company and overcome a 'them' and 'us' attitude. Consequently, subordinates (at all levels) feel a constraint on communication upwards. This denies management the feedback it needs, and denies subordinates possible support.

These problems are primarily a matter of attitude. However, as has already been recognised in a small way, meetings and consultations which bring together different groups of people to discuss joint problems, and to work on these, are a way of improving understanding and changing attitudes.

Part II

3.1 The furtherance of the aims of the research project

The research has four main aims:

(i) to study firms who are making technological innovations in order to assess how decisions to innovate are taken.

(ii) to examine the innovation implementation process to see whether decisions are taken participatively or not and their consequence.

(iii) to identify the communication structure and to determine the nature of interpersonal communication flows and how the formal structure and informal processesarare related.

(iv) to provide a general theoretical approach to help organisations cope with innovation implementation.

I feel that the past three months have given me some understanding of the organisation; the next stage is to monitor a number of on-going innovations using a variety of techniques e.g.:

(i) Sociometric survey

(ii) Organisational mapping questionnaire.

(iii) Best and Worst Innovation Implementation.

(iv) Case histories.

(v) Informal assessments etc.

This could result in the first step towards providing a general theoretical approach to help organisations cope with innovation.

In order to do this I need your help in identifying several well-defined innovations within C.D. at the present time.

3.2 Establishing a Further Work Contract

I would like the monitoring of these innovations and a further two reports to you on my progress to be the basis of my work in C.D. over the next six months.

Also there may be areas in this report which you feel need following up for the benefit of C.D. These would be the basis of an additional contract between us.

APPENDIX 3

Management Meeting - 23 January, 1980

A report on the feedback session centred on the first Quarterly Report

(i) The meeting lasted roughly 2½ hours; (9.40 - 12.20). We had to wait a few minutes for the Accountant (A) to come and during that time I discovered that the Works Superintendant (WS) had not yet read the report. I was a little worried about this particularly as specific reference had been made to him in the report. He proceeded to scan through it there and then. The GM withdrew behind his paper and the Industrial Engineer (IE) just commented that he thought the report could have been much more 'hard hitting', more specific - that I could have 'laid things on the line' more, particularly in the areas of communication and information.

While this took me aback a little (I suppose I had subconciously been expecting support from him rather than criticism) I was also relieved as I had been worried about the confronting nature of the report.

(ii) When A arrived the GM turned to me and said: "We're all here - it's your meeting, tell us what you want." This again surprised me because it did not fit in with his behaviour that I had observed in other meetings, where he set the tone of the meeting from the start and directed things fairly heavily thereafter.

But it did give me a welcome opportunity to begin by saying that the report really sprang from a success situation: that it was because CD was on the point of expansion, because it was progressive and forward looking that a lot of these issues centred on role structure, communication, lines ofauthority, etc. were emerging.

From this a short discussion followed - what I term as 'nit-picking' where minor details of terminology and understanding are picked on and tossed around, e.g. CD was not expanding 'it was developing' existing resources; it was in a stage of transition, moving from older craft-based ideas to more modern ways of production; the emphasis was on raising the Sheffield unit's status in the eyes of London (group headquarters). Also, emphasis was laid on the good things that had occurred within the Sheffield site in the last fifteen months - a 50% increase in productivity, better promotion paths for personnel etc. This gave me the opportunity to say that of necessity I had collected mainly negative data because of the method of data collection - interviews, informal conversations etc.

(iii) After this introductory 'shake-down' the meeting got down to some real work on the issues ofcommunication, oppeness and trust, between the four members of the senior management team, I decided to take the role ofprocess observer and mainly intervened on this level. This was because I was anxious that the meeting did not remain as a general time for letting off steam but that some learning was brought out; that it was recognised that this type of meeting - i.e. one not concerned primarily with task issues but more with relationships - could be of value andccould bring about constructive change.

Important points raised included:

(a) do we see ourselves as a management team or not?

(b) what is the level of trust between us?

(c) what are our assumptions about each other in relation to task, role and status?

(d) are we equals?

(e) should we all have access to the same information?

(f) what would be a satisfactory way of operating as a team in the future?

It was significant to find that the GM saw the three others as the management 'team' and saw himself outside of this - more as a liaison between Sheffield and London and being fairly directive to his 'team' at Sheffield. It was also interesting to note that he was not willing to collude with the general feeling of the meeting and agree to operate as a member of a senior management team. He retained his position of separatism. (After the meeting this led A to say, "Nothing's changed - he won't change his attitude.")

(iv) Four main actions arose from this part of the meetingt

(a) Every 2nd Wednesday in the period (roughly once a month) there would be a formal management meeting of the top 4 in order to provide a structure for cross-fertilisation of ideas and knowledge and to enable members to begin to operate more on a team basis. It would also be a meeting to examine relationship issues as well. Decisions would be taken and action plans formulated so that everyone was clear about future plans.

(b) There would be a review meeting held next week (Tuesday, 29 January) to start them off where there would be a recapitulation by each member of the team of where he was - projects, policies, budgets, etc.

(c) Areas of responsibility were more clearly defined:-

- IE was responsible for seeing that middle management operated as a team
- WS was responsible for structuring meetings between all senior foremen
- A was to start building up the production control side.

(d) Each of the three managees was more clearly established as a project officer:-

- IE responsible for plant re-location and use of space
- WS påanning of a new forge
- A data collection and control for production.

I was left with the feeling that there was a greater spase of satisfaction with having faced up to some of the personal issues and antagonisms that were getting in the way of proper communication. The GM did not really subscribe to the view that management meetings should be held at definite pre-determined times - he felt they should occur when the need arose, on an 'ad hoc' basis, but he agreed fairly readily to a monthly meeting of the type described. This was seen as important by the others in that the meetings would provide a structure for more safely bringing up process issues.

The central issue that seemed to emerge was 'where is the company going and what organisation does it need to get there?' This seemed to be explored in personal terms and to have some satisfactory tangible outcome for the members at the meeting.

The feedback to me was that the report was 'basically right' and 'enlightening' although 'it doesn't really say anything that's new'. This was important for me because my 'facts' at that time were only so many one-sided statements (admittedly collected from a large proportion of the work force) and personal hunches. The data, subjectively derived, could only become 'factual' through developing shared acceptance of it. Questions of communication, roles, personalities are social matters and data about these can, therefore, only acquire the status of 'fact' through a social process (viz. sharing it).

I also became aware that giving data feedback clarification perhaps improves the understanding of individuals but does not necessarily motivate them to change. Perhaps too the time had come for the managers themselves to start generating and evaluating data, instead of relying on me to go from one person to another and collect it. Group generated data would have more power to influence participants to seek changes, if that is what they wanted.

Finally, I had been wondering whether the focus I had adopted reflected my preferences or the reality of the situation. I tended to look on the resolution of role relationships as an end in itself - as a 'rational' problem to be solved. In so doing, I was adopting the conventional view of the organisation as a hierarchical, functionalised, routine-performing system, dominated by authority relations. But the impression was that my approach in this had reflected the actual state of the organisation and that by working on an area which many personnel at all levels had identified as important, I had not imposed my own views or preferences. One comment was, 'It didn't really matter what you wrote in that report did it? We'd have ended up talking about this anyway."

Two of them (IE and WS) intimated that they would like to talk with me further about their own team set-ups. I also asked whether I could attend their monthly management meetings to keep abreast with the climate and progress of work etc. This was agreed upon: my role would be purely as non-participatory observer.

(v) The final part of the meeting was concerned with my position, and research work on innovation and decision making.

It was decided that there were three main areas of innovation:-

(a) the data control system for planning production - headed by A

(b) the relocation of machinery and plant space headed by IE

(c) the development of a forge on site - headed by WS.

