ORGANISATIONAL CHANGE, QUALITY AND CYBERNETICS

STEPHEN ALLAN HARWOOD

Doctor of Philosophy

THE UNIVERSITY OF ASTON IN BIRMINGHAM

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Thesis Summary

Cybernetics provides a way of thinking about situations, placing emphasis upon the distinctions we make about situations. It provides a theory for handling these distinctions, a language to support relevant conversations and a framework for effecting change.

Whilst Stafford Beer's Viable System Model (VSM) has become familiar as a management tool, difficulties have surfaced regarding both its appreciation and use. From Raul Espejo's efforts to clarify the language describing the VSM and develop an insight into the processes underpinning the situations in which the VSM can be used, has emerged his Cybernetic Methodology. It provides a coherent framework embedded in a rigorous logic for dealing with the complexity of "problematical situations".

This thesis focuses upon the use of the Cybernetic Methodology in the context of the company, addressing the specific issue of effecting organisational change from the perspective of quality. Insights are provided into the concept of the organisation and approaches for effecting organisational change, drawing upon both the quality domain (The Shewhart cycle, Continuous Improvement Programmes) and the systems domain (The Soft Systems Methodology). The concepts underpinning Cybernetics, in particular the VSM and the Cybernetic Methodology, are reviewed then used:

- to examine the complexity inherent in the situation of examining the activities of a manufacturing site to effect quality orientated improvements from the perspective of a researcher (observer) as a member of a multi-disciplinary research project,
- to examine four different approaches to effect organisational change within a company from the perspective of a "change agent" (participant).

In the light of the emerging insights, a reply is provided to criticisms directed against Cybernetics, the contribution and utility of the Cybernetic Methodology is upheld and areas for further research identified. This thesis concludes that the Cybernetic Methodology offers a powerful means for dealing with complex problematical situations.

KEY WORDS: Cybernetic Methodology, Information Management, Problem Solving, Total Quality Management, Viable System Model.

Dedication

To Sue and Catherine

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CHAPTER 1
INTRODUCTION

This dissertation is concerned with the use of Cybernetic concepts, in particular the Cybernetic Methodology, as an aid for bringing about change within organisations. However, since change is an on-going and pervasive feature of organisations, attention will focus upon one specific aspect of change, that concerning the issue of quality within the context of the particular type of organisation which we name the company. The concern lies, not with the truth and objectivity of a particular doctrine, but with the establishing of a coherent and consistent way of thinking and doing (Espejo & Harnden, 1989).

Within the company, quality is commonly viewed as an issue which offers the potential for improving business performance, whether in terms of reduced costs or improved sales revenue. Despite the ambiguity attached to the meaning of the word quality, its general use appears to be in a manner which emphasises a distinction: a distinction between what is quality and what is not. This distinction tends to be based upon what is viewed as acceptable or not acceptable. When used in the context of a company the issue concerns the acceptability of the outcome(s) of the company's activities, e.g. the goods or services provided. Unacceptable outcomes and the attendant resources and effort giving rise to these outcomes tend to be viewed by management in terms of waste, e.g. defective goods, refuse, unproductive time. By reducing waste it is anticipated that costs can be reduced. By improving the acceptability of outcomes from the perspective of the existing and potential customers for these outcomes, it is anticipated that customer demand can be increased this leading to increased sales revenue.

A variety of issues are raised in the previous paragraph. The concept of the company is introduced, composed of people who are engaged in purposeful activities which are orientated towards supplying other people (customers) with a product or service. Each person has their own view of the world. Consequently, they each have their own views regarding what is acceptable from a quality perspective. In an attempt to reduce the variability between these views and thereby in the outcome of activities, and hence reduce the likelihood of unacceptable quality, quality may be defined in some way, e.g. an agreement, a benchmark or a specification. A customer orientated approach suggests that those features which the customer finds acceptable should be translated into a product and service

specification, which in turn is used to guide actions which permit the product or service to be made available to the customer. This specification can be extended to describe not only the features of the product or service but also the actions themselves, e.g. ISO9000. However, what defines acceptability or quality is continuously evolving as a consequence of the on-going interactions among those within the company, its customers, suppliers and competitors and also more generally the public. What arises is on-going change with regard to both who defines and what is defined as acceptable outcomes and also the activities producing these acceptable outcomes. To support both the production of acceptable outcomes and this change, practitioners have identified a particular organisational ethos (e.g. Total Quality), this placing emphasis upon the role of the individual. To support the performance of the individual, high profile improvement programmes (e.g. Continuous Improvement) are pursued within explicitly recognised organisational frameworks (e.g. Quality Systems, Quality Circles). Further, since a company attempts to maintain viability through its interactions in the market-place, customer-supplier relations form part of this unfolding vision of the "quality oriented" company. What the company experiences in its efforts to pursue quality is complexity, the complexity associated with its interactions within itself and those both necessary and occurring within the market-place.

A language has emerged which can help our understanding of this complexity and support our interventions in company related situations. This language is used to articulate a paradigm - Cybernetics - (Ashby, 1963). Cybernetics provides a set of coherent ideas which enhance the examination and discussion of the complexity of complex situations. A complex situation can be recognised when there is more than one viewpoint involved in the situation. Since people have a tendency to be organised into groups or organisations to achieve specific outcomes (e.g. teams, armies, schools), the organisation represents one specific manifestation of a complex situation (a social grouping may be viewed as another manifestation, e.g. the family). These ideas have been used to derive a model of the organisation - the Viable System Model (Beer, 1979, 1981, 1985) - permitting useful insights to be gained into organisational complexity. However, criticisms of this model have included concern over the difficulties associated with its use (e.g. Checkland, 1986; Flood & Jackson, 1988; Jackson, 1989). This has given rise to the development of the VSM method (Espejo, 1989), which supports the generation of insights or appreciations of the organisation. Nevertheless, complex situations are characterised, not only by individual appreciations of the situation, but by the nature of individual interventions in the situation, the arising interactions and the occurring change or transformation in the situation. This has led to the development of the

Cybernetic Methodology (Espejo, 1986, 1988a, 1991, 1992) to support more effective interventions in complex situations. It is the application of the Cybernetic Methodology to support those specific interventions directed towards bring about a quality orientated organisation that forms the main issue of this dissertation.

This dissertation consists of seven chapters. Chapter one provides an introduction to my thesis establishing the intent. The second chapter sets the scene by presenting preliminary insights into a variety of issues pertaining to organisational change and the pursuit of quality. Chapter three presents a brief outline of the main issues underpinning the theory and use of Cybernetics.

Chapter four presents the first of two case-studies. This places emphasis upon the use of the Cybernetic Methodology as an aid for *studying* the issues of organisational change and the pursuit of quality from the viewpoint of an observer. It examines a research project, making the distinction between the context and the content of the research. This distinction reveals the illusion which the researcher can utilise when studying an organisation, that of an observing system observing an observed system. This permits the researcher to distinguish the roles of an observer of a situation observing a participant in a situation. One feature of these situations are the models which are developed and used. These models play a part in the interplay between what are constituted as the observing system and the observed system.