Of these (a) and (b) seemed to be the areas for immediate work and it was agreed I should liaise with the project officers - A and IE respectively.

The 'nuts and bolts' innovations at shop floor level were not deemed particularly suitable for study as they were really outside of Sheffield control - they were prescribed by London. I would be able to collect and catalogue these though through contact with IE and the production engineer.

APPENDIX 4

<u>C.D.</u>

<u>Quarterly Report to Senior Management</u>

<u>Anne Roff</u>

<u>April, 1980</u>

CONTENTS

1. <u>The Three Main Areas of Innovation</u>

These were decided upon at the last quarterly report meeting.

(i) the data control system for planning production control – headed by A

(ii) the relocation of machinery and plant space – headed by IE

(iii) the development of a forge on site – headed by WS.

I would like to discuss how individuals feel these areas of work are progressing.

2. <u>Innovation Profiles</u>

I have focussed on four types of innovation over the last three months.

(i) <u>process innovation</u>; for example the beginnings of creating an increasingly efficient system of production control (e.g. the introduction of batch route cards)

(ii) <u>adapted-technology-process</u>; the use of on-going adaptive technology on existing machinery – usually with a view to increasing productivity. (e.g. Smith Petersen nail)

(iii) <u>adapted product</u>; coping with design innovation required by surgeons; usually this has been an adaptation of a standard product line, but sometimes has meant a new product (e.g. Rings' hip joint)

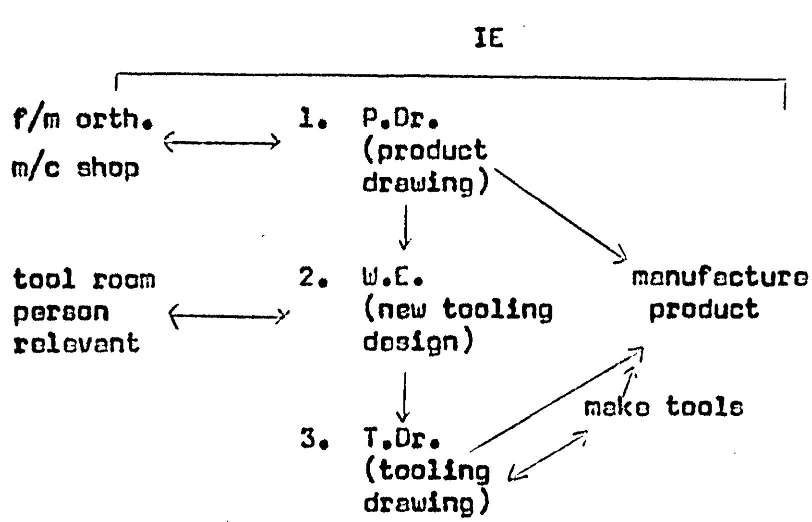
(iv) <u>organisational structure innovation</u>; this does not really fall inside the definition of technological innovation, but does serve to illustrate some of the human factors which account for the bulk of variations in the innovation process (e.g. Rqquisition system for new tooling).

In looking at the innovation implementation process, there seems to be a need to integrate all the people and subsystems relevant to the innovation. The existence of integrative devices - committees, liaison departments etc. is apparent when looking at organisations. Traditionally it has been the responsibility of the managers in an organisation to ensure integration between people and subsystems. But the problem is that an appreciation of problems in general terms e.g. 'poor working together on a project' is followed by the use of 'plug-in' solutions e.g. project teams, co-ordinating groups, job rotation etc. when in reality each situation is different and the success of the group working together will depend on how the group sees itself in the task situation and how aware individuals are of the formal and informal roles within the group.

This would seem to point not to 'plug-in' solutions but to helping members to learn from the process of taking part in the innovation implementation process; to learn about relevant behavioural factors - how decisions are taken, how problems are solved, how to work in a group etc. This learning could then be taken forward to aid future innovation implementation situations.

Example

New Product Development Group (NPDG)



P.DR
Product
Draughtsman

W.E.
Works
Engineer

T.Dr.
Tooling
Draughtsman

I.E.
Industrial
Engineer

- The Central core of the NPDG would remain the same, i.e. Product Draughtsman, Works Engineer, Tooling Draughtsman. They work as a team.
- However, at each stage (1, 2, 3) a relevant person is brought in for advice and consultation.

  e.g. 1. – the advice of the foreman (or other machinist) in the orthopaedic machine shop

  2. – a relevent person in the tool room

  3. – the tool room manufacturer.
- Tooling and product drawing having been prepared production can begin in the machine shop.
- Any queries revert to the specific NPDG member.
- I.E. has general oversight of NPDG.

3. <u>New Product Development Group</u>

With the previous points in mind, I would be interested in following the development of a flexible group to deal with new product development. (See Example) I would also be interested in helping group members to draw out the learning from co-operating in such a group and in taking that learning forward into further innovation situations.

4. <u>My Role</u>

I would like to hear from each of you what <u>you</u> think I have been doing over the last three months and if you think I have had any effect (good or bad) on you or the company.

This is to belp me classify what my role has been in the company over the last three months. N.B. this <u>honestly</u> how you have seen me and not what you would have liked to have seen, or what you think I might have been doing.

5. <u>Looking Forward</u>

I would like to hear:

(a) what you think of the work I have done so far

(b) what you think about New Product Development

(c) where you think I could concentrate in the future.

APPENDIX 5

C. D.

Quarterly Report to Senior Management

Anne Roff

July 1980

CONTENTS

1. <u>Introduction</u>

The previous quarterly report (April 80) looked at three main areas of innovation and also at smaller innovations occurring within these main areas. It was suggested at the meeting that the Innovation Profiles are part and parcel of the larger innovation area; that the larger innovation areas are composed of small incremental change: that in effect everything is inter-linked and dependent although it does not always appear to be so. A request was made for me to explore further this separation/dependency issue.

Interest was also expressed in the 'knock-on' effect of innovation. Innovation is a result of pressures from both outside and inside the company, but pressures are also created in different departments by the innovation or the act of innovating.

This report will look at these two areas in more detail and then also consider the direction that the research seems to be taking.

2. <u>Separation/Dependency</u>

The Cuban order for 2,000 Smith-Petersen nails is a recent innovation that illustrates the separation/dependency issues involved in the innovation implementation situation.

2.1 <u>Brief Description</u>

The GM called a meeting of the IE, PE, and WE in the first weeks of January 1980 to discuss a new order from Cuba. The order, based on a letter of credit expiring in March 1980, was held up in London due to an oversight and now the pressure was on to fulfil their commitment. There were only 8-10 weeks to get the order through but the GM decided to take it on.

The order was for:

- 2,000 Smith Petersen nails
- 1,300 McClaughlan plates
- 5 hole brackets.

Due to luck and the IE's foresight they had tooled up for the McClaughlan plate in November. There was no tooling for the SP nail. At the meeting the production process of the nail was looked at to try and identify blocks and snags in manufacturing. The PE was briefed to design a new fixture for the Brook Mill machine.

The essential part of the production process was in the milling of the nail, and also in reducing the time spent in the wheel room glazing and polishing.

Blank	machine shop (milling)	wheel room (polishing)

The PE was to design a fixture for tri-fin milling which would:

(a) produce c100 nails per day

(b) reduce chatter marks due to vibration and so cut down on polishing time.

The sequence of events was as follows:-

(i) specific order January 1980 - 8 weeks to complete

(ii) design fixture for milling machine and make it in tool room

(iii) set the machine

(iv) make the first nails (6)

(v) take them through the production sequence

(vi) estimate time for polishing (1 minute)

(vii) check standard with quality

(viii) produce 2,000 nails.