Chapter five presents the second case-study this placing emphasis upon the process of *bringing about* organisational change and the pursuit of quality from the viewpoint of a participant. It examines the efforts of a small manufacturing / engineering company to improve the way things were done within the company. Although the managing director recognised that there was tremendous scope for improvements, the question arose of what issues should be attended and how. Four approaches were attempted over a sixteen month period with varying levels of achievement. These approaches are examined using the Cybernetic Methodology to develop insights into their strengths and limitations. The Cybernetic Methodology is presented as an aid for managing change, raising issues pertaining to quality, organisational change and providing insights into the role of the "change agent".

Chapter six reviews the findings of this thesis, discussing the strengths and weaknesses of the research and raising questions for the future. Chapter seven concludes this thesis, summarising the outcome.

CHAPTER 2
BACKGROUND

Man's desire to find a better way of doing things can be recognised throughout history, this manifesting in the development of tools and techniques and the organisation of people, not always willingly. This desire has led to the development of machines of increasing sophistication and the realisation of the benefits of economies of scale. Central to these has been the ambition of achieving results, often profit. However, the gains to be made through mechanisation have conflicted with fears regarding their negative effects, e.g. Hargreaves' spinning jenny and Arkwright's spinning frame (mid 1700's). The gains to be made through exploiting the individual, whether in fields, factories and mines, have conflicted with the recognition that the individual has rights and skills. Social concerns have often been viewed as distant from business concerns. These conflicts and concerns have manifested in many forms, particularly within the domain of business. Nevertheless, numerous experiments have been attempted directed towards improving the effectiveness of the business by balancing business requirements with the adoption of machinery and a regard for the individual, against the backdrop of the laws and attitudes of that time.

In the early 1800's, Robert Owen's model factory at New Lanark indicated what could be achieved by looking after employees. The entrepreneurial Quakers transferred their beliefs regarding the individual into their business practices, best exemplified with the Cadbury's site at Bournville in the late 1800's. A more analytical approach to the workplace was adopted in the late 1800's by both Frederick Winslow Taylor and Henri Fayol. They focused their attentions upon the analysis and distribution of activities. Whilst Taylor (1947) was concerned primarily with shop-floor activities, Fayol (1949) addressed management activities. In the early 1900's, DuPont used organisational structure and financial techniques as a means to establish and maintain control over its many diverse activities (Chandler, 1962). Viewed as innovations in their time and meeting corresponding criticism (e.g. Cadbury, 1914), they provided a benchmark for what could be achieved. What emerges is an indication of two strands of thought, the first placing emphasis upon the individual, whilst the second places emphasis upon the task.

2.1 Today's organisation

Although theories have evolved to address these two issues, the question arises regarding how practices have changed since that time. Developments in the analysis of tasks have supported the design and mechanisation of the workplace. However, the issue of how to organise and manage people appears to be as much an issue today as in Robert Owen's time. The significant difference appears to concern factors external to the company, both in the marketplace and in the world at large.

Technological developments have enabled more sophisticated products and processes. They have also contributed to increased accessibility to other parts of the world. A better understanding of the world has supported a greater appreciation of the limited availability of resources, the limited potential size of markets and ecological / environmental considerations. This is exacerbated by increased and more aggressive competition on a global scale (in particular, reduced response time flexibility), the massive cost of R&D programmes and the global interlocking of economies. The need for companies to respond has to be translated into an ability to respond so as to maintain competitive advantage .

The challenge facing the company is how it can organise itself in such a manner that it can meet these demands, taking into account the pace of external developments. Attention is focusing, not only upon the individual, but also upon the fit of the individual into a group of people who have distributed amongst them a set of activities which permit the group to exist as a viable entity. The issue facing the company is that of change on an on-going basis and the question of how to live with it.

2.2 Initiatives for organisational change

In 1967, Greiner highlighted an awareness that organisational change was increasing in scale, encompassing more of the organisation. The nature of this change was consequently changing, shifting from what was accepted as an evolutionary process to what was described as a revolutionary process. Fragmented change associated with evolution appeared ineffective. A more revolutionary approach was needed, focusing upon "altering the behaviour and attitudes of their line and staff personnel at all levels of management". He observes "the overarching goal seems to be the same: to get everyone psychologically redirected towards solving the problems and challenges of today's business environment".

Since then, much has been written about the nature of the ideal organisation and how to achieve it (e.g. Peters & Waterman, 1982; Kanter, 1983; Pascale, 1990). Further, a variety of initiatives have emerged.

The most widespread of these is that of the "quality movement". An awareness of quality arose due the need for consistency of produced parts to facilitate their assembly in a mass-production environment, particularly in the armaments industry during the First World War. Concern arose over poor product quality and high levels of waste. Although inspection techniques were developed, including the use of statistical analysis (Shewhart, 1931), inspection was viewed as the responsibility of the Quality Department. During the Second World War, the inspection activity became recognised as a major bottleneck in the production activity (Heyel, 1963). Attention then focused upon the way people did things. It was recognised that "quality is everybody's job" (Feigenbaum, 1961) and led to inspection being handed back to the operator. Further developments included recognition that prevention was more effective than inspection as a means to assure quality. Since the 1960's, programmes have been carried out to enable the transfer from the "traditional" inspection approach to one which supported the continuous improvement of all activities. A "quality ethos" has been recognised, highlighting what is desirable in terms of attitudes and behaviour towards the work-place by all organisational members. The person's role within the work-place is highlighted. The scope of these efforts has been extended to incorporate suppliers, recognising the merits of stable customer-supplier relationships. Harmony is being attempted at national and international levels, by the setting of acceptable standards (e.g. the ISO series of standards). Unfortunately, despite enthusiasm and effort, many barriers exists (e.g. Stimson, 1989) and not all the programmes succeed. Further, standards are criticised for permitting some companies to be "still producing rubbish!" (Steiner P, 1989).

The "IT movement" has highlighted the merits of technology in the work-place, enhancing both communications and control. Amplifying the variety that a person can handle, technology has enhanced control over activities, reducing variation, improving rate and increasing flexibility. It has amplified the person's ability to handle data, placing demands upon specific analytical skills, but enabling more timely responses. More recently, technology advances have enhanced the ability of people to communicate (e.g. electronic conferencing), particularly on an informal un-routine basis (e.g. electronic mail). One issue that has emerged is the integration of these technologies (e.g. Completely Integrated Business Environment, Computer

Integrated Manufacturing). Within the organisation, this has significant implications for the generation and use of information (e.g. distributed information systems - MRPII). It provides a tool to support novel work practices (e.g. tele-commuting), necessary interactions (e.g. electronic fund transfer) and decision-making (e.g. expert systems). The "system" has become a powerful pervasive feature of the organisation. However, when technology is viewed as a panacea for all the company's ailments the outcome tends to be less than satisfactory.

Both quality and technology have made a significant impact upon organisations, at times giving rise to significant upheaval within the organisation. The general outcome tends to be change, though not necessarily in the intended manner nor in a positive direction. This is in addition to change as a normal feature of organisational life. However, whether we describe change as evolutionary or revolutionary is immaterial. The issue is more deep rooted. It concerns what we are trying to change; those practices requiring localised adjustments within the work-place or more widespread changes in practices requiring an underlying and more widespread change in attitude. This affects the time-scale within which we can expect these changes to materialise. Where the emphasis upon change needs to be placed is, not upon changing the activity, but upon the change required of the person - in terms of technical understanding and skills, but also of personal attitude and approach. This becomes significant if there is a shift in the power, status and prospects of individuals (Liker et al. 1987), revealing the political aspects underpinning change. The recognition that there is a psychological element in the work-place has given rise to the concept of an organisational culture.