Implementation Process

It took the P.E. (a new employee) longer than he estimated to produce the fixture. A great deal of pressure was put on him to come up with something quickly - everyone in the works was aware and interested, as evidenced by the number of people continually buzzing around the milling machine, trying not to show their interest but obviously watching everything that was going on. Previously there had been some talk amongst management of the likelihood that the machine operator would be obstructive as he was opposed to any change. He was described as 'a frustrated tool maker' who relied on his ability in setting up machines to give him some importance and status. In the event there was no hitch at this point. It is my opinion that the reason for his co-operation was the interest being shown in him and his machine: the status of having an important order running through his machine and being responsible for getting it through. He was pleased to show me over - "You know about it as well, do you?"

By 21 February, 1980 the fixture was working well and turning out about 100 nails per day - but it was obvious that the March deadline was not going to be met. Owing to the letter of credit the company stood to lose a substantial amount of money. The understanding was that because of the rush order the quality standard would be lowered. However it proved very difficult to fix a reduced standard of quality.

Traditionally CD had always given a very highly polished mirror finish to all work done by:

(i)	glazing	(12 minutes)
(ii)	electro polishing	(Quality control to show up any marks)

(iii) hand polishing (6 minutes)

The PE tried to design his fixture to cut down on glazing time - an estimated 1 minute to eradicate the 5/1000" clime milling mark at the end of the cut; because of time pressure hand polishing was also cut resulting in a product which was substandard according to traditional CD's standards but on a par with competitor's products.

However Ted, the glazer, was used to removing every mark and could not adapt for one order to not doing as usual. He was uncertain about the quality standard; so was the Quality Control manager, the person in charge of electro-polishing and the GM. All were working against each other - pulling in different directions.

It was compounded by the fact that in the pilot run the PE had naturally gone to the polishing foreman who had done the job in an estimated 1 minute: the worker actually assigned to the job (Ted) could not achieve this time, but the senior foreman of the wheel room was certainly not going to let a new PE in to his department to discuss work allocation. He keeps very rigidly to the idea of being a master to himself (grown up out of the 'little-master' ideas), To the polishing foreman it was just another job; there was always pressure of time being put on their work - this was no exception; there was no real reason to come forward and help.

AS IE said:

"It is an engineering success story, but it's shown up weaknesses in the performance of the rest of the manufacturing sequence; an improvement in machinery has had a detrimental effect down the line; an advancement in one area is thwarted in another."

2.2 Notes on Implementation Phase

The actual operation of setting a new fixture on a machine and increasing production of the nail seemed fine. The hitch occurred later on in the cycle of production and seemed to be a combination of:

(i) defining the quality standard

(ii) the actual people involved in quality.

It would seem that a greater oversight of the whole project would have been useful, taking into account all the relevant people.

The following points seem to be significant:

(i) those who made the policy were not those who had to carry it out; however there are ways of facilitating the implementation process. In this case the glazer who was to actually do the polishing could have been approached for the pilot run; the polishing foreman could have been involved in an explanation of the importance of this particular order.

(ii) As the implementation process becomes involved with more people, changes in programme shape are almost inevitable. Ideas and standards of quality were continually being re-defined by different people to suit their own purposes. In re-defining, the innovation moves away from being the property of a single individual or small group to being the property of a substantial group within the organisation, if not of the entire organisation. Essentially this is a process of communication - a process of adjustment, compromise and accommodation of different interests.

In this case, as the SP nail moved into production more emphasis could perhaps have been placed on re-thinking and re-defining the quality standard with all those concerned with quality. This would have meant re-thinking in terms relevant to parts of the organisation which had not yet been involved in the original planning; i.e. anticipating Ted's difficulties; bringing in someone more acceptable to the senior foreman of the wheel section (e.g. WS) to ensure his co-operation. It also points to the importance of feedback in the decision-making processes and also to the fact that the decision-making processes are not necessarily simple linear progressions but complex interactive patterns.

Decisions about innovations and about how they are to be implemented within the organisation cannot be taken as purely separate entities but must be taken in the context of how the innovation can become part of the organisation. This means taking into account the dependent nature of what seems to be a separate isolated event, and would suggest an integrative team approach involving relevant personnel at different stages.

3. Innovation/Pressure

The innovation taken to illustrate the issues of 'knock-on' pressures of innovation implementation is the introduction of route cards to aid production control.

3.1 Brief Description

The need for a proper production control system has been recognised since September 1978. The General Manager (GM) and the Accountant (A) discussed the matter: their first thought was to use a small computer, but as A commented: 'You look at these things, but you know you've got no power to buy them, it's over £30,000 for software'. They next looked at using the services of a computer bureau: 'we got as far as we could before we actually had to spend any money'. (June 1979) This resulted in a meeting between GM, A and the Management Services Manager (London) and the computer bureau people. Following this it was proposed to purchase a ready made system and use it on London's computer. This would:-

(a) facilitate site production control

(b) solve the interface problem with London.

December 1979: A - 'We are still waiting for approval - money; nothing has happened yet; but we haven't left it completely; we're trying to put in one or two innovations as we go along - like route cards - something that we need now which won't be useless or upset us no matter what we take in the future.

Description

Basically the route card removes control of work schedules from the individual section foremen to production control management (a relatively new post). It is mainly concerned with surgical instrument manufacturing. Batches of work move around the shop floor from section to section. Previously foremen received a total annual schedule and could pick and choose at will the work they wanted to do. This was resulting in a lack of order and sequence of work. Bottlenecks occurred in production, orders were not being met and management had no knowledge of what was being done at any one particular time. There was increasing pressure on top management from London as their enquiries about orders became more specific through use of a computer.

The route card was designed so that:-

(i) foremen no longer had to requisition materials

(ii) foremen no longer had to chase work batches around the shop floor

(iii) at any one time management could find out what work was in progress and where it was

(iv) reasons for delays should become apparent

(v) where delays were happening should become apparent

(vi) management could sequence work according to their production schedule

(vii) a smoother work flow and greater efficiency were promoted.

Process of Implementation

(i) A formulated the card

(ii) Proposed experiment to GM, WS, IE and PC

(iii) Explanatory meeting with A, WS, PC and one foreman showing completed route card.

(iv) Pilot experiment for one month in one section (January 1980)

(v) General meetings with foremen to inform them about route cards (4 February 1980)

(vi) General implementation (5 February 1980)

(vii) Feedback meeting of foremen (29 February 1980).

3.2 Pressures to Innovate

(i) Outside

- The main pressure seemed to be from London who were requiring more specific and instant information about work in progress and product costing. Their requests for information highlighted the inefficiendes of the present methods of product costing and production control within the company.
- Øressure was being put on individuals to come up with instant knowledge.
- Inadequacies in the present system were holding up future growth plans; it was felt that to become, or remain, a progressive 'successful' company, a more detailed system, able to respond to changes and providing up-to-date information was vital.

(ii) Inside

- The main pressure seemed to be the occurrence of bottlenecks in the manufacturing process.
- There was a need for a proper order and sequence of work as a means of identifying priority work and also identifying batches 'on the floor'.
- Due to personalities involved it was also importanb to implement one system for all so that it was not seen as a 'blaming' or 'picking-on' exercise.
- The pressure was also to instigate something which would be useful as a pemmanent measure and not as a stop-gap measure.

The ultimate aim is to bring in some kind of computerised production control: the introduction of route cards was seen as a first step in dealing with these pressures to innovate but also a step which was useful in its own right.

3.3 Pressures caused by Innovation of route cards

- A was very aware of the effect the introduction of route cards might have on the foremen and went to great lengths to try and forestall any resistance. 'I tried to impress on them that none of this was taking away the real skill of their job which is dealing with their men, allocating to them the job, knowing what man can do what job and so on. I think it will come if it's done properly - only if you just swept in next week and started throwing these around I think they'd resist it.'

- However there was still some feeling from foremen that they would have liked to have been involved in the design of the card - to be able to contribute ideas etc. Also some thought it should have been introduced to all sections at the same time:-

  'Introducing route cards to one section without informing other sections what was being done, was wrong. Bad communication'.

- Some continued to see no practical use for route cards:

  'not necessary for this section, our own method is the best.'

  'only interested in increasing production, I cannot see how the route cards will improve production.'

  Conversely, and perhaps this points to a greater involvement of people to ensure acceptance:-

  'By using our section as a test, I could see I would benefit by it.'

  (As an aside, SPI was chosen as the section for the pilot run. This seemed an inappropriate choice in one way, although there were other good reasons for choosing it. Problems were foreseen in the wheel section because of work piling up: the route card was an attempt to rectify this: yet this problem was by-passed in the pilot run because the wheel section did not delay SPI work anyway - it was other section's work, e.g. bows that tended to be left.)

So far success seems to have been measured in terms of keeping batch cards with the batch tins. It remains to be seen whether the system is continued and whether productivity or efficiency in meeting orders is raised.

4. Looking Ahead

The introduction of route cards was always seen as an interim step. Full computerised production control was always an ultimate aim. As this has become increasingly probable in the last couple of months, it might be right to try and anticipate some of the pressures that are likely to come with it.

4.1 Anticipated Pressures

(i) Pressure from outside concerning amount of capital and resources involved.

(ii) Resistance from inside the company because of perceived threat to their own jobs, fear of change, loss of control over aspects of their jobs, being 'watched'.

(iii) Pressures through lack of recognition of any personal benefit from implementing the innovation.

(iv) Resentment at the amount of work involved with no perception of any recognition or reward for that work.

(v) Confusion over new responsibilities and demarcation of areas of work.

(vi) Pressures from lack of involvement creating a 'them and us' situation.

4.2 Suggested Guidelines for handling Innovation

(i) Arrange for the innovation plan to be sponsored by a board member who will be seen to have influence and enthusiasm.

(ii) Tell employees of the plan so that they will know likely time-scale, probable risks and any radical changes that might follow.

(iii) Set up recognised lines of communication to employees and board.

(iv) Be aware of the need to graft the innovative group on to the existing organisation through effective communication and initiating procedures which clarify the manner in which responsibilities are shared among, or passed to, appropriate departments.

(v) Set up a steering committee for policy and a more grass-roots implementation committee.

(vi) Evaluate staff abilities and continue to make use of their full potential: Provide opportunities for continual growth - specialist function? training?

(vii) Encourage enthusiasm in a learning situation: allow those involved to benefit from their participation: foster feedback of perception and information.

5. Research Role

In continuing to look at innovation situations I would like to co-operate with others as co-researchers. This would mean exploring ideas and suggestions with them and gaining feedback on the usefulness of these ideas when put into practice.

APPENDIX 6

A REVIEW OF THE

INDUSTRIAL ENGINEERING DEPARTMENT

9 May, 1980

A REVIEW OF THE INDUSTRIAL ENGINEERING DEPARTMENT

Introduction

This report has been published to clarify the role of the Industrial Engineering Department and its staff within C.D. (Sheffield) Ltd.

The report covers the existing organisation and structure of the department together with areas of responsibility of departmental staff and proposals for a revised organisation within the Sheffield unit.

Departmental Role

The role of the Industrial Engineering Department is to provide an engineering support service for the Sheffield manufacturing unit so that the unit can maintain its agreed scheduled output levels.

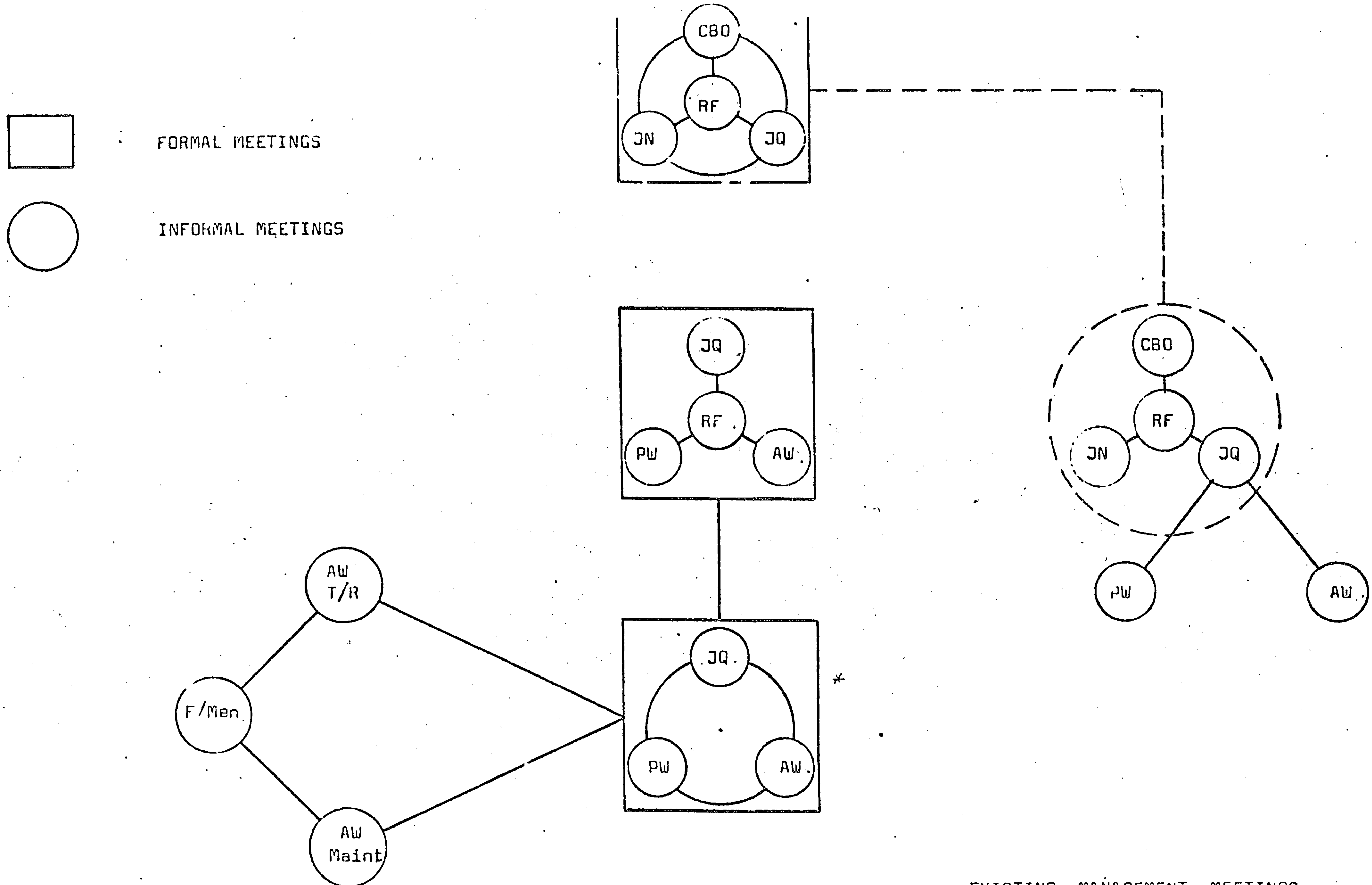
The support service includes the provision of tool room, maintenance and new product development facilities under the supervision of the Works Engineer, a production engineering service involving improvements to existing manufacturing methods supervised by the Production Engineer and a tooling drawing facility supervised by the Industrial Engineer.

The overall industrial engineering function is controlled by the Industrial Engineer.