2.3 Insights into the concept of organisational "culture"

Four definitions of culture are presented in figure 2.1, each presenting a different insight into the nature of a culture. Smircich (1983) presents an observer's view of the concept, establishing in general terms what it is that is being observed. Pettigrew (1979) and Kilmann *et al* (1986) clarify this by identifying specific issues of concern, these highlighting the uniquely humanness of culture. Schein (1984) presents a view that permits us to identify the organisational context in which these issues have meaning and which determines the nature of any learning.

"Culture is the system of such publicly and collectively accepted meanings operating for a given group at a given time... A potentially more fruitful approach is to regard culture as the source of a family of concepts. The offspring's of the concept of culture I have in mind are symbol, language, ideology, belief, ritual, and myth." (Pettigrew, 1979)

"the idea of culture focuses attention on the expressive, non-rational qualities of the experience of the organisation. It legitimates attention to the subjective, interpretive aspects of organisational life." (Smircich, 1983)

"Organisational culture is the pattern of basic assumptions that a given group has invented, discovered or developed in learning to cope with its problems of external adaptation and internal integration, and that have worked well enough to be considered valid, and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to these problems." (Schein, 1984)

"Culture can be defined as the shared philosophies, ideologies, values, assumptions, beliefs, expectations, attitudes, and norms that knit a community together." in other words "the way things are done around here". (Kilmann, RH, Saxton MJ, Serpa R, 1986)

figure 2.1 Definitions of the concept of "culture"

Pertaining to each is the notion of a shared domain in which things happen. Within this domain, meaning is shared to promote the sharing of values and a particular mode of behaviour (e.g. rituals). Meaning is conveyed through the use of a language, which in turn suggests that there are interactions that support the use of language. The language derives its meaning from its context, which is defined by the shared domain identified by these interactions. Further, the context or shared domain is reinforced and developed with developments in the use of the language. This suggests that cultures are constantly developing. Questions that arise include whether these interactions are necessarily formal or informal, whether these interactions constitute an organisation and whether the interactions within an organisation can constitute a culture. Further questions that arise include: how can individuality and self-interest be accommodated within the culture of a group? What constitutes a sub-culture and how is it identified?

Whatever the answers to these questions are, when we use the concept of culture we are making reference to those aspects of an organisation that pertains to the humanness of man. This is distinct from the sterile mechanical view of activities which ignores the human element and which we tend to adopt when we wish to technify them. Values / beliefs underpin judgement, which in turn underpins actions. Views on legal and ethical behaviour contribute to the perceived validity of these judgements and actions. The culture affects how those within the organisation view and interact with others, as well as affects how others view the organisation. This supports Morgan's (1986) view that culture "must be understood as an active,

living phenomenon through which people create and recreate the worlds in which they live", though he recognises that "our understanding of culture is usually much more fragmented and superficial than the reality". Morgan warns us about focusing upon prominent features whilst neglecting the underlying form. If we are to get a feel for the underlying form, we must attend to the nature of the interactions, both formal and informal, these manifesting in what we can recognise as constituting the organisation.

The issue of culture is highlighted in the context of change if we consider the two initiatives of quality and IT (section 2.2). Within the quality initiative the concern is with the way people do things. The emphasis has been upon a transition from one in which quality is the responsibility of the quality function to one in which everyone is responsible for quality. The IT initiative places emphasis upon the technification of activities, this requiring a fit between the activity required and what the technology can do. Nevertheless, whereas the effect of the quality initiative upon the person is apparent, this is not so with the IT initiative and is easily overlooked.

Whilst an inappropriate technology for the required task will lead to "technical" difficulties, an appropriate technology can still lead to difficulties. The impact is likely to extend beyond the boundaries of the technified activity - "the knock-on effects". Whereas the impact may have been considered in terms of anticipated benefits, both tangible (e.g. reduced inventory, scrap and labour, faster response time, lower costs and greater flexibility) and intangible (e.g. greater commitment, improved morale, better communications and control), the question arises whether the impact was considered in terms of compensatory responses. An improvement in efficiency through the use of technology may expose inefficiencies in the other activities. Faster throughput may place pressure on other activities. Labour savings may be counteracted by higher levels of absenteeism and more mistakes.

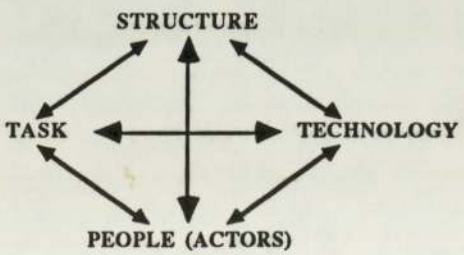


figure 2.2 The variables of an organisation (after Leavitt, 1965)

New management, the introduction of technology, expansion, or simply a basic desire to improve things, all affect "the way things are done around here". This is illustrated with Leavitt's model of the organisation which identifies four prominent interacting variables: change one and the others will be affected (1965). When we effect change, we are affecting the culture of the group. "Since organisation ultimately resides in the heads of the people involved, effective organisational change implies cultural change" (Morgan, 1986). This becomes a more complex issue the greater the number of people involved. The richness of an interaction between two people, manifesting in an appreciation of each other's views and the interlocking of behaviour (Maturana & Varela, 1987), is expanded with more people. An issue that is the focus for change will shape and be shaped by the nature of the interactions, these illuminating the underlying culture of these people. Thus, when a technically sound technology or a "system" continually fails to perform as expected, the easy response is to place blame upon the attitudes of the users; "the culture is wrong".

When the object of change is the culture itself, it is questioned whether the development of the culture can be controlled (Morgan, 1986). It is suggested that the culture is developed by affecting the people. It can be argued that since we can understand only aspects of culture, the best we can do is to influence the emergence of a desired culture. We select actions oriented towards desired outcomes, with the anticipation that the culture develops as we intend. However, Morgan raises the danger of "developing the art of management into a process of ideological control". This raises the question of how we can be effective in how we influence the emergence of a desired culture when engaging in organisational change.

2.4 What are we trying to achieve - the ideal organisation?

Books abound which aim to provide insights into management and organisational behaviour. Many are descriptive "stories" based upon experience, others are rhetorical proclamations based upon observation and "common sense" and a few provide speculative insights based upon "factual" analysis. These are aside from the technical texts that attempt to provide "objective" overviews and detailed explanations of their subject areas. This proliferation is exacerbated by the nature of the subject matter which is dominantly based upon interpretation and by anyone who has exposure it. One theme which is common to many is the idea of how things should be done. The vision of the ideal organisation is not about a particular organisational structure and the existence of various functions. The concern is not

so much with how technology can facilitate the pursuit of goals, nor how tools and techniques can enhance our understanding of what is happening, though these have an important role. Instead, the focus is upon the requirements of the business, the attitudes and behaviour of people and how these people function together to fulfil the corporate intent. Attention is not confined to within the boundaries of the organisation, but now extends to incorporate other organisations in the supply chain. One provocative insight into these developments can be found within the quality literature, this identifying the kind of behaviour and ethos that should be expected within an organisation.

figure 2.3 Deming's 14 points for management (1982)

1. Create constancy of purpose towards improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.
2. Adopt the new philosophy.
3. Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6. Institute training on the job.
7. Institute leadership (see Point 12). The aim of supervision should be to help people and machines and gadgets to do a better job.
8. Drive out fear, so that everyone may work effectively for the company.
9. Break down barriers between departments. People in research, design, sales and production must work as a team, to foresee problems of production and in the use that may be encountered with the product or service.
10. Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force.

11a. Eliminate work standards (quotas) on the factory floor. Substitute leadership.

11b. Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.

12a. Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.

12b. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, *inter alia*, abolishment of the annual or merit rating and of management by objective.

13. Institute a vigorous programme of education and self-improvement.
14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

This insight is provided through the scholarship and experience of W Edwards Deming (1982). He highlights the important role of management with regard to organisational viability and provides a fourteen point theory of management (figure 2.3). These fourteen points, appearing as yet another list, disguise his view of how the business should function as a whole. They indicate the need for long-term direction, thinking and doing with regard to this direction, leadership and self-

management / self-control, whilst highlight the importance of the person and interpersonal interactions. Further, he presents an insight into how we can understand the behaviour of a process, this based upon the pioneering work of Walter A Shewhart during the 1930's on the use of statistics for process control.

2.4.1 "Behaviour"

Deming's central tenet is that a process will behave in a random manner under given constraints. "Faults" that arise are distinguished by Deming as due to either common causes, denoted by random variation in an observed output, or special causes, denoted by a variation for which a pattern can be discerned over time. Control over the cause of special faults is viewed as within the scope of the person "controlling" the process, whether directly or indirectly. Common causes are viewed as outwith the control of the person "controlling" the process, these being "faults of the system" (Deming, 1982). The point Deming makes is that many of the faults that are experienced in an organisation are due to common causes, i.e. "faults of the system" and hence are the responsibility of management.

figure 2.4 Pitfalls in the implementation of SPC programmes
[Owen M (1989)]

1. lack of understanding and commitment among top management
2. lack of a plan
3. SPC is not company-wide
4. lack of long-term commitment
5. inadequate training
6. failure to involve suppliers
7. emphasis upon short-term profits
8. commitment in only one department
9. lack of funds
10. failure to consult the workforce
11. underestimating workforce
12. failure to acquire adequate statistical support
13. lack of market research
14. management by fear
15. lack of middle management support
16. lack of quality materials
17. over-emphasis upon computers
18. moving too quickly
19. lack of projects
20. pilot areas not chosen carefully
21. monitoring products instead of processes
22. over-emphasis upon one technique
23. failure to respond to chart signals
24. failure to understand SPC
25. reluctance to change
26. general lack of knowledge and expertise in SPC
27. lack of concern for detail

figure 2.5 Introducing and implementing SPC

[Shaw P, Dale BG (1990)]

Main difficulties experienced in the introduction of SPC
(in decreasing order of importance)

1. lack of knowledge / experience on SPC
2. lack of action from senior management
3. poor understanding and awareness within the company of the purpose of SPC
4. lack of SPC training for operators
5. a general lack of encouragement
6. lack of SPC training for senior management
7. lack of knowledge of which parameters to measure or control
8. negative reaction of middle management
9. negative reaction of senior management
10. deciding which of the various charting techniques to use
11. negative reaction of operators
12. lack of action from line management
13. lack of action from middle management
14. lack of SPC training for middle management
15. lack of SPC training for line management
16. deciding whether to express data in an attribute or variables format
17. negative reaction of line management
18. poor communication between management and the shopfloor
19. negative reaction of trades union
20. literacy / numeracy of operators
21. feedback of data
22. an inadequate computer system
23. literacy / numeracy of line supervision
24. organisational changes
25. high workload
26. replacement of machinery
27. insufficient data to show that SPC techniques are beneficial

Difficulties encountered in applying SPC
(in decreasing order of importance)

1. applying SPC to a particular process
2. deciding which charting technique to use
3. deciding which characteristic to chart
4. resistance to change
5. lack of management commitment
6. lack of problem solving skills
7. poor understanding of SPC techniques
8. lack of time
9. lack of a company-wide training programme on SPC
10. an inadequate computer system
11. attitudes of the workforce
12. lack of equipment to measure specific characteristics
13. lack of appreciation of the discipline necessary to support SPC and respond to the data

To establish whether a state of control can be ascribed can be achieved either in terms of required tolerances or with regard to the natural variability (random behaviour) about a nominal state of a selected output from the process. The former approach is viewed as that used by traditional management and is criticised by Deming as hindering improvement. This latter approach forms the basis for Statistical Process Control (SPC). The emphasis is placed upon the behaviour of

the process. If output states occur outwith the natural variation (randomness) in output states for the process, the process is viewed as out of "statistical control"; this state is indicated by identified states either outside the natural variation limits (3σ) or exhibiting trends. Capability is indicated if the tolerance range is outwith the natural variability bandwidth (6σ). The numerical aspects of SPC are well understood and documented (e.g. Owen, 1989). The issues which create difficulty concern its use and the conditions to support its use as illustrated in figures 2.4 and 2.5 and section 5.3.1.3.2.

The value of Deming's approach lies in its use to facilitate the improvement of the process. Deming observes that an improvement proceeds through the following states

"out of control" → "controlled" → "capable".

A more insightful interpretation is presented in figure 2.6. By focusing upon the issue of variation improvements can be continuously made.

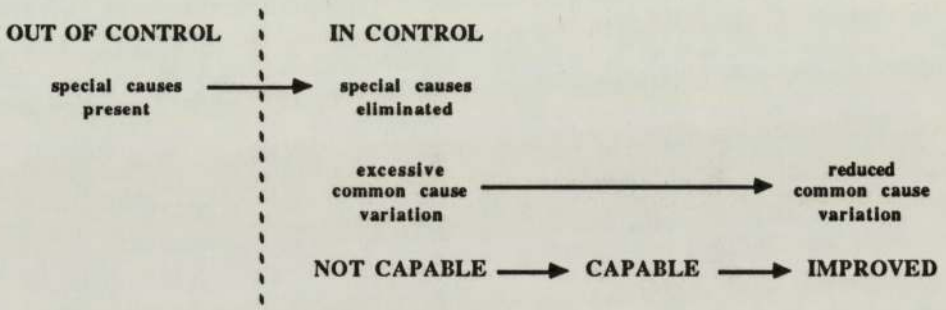


figure 2.6 A Process for Achieving Zero Variation

However, Deming makes the distinction between "tampering" with the system and improving the system. Whereas the former can be viewed as interfering with the random behaviour of the system, the latter is concerned with effecting permanent change to the randomness of its behaviour. Once control has been established, further improvements are achieved by reducing the variability in the process (improving its capability). However, since these improvements concern "faults of the system" these fall within the domain of managerial responsibility. What appears to be the main weakness in Deming's work concerns how management should organise themselves to deal with these "faults of the system", though he does stress the need for teamwork. Further, he leaves to others the more detailed aspects of the tools and techniques that are available (e.g. how to plan (design) for quality - Juran,

1992; the cost of poor quality - Gryna, 1988; the "quality control tools" - Barker, 1989). Nevertheless, the insight he presents makes clear the key issues that management should be addressing.

What is emerging is a vision of an organisation which places emphasis upon a culture (or shared outlook) which supports the professionalism (self-management) of the individual, teamwork throughout the organisation and on-going improvement and flexibility in both activities and interactions. Change is an on-going feature of organisational life, whereby a vision of the future is translated into "reality". TQM is a widely used acronym which can conjure up this view, endorsing the desirability of this view. The question that arises concerns how this is vision can be achieved. How can we create this desired mode?