Existing Organisation

The existing Industrial Engineering Department meeting structure is shown in Figure 1. An examination of the chart reveals that there is the framework for good communications between members within the department and some other employees. However links with other areas of responsibility have the following short comings:-

(i) There is no link between the Plant Accountant, Works Superintendent, their staff and the Industrial Engineering Department other than through occasional 'ad hoc' discussion groups. These discussions usually take place after a specific problem



EXISTING MANAGEMENT MEETINGS

INVOLVING ENGINEERING PERSONNEL

FIG. 1

has occurred.

(ii) There is no link between the formal weekly meeting of the General Manager, Industrial Engineer, Works Engineer, Production Engineer and the Management Committee meeting.

(iii) There is no link between production unit employees, the Works Superintendent and Industrial Engineering staff other than on an individual to individual basis.

The reporting structure of the department is shown in figure 2. Detailed job descriptions indicating areas of responsibility are available.

The organisation of the tool room, maintenance and drawing office are detailed below:-

1. Tool Room

The role of the tool room is to provide jigs, fixtures, press tools and a cutter grinding service for the Sheffield factory to enable the production unit to maintain its agreed scheduled output levels. In addition the tool room provides a tool and cutter grinding service for other production units of the C.D. group.

Supervision of all work carried out in the tool room is the direct responsibility of the Works Engineer including:

(a) The receipt of job requests and estimation of the time required to complete each job.

(b) The allocation of job priorities is referred for approval to the General Manager through the Industrial Engineer.

(c) The allocation of work to individual toolmakers.

(d) The reporting of work in progress, together with estimated completion dates to the Industrial Engineer on a weekly basis.

(e) The co-ordination of the design and development of requested tooling in conjunction with the Toolmaker, Draughtsman, Production Engineer and Foreman as required.

C. D. (SHEFFIELD) LIMITED

INDUSTRIAL ENGINEERING DEPARTMENT – ORGANISATION CHART

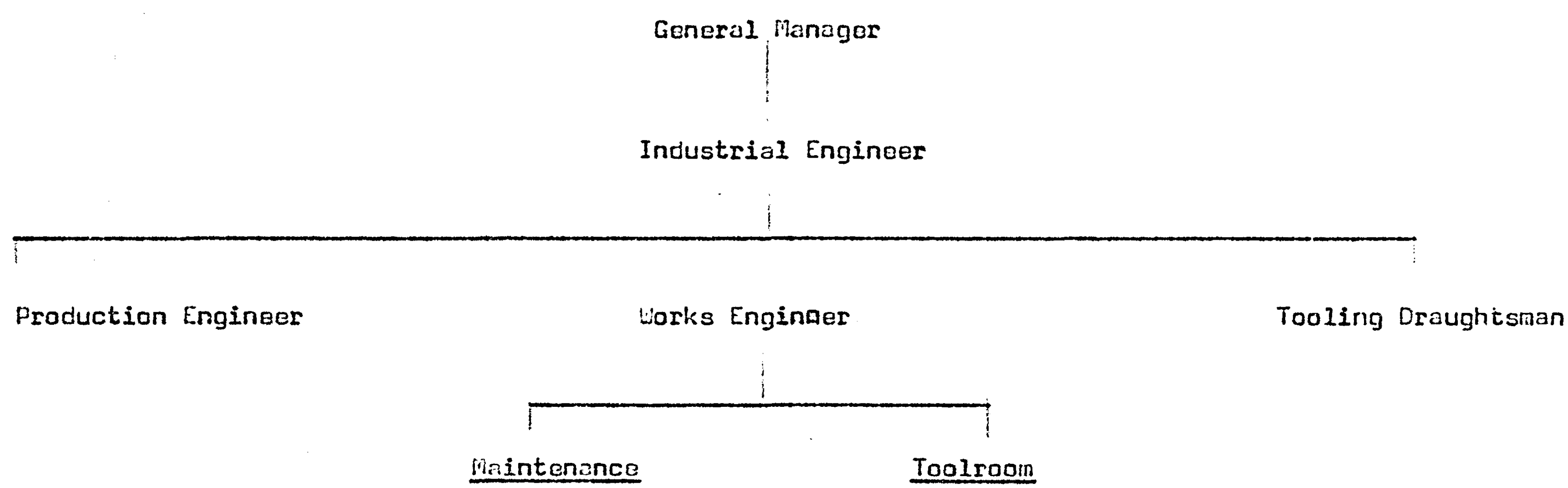


FIG. 2

All work loaded into the tool room must be received in the form detailed in the Industrial Engineering Department Request and Authorisation Prodedure, dated 17 October, 1979.

To meet current tooling requirements the minimum manning levels are two toolmakers, one apprentice toolmaker and one tool and cutter grinder. Any increase in demand above current levels for production tooling will require additional toolmaking capacity, i.e. men, machines and floor area or sub-contract manufacture. A statement of work completed and the forward loading of jobs on the toolroom is detailed in the Industrial Engineering Department period report. In addition a job status and progress report is compiled and updated by the Works Engineer on a weekly basis.

2. Maintenance Department

The role of the maintenance department is to provide maintenance cover for the plant, buildings and services on the Sheffield factory to enable the production unit to maintain its agreed scheduled output levels.

Supervision of all work carried out by the maintenance department is the direct responsibility of the Works Engineer, including:-

(a) The allocation of work to individual maintenance staff.

(b) The report of work in progress with estimated completion dates to the Industrial Engineer on a weekly basis.

(c) The monitoring of orders placed against the repairs and maintenance budget on a period basis.

(d) The formulation and control of a planned maintenance scheme.

(e) The supervision of a sub-contract labour.

All work loaded into the maintenance department must be received in the form detailed in the Industrial Engineering Request and Authorisation Prodedure, dated 17 October, 1979.

3. Drawing Office

The role of the Drawing Office is to provide, for the Industrial Engineering Department, a formal record of the design and development of production tooling for use in the Sheffield factory.

Additionally there is a link, through the Group Technical Services Office, with the Orthopaedic Product Draughtsman based in Sheffield.

Supervision and allocation of work for the Tooling Draughtsman is the direct responsibility of the Industrial Engineer including:

(a) The receipt of job requests and estimation of the time required to complete each job.

(b) The allocation of job priorities.

(c) The reporting of work in progress and completed together with the forward loading in the Industrial Engineering Period report.

The tooling draughtsman will keep a record of job requests received together with project starting and completion dates. A weekly job status and progress report is compiled by the draughtsman for the Industrial Engineer on a weekly basis.

4. Production Engineering

The role of the production engineering function is to employ production engineering techniques to improve machining processes so that the Sheffield production unit can achieve the agreed scheduled output levels.

Supervision of the work of the Production Engineer is the direct responsibility of the Industrial Engineer.

Conclusion

There is a need to reduce the number of formal meetings and to integrate the method of collating information for formal meetings together with the creation of strong links with the production unit organisation. Details of possible improvements are dealt with in the following section.