2.5 Insights into the process of change

2.5.1 Scenarios for organisational change

Organisational change, whether viewed as a distinct event or as a pervasive feature of the dynamics of the organisation, is an issue the complexity of which can easily be underestimated or found overwhelming. Consequently, when we wish to effect change, the question arises regarding how we should handle the change process. A variety of scenarios for change can be envisaged, of which several are presented in figure 2.7 centring upon an improvement in the "systems" used.

One possible scenario is where the Managing Director (MD) decides that it is time to reduce the inefficiencies that cost him dearly. He informs his managers that he wants to see an improvement. The traditional approach is the cost-cutting exercise focusing upon reducing the cost of resources used. A more thoughtful manager may appreciate that the issue concerns, not the "unnecessary" use of resources, but the mechanisms which use these resources and seek ways to improve these. The manager, if (s)he understands how the mechanisms under his/her responsibility function, will design a better way of doing things then declare that this will be the way things are to be done. The new "system" may or not be any better. However, despite improvements, it falls short of what was anticipated. The new "system" is not being used any more effectively than the old "system". The same scenario can be re-enacted when it is the enterprising manager instead of the MD who recognises the need to improve things and starts the ball moving.

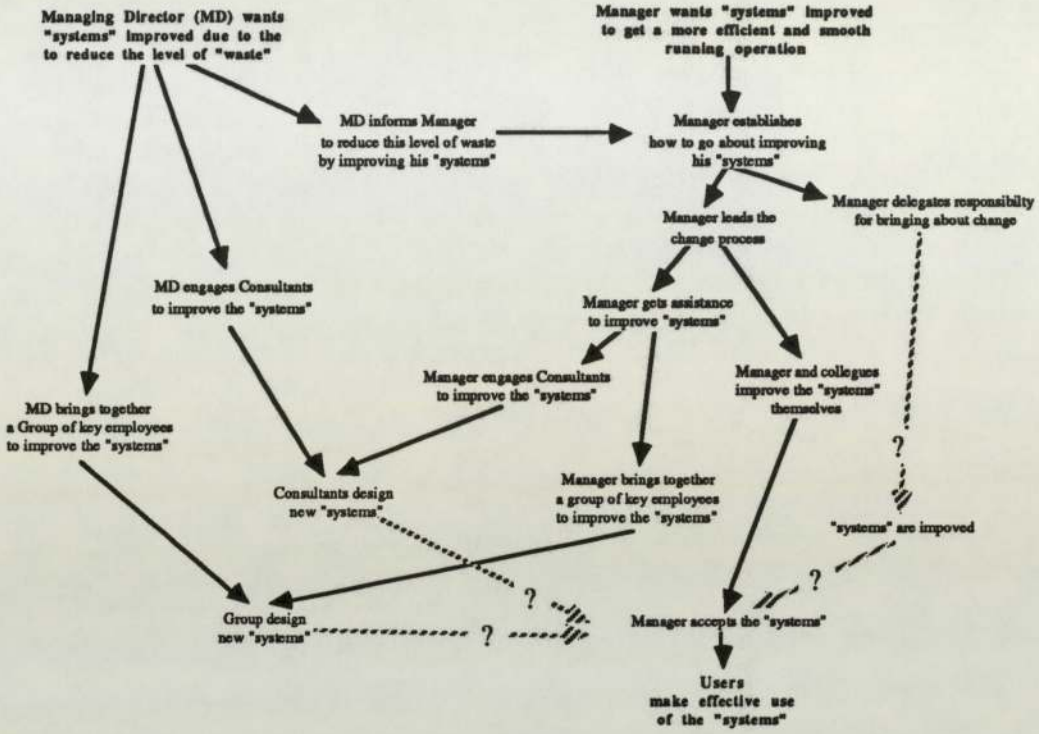


figure 2.7 **Bringing about change in a company - different scenarios**

In either scenario, if the manager does not have the time or does not know what to do he may invite consultants in to carry out the change for him. However, despite intense discussions with the manager and the users regarding what they require and the design of a "system" which meets these requirements, the presentation of the new "system" may be only warmly received. The manager and the potential users need to be trained to use the "system" and in doing so may play up the negative features of the "system", whilst down-playing its advantages.

An alternative scenario arises when the MD or manager recognises that the cost of consultants, based upon past experience, does not merit the solutions presented, since the solutions either do not "work" or fail to bring the expected benefits. Instead, the decision is taken to form a group of people to bring about the desired change. This "team" examine the issues, discussing these with others as they deem necessary, and design a "better system". If the manager accepts the new "system", then (s)he will authorise its implementation. If the team are the not the users of the "system", they will need to sell the "system" to the users and train them how to use the "system". Difficulties, as they arise may be sorted out by the users or be handed

back to the team to sort out. If too many difficulties arise, the users may simply stop using the "system" and revert back to former practices - "at least the old system worked". If the team are the users of the "system", as may arise if the manager delegates responsibility, they may continue with the implementation, ironing out difficulties as they arise. If too much disturbance arises from the implementation, the manager may intervene and discontinue the implementation unless progress can be made. If the manager delegates responsibility then withdraws from the scene, the team may quickly become disenchanted, questioning why should they add to their work-load. If a "system" improvement does result, they face the task of selling the "system" to their manager, who still has the authority to prevent its use.

These scenarios reveal a number of issues. The first concerns the options available. Different routes are possible with the successful outcome being achieved as a consequence of a series of "right" decisions being made. Each decision depends upon the situation as appreciated at the time, whilst is influenced by the issues of cost, prior experience and confidence in handling change. Highlighted are the options in terms of participants and roles enacted by the participants, raising the question of how to get everyone "in sync.". Further, whilst the issue to be addressed is the "system", attention is focusing here upon people, this revealing itself as a significant factor in achieving an improvement in the "system". Further, the route that unfolds is influenced by the way power and authority is used within the organisation being affected by the change. An autocratic management style can conflict with the delegation of responsibility to users for the design and implementation of an "optimal solution". The change process can now be perceived as complex and without penetrating the complexity of the "system" to be improved.

Greiner (1967) provides a useful insight into the involvement of people in effecting organisational change. He identifies as a key issue "the power to define and act upon problems", distinguishing three approaches towards change: unilateral authority - which emphasises the authority of "the upper echelons" which is "directed downward through formal and impersonal control mechanisms"; sharing of power - based upon the distribution of power through interaction; delegated authority - whereby the "responsibility for defining and acting on problems is turned over to the subordinates". He concludes that successful change arises through the sharing of power. The other two approaches inhibit the acceptance of change by subordinates, with the latter approach signifying senior management's apparent lack of commitment to the change and abdication of responsibility for the change.

Failure to pay adequate attention to people may prompt them to respond unfavourably to organisational change. One study of organisational change (Liker et al., 1987) suggests that individual's form opinions regarding proposed change influenced by their prospects. This raises the issue of how to handle those who are excluded from the change process, who may question their trust in management. Carnall (1986) distinguishes seven responses (table 2.1), ranging from opposition to acceptance, with departure as an option. Buchanan and Huczynski (1985) cite Bedeian's classification of reasons for resisting change (figure 2.8), this acknowledging that other reasons may arise. Powell and Posner (1978) suggest that "if resistance occurs, it should be regarded as a useful red flag, not signalling necessarily so much *what* is wrong but instead that *something* is wrong". It appears that people can be willing to accept change, but this in part reflects the adequacy of how the proposed change is managed.

FORM OF RESPONSE		MODE OF RESPONSE	
		Active:	Passive:
Opposition:	control over resources relevant to the change	"voice", mobilize support, creativity, campaigns	delay, informing (leak)
Resistance:	lack of co-operation; no control over resources other than those they themselves provide	action (strikes, go-slows), "work to rule"	absenteeism, passive resistance and disobedience
Ritual:	pretence of acceptance of change	"impression"	disorientation, "locked into past behaviour"
Accommodation / modification:		local bargaining, grievances	"tacit" understanding
Acquiescence:	reduced moral commitment to the organisation	adherence	dependence, low work commitment
Leave:		exit	"retreatism"
Acceptance:		loyalty	faith

table 2.1 Response to change (adapted from Carnall, 1986)

Parochial self interest:	Individuals "seek to preserve the status quo with which they are content and which they see as advantageous to them in some way" (e.g. loss of power, prestige, respect, approval, status, security).
Misunderstanding and lack of trust:	People "do not understand the reasons for the change or its nature and likely consequences". This creates uncertainty and fear.
Contradictory assessments:	Differences in the evaluation of "the costs and benefits of change" can support alternative options and affect the acceptance of proposals.
Low tolerance of change:	"Individuals differ in their ability to cope with change, to face the unknown, to deal with uncertainty."

figure 2.8 Reasons for resisting change
(adapted from Buchanan and Huczynski, 1985)

Although the distinction can be made between "normal activities" and the "change related activities", it need not be assumed that they require separate managers. The management approaches may be different. However, the issue in both cases is the same - the management of people, the greater the number of people, the more complexity that requires to be managed. Organisational change concerns, not "systems", but people and their interactions. The "system" may provide the focus, but the change resides within the people. Where the number of people is small, good interpersonal relations may trivialise the need to the focus upon people, highlighting instead the issues. However, failure to "win" these people over will give rise to unfulfilled change and instability in interactions. Further, the workload of those involved may increase, with "change related activities" superimposed upon "normal activities", this creating workplace stress. Consequently all the issues pertaining to good management are applicable to the management of change. The value of making the distinction between "normal" and "change" is that it permits managers to plan the change in detail, establish what is necessary to support the change and gain the support of people for the change. It also reduces the likelihood that the manager's integrity and credibility will be compromised at a later date by the announcement of promises which are later broken. This may mean that the manager is overburdened with work, but having separate managers is likely to be divisive. This suggests that the manager has some form of assistance, in the form of a facilitator, to help deal with the actual process of change.

One route that can appear attractive is the self-development route, whereby management provide leadership to their personnel, giving them direction and support for their actions. This raises the dilemma of what constitutes leadership. Consideration can be given to personal characteristics (Handy, 1985). However, without entering into a debate regarding this, it can be observed that people choose whether they will be led by a person. In this sense, leadership is a property ascribed by those affected by it. Often the "followers" assume that the leader "knows what he is doing", especially if the leader appears confident. The danger arises when the leader deceives himself into also thinking this, when what is actually happening is that the leader is "feeling his way - using his common sense". This raises the issue of how able the leader is to think through and judge the situation and make decisions: what are the assumptions? what issues are overlooked? This raises the desirability of having a procedure or methodology to guide the change process, whether this concerns "solving a problem" or "improving a process".

2.5.2 "The Shewhart cycle"

One approach, introduced in 1939, is "The Shewhart cycle" (figure 2.9). Deming describes this cycle as a "procedure to follow for improvement of any stage" (1982), presenting his own simplified version: "Plan-Do-Check-Act". Whilst the cycle supports the use of SPC and the quality control tools, it has more widespread application supporting the handling of general problematical issues. Dmytrow et al. (1989) use it as one of four principles underpinning their Quality Improvement Programme. The cycle is a learning cycle.

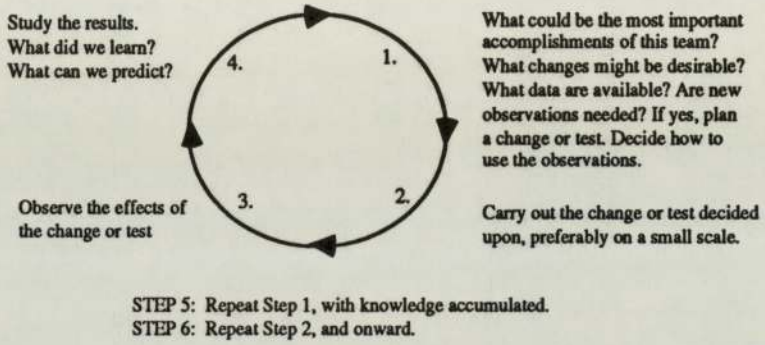


figure 2.9 **The Shewhart cycle (also known as "The Deming cycle")** (from Deming, "Out of the crisis", 1982)

However, this cycle places emphasis upon the content of the problematical situation. It is apparent that the simplicity, associated with the situation whereby a single person can identify that something is wrong then "fix" it, rapidly escalates into a major problemmatic situation the greater the number of people that become involved in the "something is wrong" situation. A corresponding increase in complexity arises when ambitions for change encompass increasingly wider horizons, affecting more people. This awareness of the need to handle these people in a manner that converge their efforts has led to the development of frameworks which attempt to give due consideration to the conditions which will support these efforts.

2.5.3 Programmes for continuous improvement

The emergence of programmes for continuous improvement over the last decade have placed emphasis upon how things are done. The desired ethos is captured in slogans such as "do the right things right first time". The assumed state at the outset is one where people are not doing the right things right first time. Figure 2.10 outlines the features of such a programme. The aim is to impregnate the whole organisation with the desired ethos and stimulate continuous improvement in practices. Under the leadership of top management, the programme is characterised by its forethought, organisation and focus upon people. A similar type of programme can be anticipated where information technology provides a focal point for change (e.g. an MRPII "system"); there is an underlying desire and need for people to behave in a prescribed manner. In both cases, it may be necessary to develop the individual's skills to adequately handle the new situation, e.g. problem solving skills or keyboard skills. Whatever the change, the focus is upon people.

CONTINUOUS IMPROVEMENT

OBJECTIVE:
to become more competitive
to lower costs
to improve customer satisfaction

APPROACH:
by means of a company-wide continuous improvement programme to reduce non-conformance in all activities. This requires:
- understanding of the business, the process making up the business and the implications of the change
- focus

employing
- planning, implementation and control
- education / training of the workforce, including management

PARTICIPANTS:
all participants in the organisation, requiring
- individual understanding and awareness (by means of effective communication) and responsibility (for action)
- recognition for success
- management commitment and leadership... especially from top management

NB. Xerox Corp, IBM (UK) and Ford involve their suppliers

figure 2.10 A model of the improvement process based upon published case-studies

Notes:

1. Kacker (1988) suggests that "a clear understanding of the actual process is essential for control and improvement", the first step being to define the process. This should include establishing ownership: a lack of ownership leads to lack of control.
2. Companies tend to form committees (e.g. Steering Committees) and teams (e.g. Quality Circle teams, Task Force teams). Committees, usually chaired by the chairman, director or general manager of a company, appear to be concerned mainly with strategic issues, whilst the teams are concerned with operational issues.
3. The majority of case-studies indicate that they use some form of performance measure throughout the organisation. In an operational function this may take the form of Statistical Process Control (SPC). Administrative functions tend to be more difficult to quantitatively measure, but this may take the form of Critical Success Factors (CSF).
4. Recognition is an important issue. However, Dempsey and Hesketh (1988) express the view that financial incentives are not in keeping with the ethos of Total Quality. The desire is to have people working with each other rather than competing against each other. They suggest that recognition can be achieved through high visibility, though should be supplemented by more "inventive and imaginative" approaches. Tickel (1988) examined reward "systems" and identified four categories:
   - financial: but can create internal competition.
   - tangible: (e.g. health care) but can become taken for granted.
   - intangible: (i.e. perks - executive dining areas) but tends to discriminate.
   - negative: (e.g. non-recognition for work done, reprimand) but can demotivate.