PROPOSED ORGANISATION

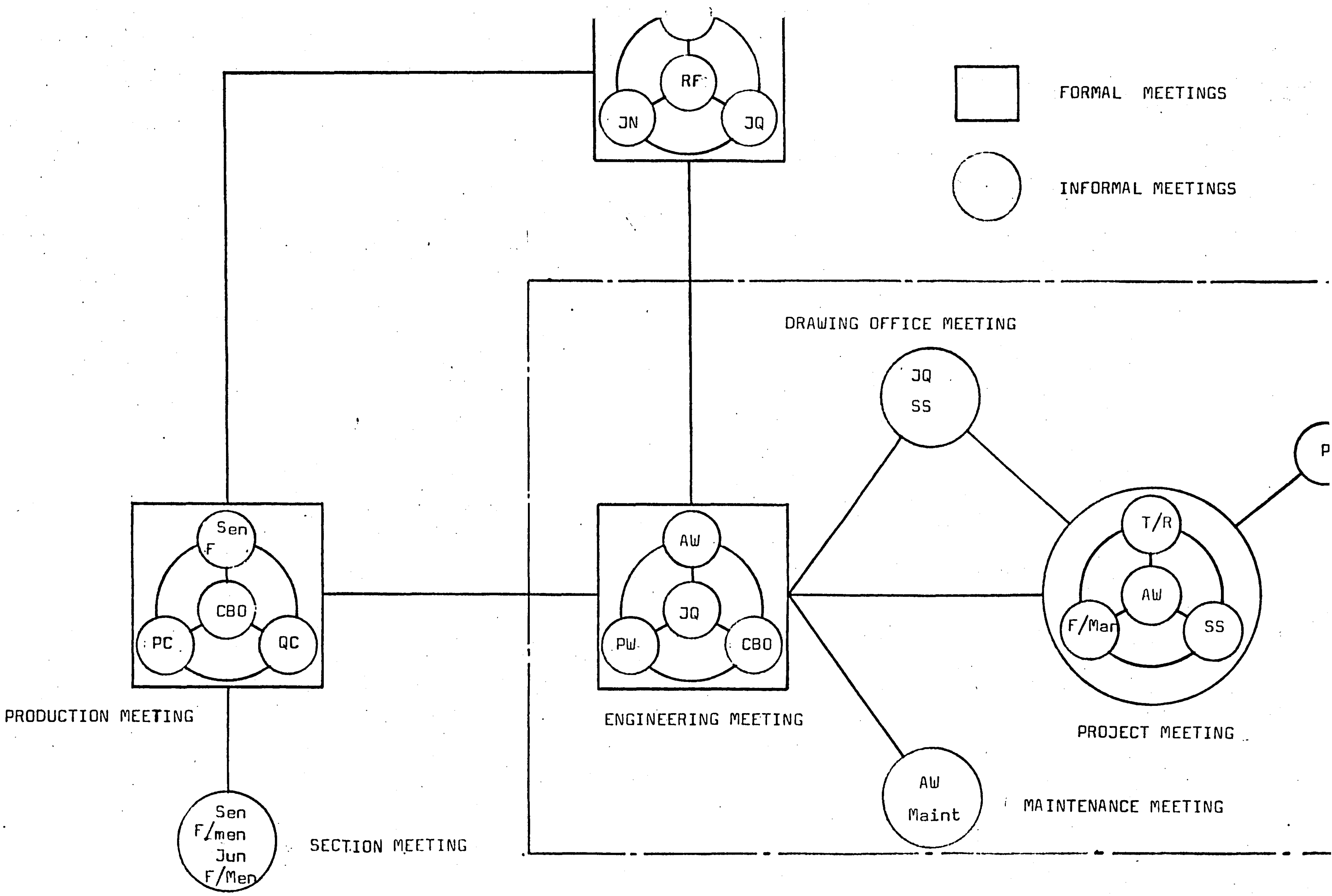
The proposed Industrial Engineering Department meeting structure together with suggested relevant meeting structures are shown in figure 3. The function of eabh meeting is as follows:-

(i) Maintenance Meeting - carried out as an on-going informal dialogue between the Works Engineer and the maintenance department staff to discover problem areas and to establish job priorities. Information obtained from this source is presented by the Works Engineer to the Engineering Meeting for discussion.

(ii) Project Meeting - carried out on an informal basis between the Works Engineer, toolroom, production foreman concerned and the tooling draughtsman to ensure that toolingsis produced to the optimum design for the task required. The basis for discussion will be detailed on job requests received for tooling. When job requests are originated by the Production Engineer his presence will also be required at these meetings. Information from this source is presented by the Works Engineer to the Engineering Meeting for discussion.

(iii) Drawing Office Meeting - carried out on an informal basis between the Industrial Engineer and the Tooling Draughtsman to formulate a drawing office programme. Information from this source is presented by the Industrial Engineer to the Engineering Meeting.

(iv) Section Meeting - carried out on an informal basis between Senior and Junior Foremen to identify problem areas. Information from this source is presented by the Senior Foreman to the Production Meeting.



PROPOSED MANAGEMENT MEETINGS

INVOLVING ENGINEERING PERSONNEL

FIG. 3

(v) Production Meeting - carried out on a formal basis with the Works Superintendent as chairman and attended by the Senior Foremen, Quality Controller and Production Controller to discuss problem areas. Information from this source is presented by the Works Superintendent to the Engineering and senior Management Meetings.

N.B. Meeting (iv) and (v) are only a suggested framework by which production can accurately relate its specific problems to the Industrial Engineering Department for action.

(vi) Engineering Meeting - carried out on a formal basis with the Industrial Engineer as chairman and attended by the Works Superintendent, Works Engineer and Production Engineer to discuss problem areas and formulate an Industrial Engineering Department work programme. Information from this source is presented by the Industrial Engineer to the Senior Management Meeting.

(vii) Senior Management Meeting - remain in its present form.

Recommendation

The correct implementation of the above proposals will enable a more formal interchange of ideas and information whilst keeping the number of meetings to an absolute minimum. It will also enable production foremen to have a closer involvement with the Industrial Engineering Department developing an atmosphere of mutual co-operation rather than mistrust. Implementation of the proposals can only take place when the format of the suggested Production and Section meetings has been formulated by the Works Superintendent.

APPENDIX 7

A REVIEW OF ORTHOPAEDIC MACHINE SHOP PROCEDURE

No. 1 The Production of Hip Nails

Introduction

Following receipt of the "Cuban" order, which included a high proportion of Smith-Petersen nails, it was decided that this would be an ideal opportunity to review machine shop procedures concerning all hip nails, with an ultimate aimoof increasing the quality of the machined component, to such an extent that hand finishing (glazing and polishing) was minimised or phased out completely thus achieving a reduction in works costs per item.

The main area of consideration was the milling of the fins, which fall into two categories:

1. The fin that runs out at the blunt end of the nail.
2. The fin that reaches a 'dead end' at the blunt end of the nail.

These two types are machined in two entirely different ways:-

This first report deals with nails with 'run out' fins, e.g. Smith-Petersen, McKee, Northampton. Before the review of methods, these were manufactured using the following method:-

FORMER METHOD

The machine used was the Csepel horizontal milling machine using a gang of three form cutters. The work holding fixture consisted of three semi-circular section grooves, in which the components were clamped by means of a toggle tightened by a nut and spanner. The operation sequence was as follows:-

1. Load one component in groove 1, machine one face of nail to $\frac{3}{4}$ full depth, return table to start position, raise table to allow cutters

to cut full depth and machine one face of nail to full depth return table to start position un-clamp component.

2. Remove component from groove 1 rotate through 60 degrees and insert into groove 2 (Locating on angled key in groove).

3. Insert blank nail in groove 1.

4. Repeat 1.

5. Remove nail from groove 2 rotate through 60 degrees and insert in groove 3.

6. Repeat 2.

7. Repeat 3.

8. Repeat 1.

9. Remove nail from groove 3 nail complete.

10. Repeat 5.

11. Repeat 2.

12. Repeat 3.

13. Repeat 1.

14. Repeat 9.

Table feed 0.64" per min.
Cutter speed 75 R.P.M.

All this action was producing nails of poor surface finish and inaccurate fin thickness at a rate of 200/week, each nail needed the following subsequent treatment:-

1. 12 mins. each glazing. 200/Week.
2. 6 mins. each polishing. 400/week.
3. 10 mins. load of 10 Poligrat. 2400/week.

With the output of the two other operations involved, Blanking and Cannular drilling standing at 1200 and 200 per week respectively, it can be seen the maximum output was 200 items per week when running at a through flow rate.

PRESENT METHOD

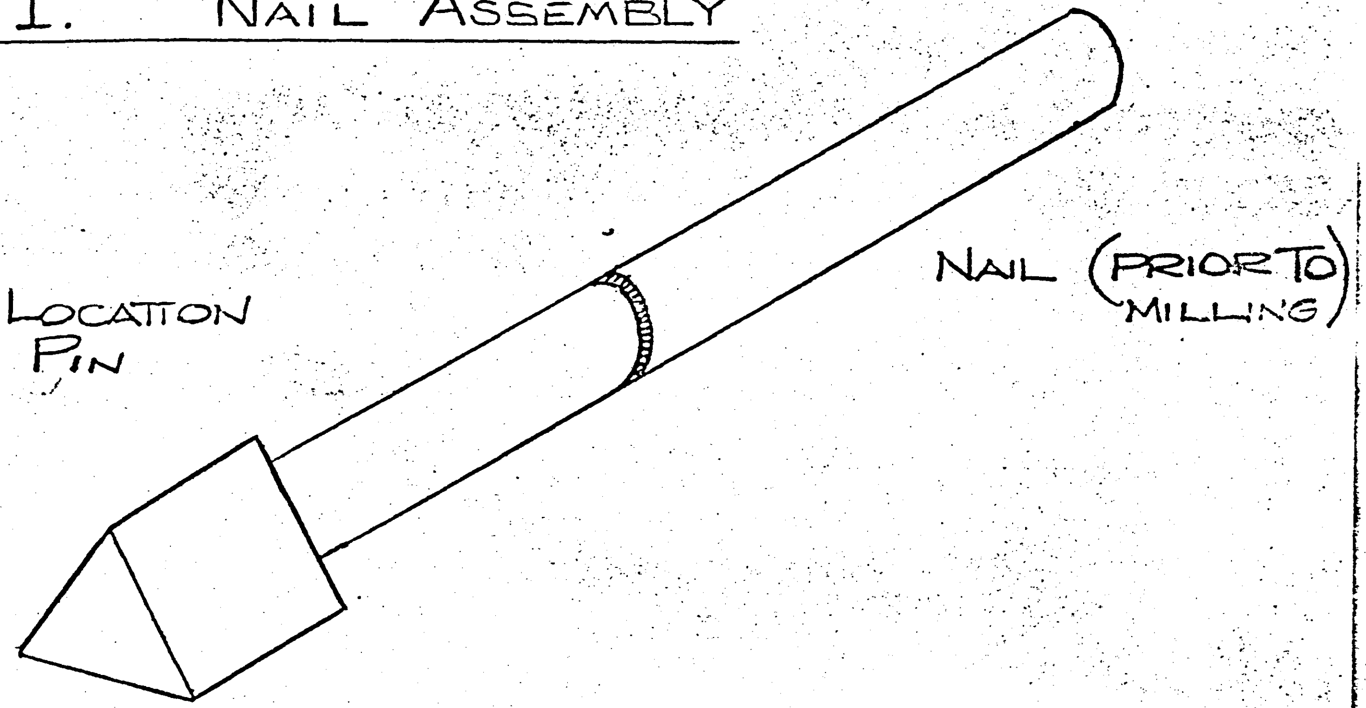
With the purchase of a new Cannular drilling machine drilling capacity is going to be increased to at least 400 per week. This would leave "bottlenecks" at milling and glazing and therefore the new method of milling had to take care of both these areas. The successful method chosen included a re-design of the existing fixture. Indexing was improved by incorporating a dovetail slide arrangement at the rear of the fixture. The component was located by being screwed on to one end of a $\frac{1}{2}$" diameter pin, Fig. 1. At the opposite end of the pin was fixed a triangular block, which located in the dovetail slide. The opposite end of the nail located the Cannular hole on a tapered pin. Clamping was effected by 3 hydraulic rams, 1 behind each triangular block pushing the nail on to the tapered pin and 2 Clamping a bar downwards across the three $\frac{1}{2}$" Pins (see diagram 2). This resulted in far more work support than had been experienced before, which allowed cut depth and feed to be increased accordingly and resulted in an improved surface finish.

The operation sequence was as follows:-

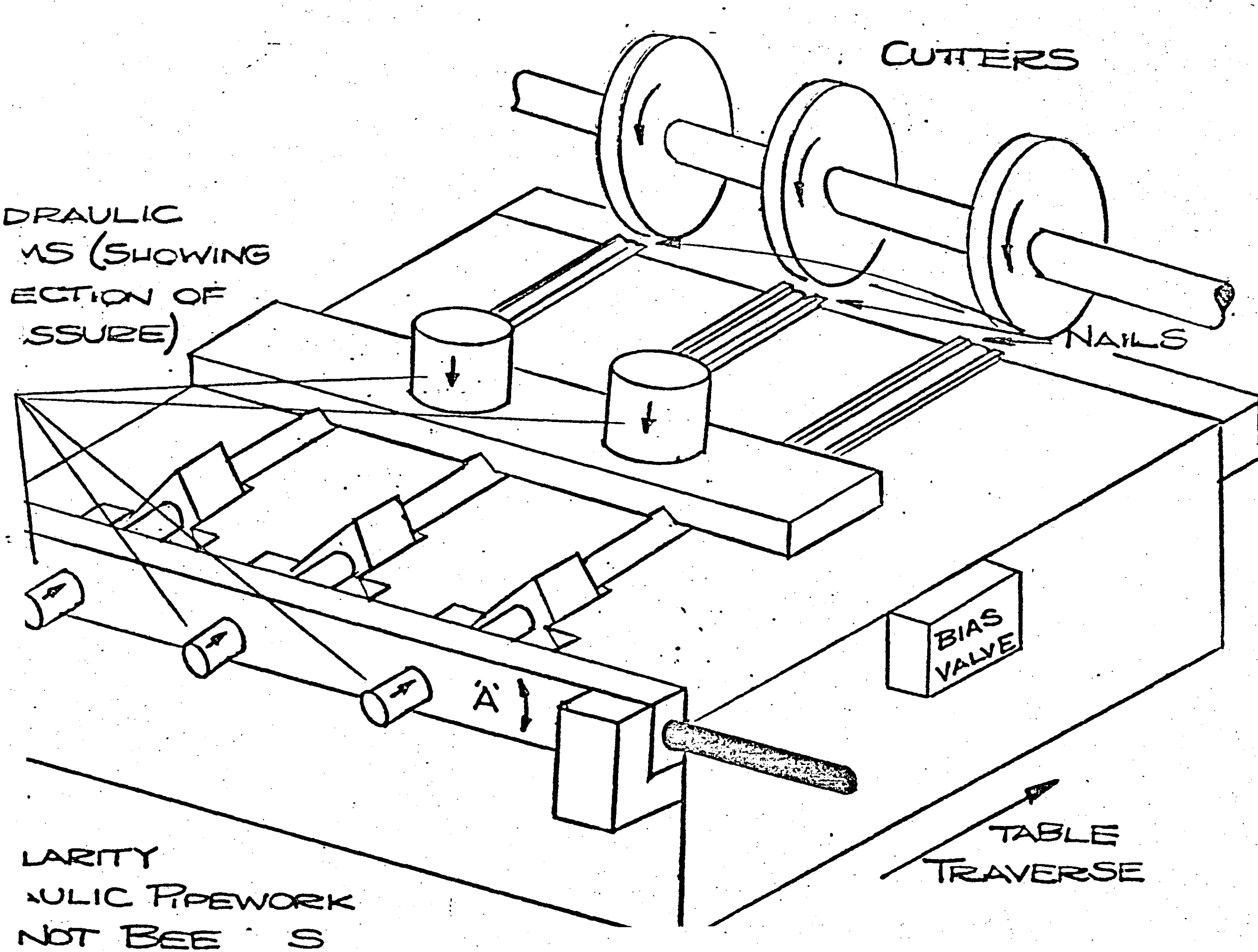
1. Assemble three nails on to three location pins.
2. Load three assemblies into fixture, lower bar "A" (Fig. 2) and clamp.
3. Machine three nails.
4. Unclamp, lift bar "A" and Index three nail assemblies, lower bar "A" and Clamp.
5. Repeat 3.
6. Repeat 4.
7. Repeat 3 and 1.
8. Unclamp, lift bar "A" remove three finished nail assemblies.
9. Repeat 2.