   He emphasises that performance may be "more attributable to the (reward) system rather than the individual". This suggests that reward "systems" can actually inhibit progress, unless they are implemented with consideration of their consequences. A reward "system" may conflict with attitudes of professionalism, where it is not the reward, but professional values which determines the outcome.

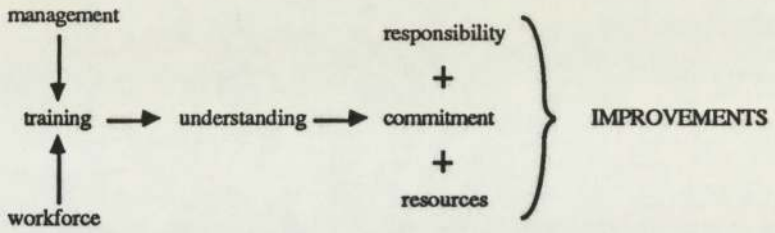
CASE-STUDIES

Rank Xerox (UK) (Huckett, 1985)
Xerox Corporation (DeToro, 1987)
Ford of Europe (Henshall, 1988)
IBM (Kane, 1986)
ICL (Marsh, 1988)
Hewlett Packard (Gold & Holtry, 1984)
Philips (van Ham & Williams, 1986)
Texas Instruments Ltd. (Dempsey & Hesketh, 1988)
IBM (UK) (Ogilvie, 1987)

figure 2.10 (continued) Notes

The model of an improvement process presented in figure 2.10 does not provide any indication of the dynamics of organisational change. From the case-studies can be derived a probable sequence of events:

1 proof of need is identified, project format adopted; economic forces prompt a senior management decision to implement an improvement programme.
2 senior management develop an understanding of what the improvement process entails using consultants and training.
3 a committee is formed to deal with the strategic issues, including identifying issues, evaluating options and determining resource requirements.
4 the improvement process is passed down throughout the organisation for development and implementation. Problematical issues are identified (e.g. bottlenecks, redundancies) and addressed:



5 feedback is elicited, this being essential if the improvement is to be assessed and further improvements are to be made (cf. Kobayayshi, 1986).

Placed within the context defined by the features presented in figure 2.10, what emerges is an approach which may support continuous improvement. Whilst this highlights employee participation and training, the danger arises of underplaying the effort involved in each of the activities. Is the planning detailed enough? Is everyone receiving adequate attention? Are management undermining the effort through bad management practices? A survey into the effectiveness of UK quality improvement programmes identified that the most significant difficulties experienced concerned achieving cultural change, changing management behaviour and finding the time (Develin & Partners, 1989).

An alternative approach is presented by Juran (1992). To achieve a "breakthrough" in the pursuit of improvement, he prescribes a "universal sequence of events" (table 2.2).

table 2.2 "The Three Universal Processes of Managing for Quality" (from Juran, 1992)

MANAGING FOR QUALITY		
QUALITY PLANNING	QUALITY CONTROL	QUALITY IMPROVEMENT
Establish quality goals	Evaluate actual performance	Prove the need
Identify the customers	Compare actual performance to quality goals	Establish the infra-structure
Determine the customer's needs	Act on the difference	Identify the specific needs for improvement - the improvement projects
Develop product features that respond to customer's needs		Establish project teams with clear responsibility for bringing the project to a successful conclusion
Develop processes that are able to produce those product features		Provide the teams with resources, training, and motivation to: Diagnose the causes Stimulate remedies
Establish process controls and transfer the resulting plans to the operating forces		Establish controls to hold the gains

It is worth noting the emphasis Juran places upon planning. This sequence is driven by what the customer requires. Using a 2D matrix approach (Quality Function Deployment) it is possible to translate from customer requirements through to key process features and hence to key measurements:

Customer needs → Product features → Process features → Process Control features

Not only does attention focus upon what we are trying to do (Quality Planning), it also focuses upon how progress is monitored (Quality Control) and upon the conditions neccesary to achieve this (Quality Improvement), these three issues forming "The Juran Trilogy".

Both these sequences indicate the probable steps which will effect improvements. However, in practice we tend to operate in a step-like manner only in the most clearly defined situations. Instead we tend to flit between activities to foresee what is to come and activities to reassure or revise what has passed. Further, we may jump forward, skipping activities or jump back to repeat activities. Thus, although the value of planning is emphasised, it "allocates time" and provides direction around the more obvious pitfalls, nevertheless, difficulties do arise. The plan often does require revision and back-tracking does occur. What is emerging is the need for an iterative process which allows us to review and revise in the light of what we learn. Further, whilst it is useful to have an approach which provides a guide, often difficulty arises when translating it for use within the specific situation of concern.

2.5.4 The "Soft Systems Methodology"

One approach has emerged which attempts to establish the process by which we can effectively handle problematical situations. It takes the stance that that there is no objective reality, merely its interpretation. This approach, the Soft Systems Methodology (SSM), was developed by Peter Checkland (1981) from research in the Department of Systems at Lancaster University, into the nature of "management problem-solving" (Wilson,1984). Since its introduction it has matured under the experience of people using it. Checkland (1989) describes the methodology as a learning system:

> "The learning is about a complex problematical human situation, and leads to taking purposeful action in the situation aimed at improvement, action which seems sensible to those concerned. (Checkland, 1989)

It now appears to have gained acceptance in a wide range of areas (e.g. industry, local government and health-care).

2.5.4.1 The methodology described

A recent description of the methodology (Checkland, 1989) is presented in figure 2.11. It is presented as a logical chronological sequence of seven stages. However, in practice, these stages would occur in a more irregular manner, involving to-and-froing between stages and several iterations of the learning cycle. The methodology makes the distinction between reality and systems thinking. The former is the domain in which we perceive and take action, i.e. "'real-world' activities necessarily involving people in the problem situation... in general,... (in) the normal language of the problem situation" (Checkland, 1981). The latter is the domain of "activity related to the use of systems concepts to structure thinking about the real world" (Wilson, 1984) in "the higher level language (or meta-language) of systems" (Checkland, 1981).