Table feed 1" per min.
Cutter speed 75 R.P.M.

FIG. 1. NAIL ASSEMBLY



IG. 2. MILLING FIXTURE



The provision of a bias valve in the hydraulic circuit ensured that the three rams at the rear clamped before the two on top.

SUMMARY

It can be seen from the attached Labour Cost Calculation Sheets that the savings were gained entirely from milling and glazing/polishing. Milling was speeded up by removing the need for two passes across the work and also by increasing feed rate, e.g. 3¾ minutes/item, new method, 12 minutes/item old method.

By improving surface finish and also by increasing the accuracy of fin thickness, glazing was speeded up as follows: 5 minutes/item new method, 12 minutes/item old method. Plus a further 6 minutes polishing, which was not necessary with the new method.

CONCLUSION

Although significant improvements have been made, it may still be possible to increase output further by reducing or removing loading time, i.e. we are looking at the possibility of incorporating two fixtures on one milling table, thus allowing loading of one fixture while the other is being used. The projected saving from this exercise would be 3p. per nail.

In addition to this if we decide to adopt the "dooley point" the savings gained in increased productivity would yield a further 16p. per nail. This would reduce the works cost to £2.87 per nail.

When this idea has been fully explored it is our intention to carry out a similar exercise with reference to McKee, Watson-Jones and Tulloch-Brown nails and Jewett and Barnes nail plates.

Production Engineer.
21.3.80.

SAVINGS ACHIEVED ON THE CUBAN ORDER FOR SMITH-PETERSEN NAILS

A Direct Comparison of the costs involved

Old Method

Average Labour Cost per item	£5.26	
Material cost	.25	
Total Works Cost	£5.51	per item

Total Works Cost for the order 2600 items

2600 x £5.51 =

£14,326.00

New Method

Average Labour Cost per item	£2.81	
Material cost	.25	
Total Works Cost	£3.06	per item

Total Works Cost for the order 2600 items

2600 x £3.31 =

£7,956.00

Saving by adopting new method

£6,370.00

25.3.80

SMITH-PETERSEN NAILS

(OLD METHOD)

BATCH: 100

Labour Cost Calculations

ref. no.	operation	SM each	SM batch	setup SM	total SM	total S Hrs	labour rate	labour cost
5	Knurl & Part Off	2.00	200	240	440	7.33	4.69	34.39
10	Face one end & centre both ends	1.20	120	30	150	2.5	3.86	9.65
15	Drill & Tap	2.40	240	30	270	4.5	3.86	17.37
20	Cannular Drill	8.0	800	10	810	13.5	3.86	52.11
25	Tri Fin Mill	12.0	1200	30	1230	20.5	6.62	135.71
30	Mill Point	3.0	300	15	315	5.25	6.62	34.75
35	Glaze & Polish	18	1800	-	1800	30	7.06	212
40	Poligrat	1.0	100	-	100	1.6	7.06	11.7
45	Mark	0.4	40	10	50	.83	7.06	5.88
50	De-grease & Passivate	0.2	20	-	20	.33	7.06	2.35
55	Final Inspect	0.5	50	-	50	.83	7.06	5.88
60	Pack	0.5	50	-	50	.83	5.00	4.15
	TOTAL LABOUR COST £525.94							
	MATERIAL: ½" Ø £2.23/Kg							
	= £0.25/Component							
	WORKS COST PER COMBONENT £5.51							

SMITH-PETERSEN NAILS

(NEW METHOD)

BATCH: 100

Labour Cost Calculations

ref. no.	operation	SM each	SM batch	setup SM	total SM	total S Hrs	labour rate	labour cost
5	Knurl & Part Off	2.0	200	240	440	7.33	4.69	34.34
10	Face One End & Centre Both Ends	1.2	120	30	150	2.5	3.86	9.65
15	Drill & Tap	2.4	240	30	270	4.5	3.86	17.37
20	Cannular Drill	8.0	800	10	810	13.5	3.86	52.11
25	Tri Fin Mill	3.75	375	30	405	6.75	6.62	44.68
30	Mill Point	3.00	300	15	315	5.25	6.62	34.75
35	Glaze	5.00	500	-	500	8.33	7.06	58.8
40	Poligrat	1.00	100	-	100	1.6	8.06	11.7
45	Mark	0.4	40	10	50	.83	7.06	5.88
50	De-grease & Passivate	0.2	20	-	20	.33	7.06	2.35
55	Final Inspect	0.5	50	-	50	.83	7.06	5.88
60	Pack	0.5	50	-	50	.83	5.0	4.15
	TOTAL LABOUR COST £281.71							
	MATERIAL: ½" Ø £2.23/Kg							
	= £0.25/Component							
	WORKS COST PER COMPONENT £3.06							

APPENDIX 8

A Summary of the Skills & Characteristics of the Integrator

This research has uncovered a number of skills of integration which would be important to recognise in the training of personnel as integrators or innovation consultants. They can be grouped under three main headings:-

(i) neutrality and credibility

(ii) diagnostic and interpretative skills

(iii) high 'people orientation' process skills.

(i) neutrality & credibility

This area includes such things as:-

- an intimate knowledge of the organisation and people - contextual knowledge
- mobility and access to all parts of the organisation
- continuing work at remaining trustworthy and credible
- a willingness to look at issues perceived as relevant and important by individuals and group members
- an ability to see the total process and where different contributions fit in - skills of inclusion
- tangible results to increase credibility and provide incentives for others to operate in a similar manner
- having a 'stateless' position unidentifiable with any one particular set of people

(ii) diagnostic & interpretative skills

these would include:-

- skills in analysis, summary and presentation
- being in touch with a large repertoire of appropriate strategies
- skills in diagnosing integration needs

- ability to perceive 'in depth' and deal with root problems rather than symptoms
- an understanding of innovation implementation as a human process of adjustment and compromise
- communication skills of listening and feedback
- interviewing skills
- ability to translate meanings into an acceptable appropriate vocabulary
- creating on-going links between outside developments and inside needs, linking theory and practice
- ability to distill learning and present it with concrete examples of the 'here and now' type
- skills in 'abstracting' ideas, making new idea associations

<u>(iii) high 'people orientation' process skills</u>

- a concern for task and process as equal partners
- acting as the 'human' promoter in the task of implementation
- skills in interaction; 'group' skills
- ability to foster learning about communication processes and 'social interaction'
- ability to heighten others' awareness of process issues and enable them to use the same skills
- non-threatening behaviour - non judgemental
- ability to communicate at all levels, particularly with power promoters

<u>Ideal qualities in an integrator would include:-</u>

(i) creative behaviour: an ability to be aware of all your resources (both internal and external) and be able to bring them to bear on the innovation situation

(ii) perceptual openness: - a receptivity to ideas - an acceptance of feelings, sensation, hunches

(iii) risk-taking behaviour - ability to learn

(iv) ability to influence - take the initiative - promote others' learning

(v) ability to include, develop, foster relationships

(vi) ability to withdraw effectively

In listing these attributes they seem to bear all the marks of a process consultant. The main difference is one of emphasis, in that the integrator is just as concerned with the task of innovation implementation. She is using her process skills to foster integration to facilitate the process of innovation implementation - that is the prime underlying motivation. To remain credible the use of process skills must be seen to have an impact not only on people and relationships per se, but on creating a more effective process. To summarise - integration is a facilitating force in the process of implementing technological innovation but can only be achieved through the use of process type skills with the people involved.

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