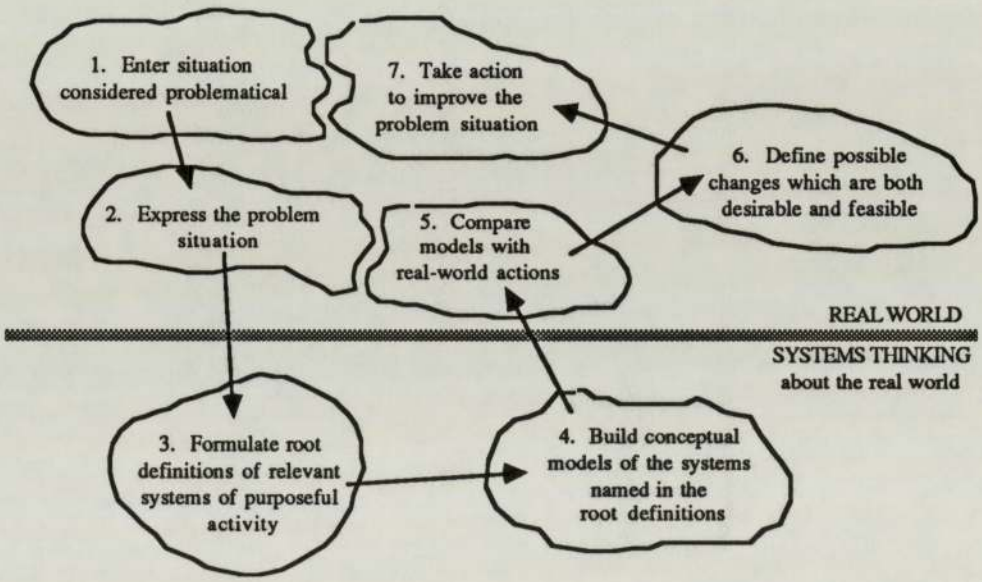


figure 2.11 **The Soft Systems Methodology** (Checkland, 1989)

The first and second stages (**"Finding out about the problem situation"**) are concerned with understanding the richness of the situation and presenting a "rich picture" of the insight gained into the situation. Checkland (1989) distinguishes three different approaches to accomplishing this.

In the initial approach the rich picture was created "by recording elements of slow-to-change *structure* within the situation and elements of continuously-changing *process*, and forming a view of how structure and process relate to each other within the situation being investigated" (1981), this identifying the *climate* of the situation.

In response to the emotion and energy underpinning problematical situations, the second approach emerged. This used the SSM, rapidly converging upon stage 4 to build models of relevant named primary tasks. Although successful in application, it suffered the disadvantage of converging to quickly upon more "boring" solutions, "namely improving the efficiency of existing operations" (1989).

Checkland's third approach is presented in three steps. The first step focuses attention upon *participants*, identifying different problem owners and hence "potentially relevant systems". Step two examines the situation as a *social system*, identifying relevant social roles, behavioural norms and performance values. Step three examines the *politics* of the situation "by asking questions about the disposition of power".

Using the "rich picture", systems are named, these being expressed as Root Definitions (**"Formulating Root Definitions"**). These names are those that are "thought to be relevant to that deeper exploration of the problem situation which will lead to action to improve it" (1989). They should be "a concise description of a human activity system which captures a particular view of it" (1981). They "have the status of hypotheses concerning the eventual improvement of the problem situation" (1981). The Root Definition is defined in terms of the elements identified by the mnemonic CATWOE. This mnemonic indicates not whether the Root Definitions is useful but whether it is well-formulated. Checkland recommends the inclusion of both issue-based definitions (issue of on-going concern) and primary-task-based (activities that can manifest) definitions to "free up thinking" (1989). Davies and Ledington (1988) expand upon this by suggesting the use of "metaphors and analogies" in the names. This can enhance creativity at the comparison stage, though requires "process abstraction" to establish conceptual models that behave systemically.

During the fourth stage (**"Building conceptual models"**) conceptual models are built. The conceptual model "is a model of the root definition" (Wilson, 1984). It consists of "the minimium, necessary set of activities (verbs), that the system must do to be the system defined by the root definition". Having identified the

operational elements, Checkland states that "the final model is that of a system, that is to say a notional entity which could adapt and survive, via processes of communication and control, in a changing environment" (1989). To complement the operational activities which accomplish the expressed purpose, Checkland (1989) has introduced a regulatory component into this model (figure 2.12): "a monitoring and control system". The behaviour of this system is evaluated by means of measures which address the three conditions of effectiveness, efficacy and efficiency. These conditions are those which were identified as relevant when responding to the question "how could the system fail?".

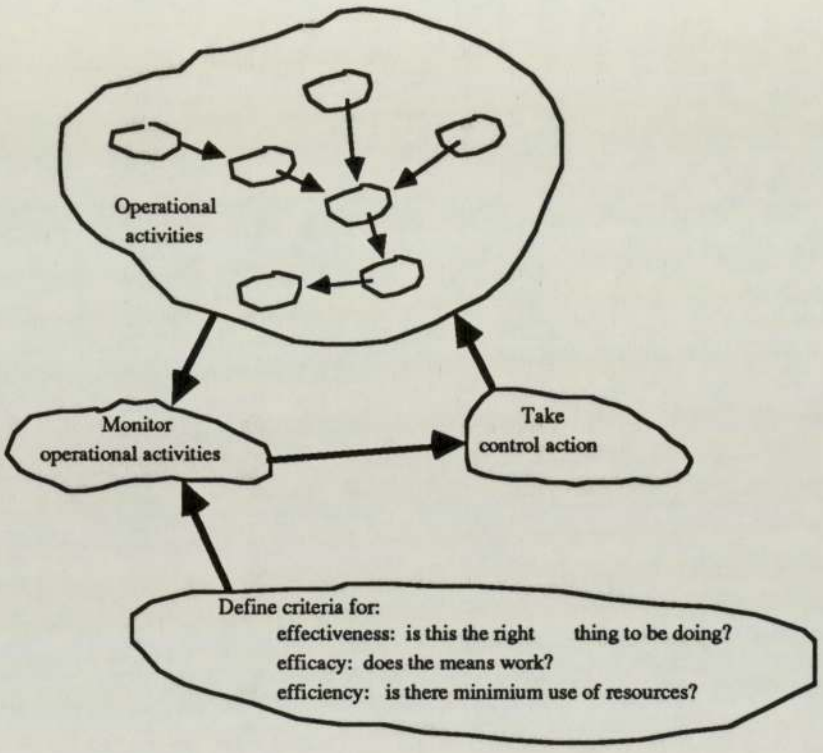


figure 2.12 **"The general structure of a model of a purposeful activity system"** (adapted from Checkland, 1989)

Having produced models, the fifth stage (**"Comparing models with 'reality'"**) is to provide "the structure and substance of an organised debate", using the distinctions raised to reveal previously unexpressed opposition, to challenge taken-for-granted assumptions and to promote novelty. Comparisons are made using both root definitions and conceptual models. Checkland (1981) has recognised the emergence of four ways to make the comparison. One way, described as the least formal, involves a straight comparison between the models

and perceptions. Discussions ensue regarding differences. This approach has been found useful "where roles and/or strategies are an issue. An alternate way, for issues requiring more detail, uses a "more formal listing of differences" to identify relevant questions for which replies are sought "in the situation itself". A third way examines the dynamics of the "activity system" generating different scenarios and comparing these scenarios with experiences. The fourth "most formal" way is a comparison (overlay) between the conceptual model of the desired state and a conceptual model of the existing state.

The sixth stage (**"Defining changes"**) which flows on from the fifth, is to generate discussion about possible changes. The intent is to determine what change is to occur that is both systemically desirable (logical) and culturally feasible (accommodatable within the humanness of the situation).

Having established what change is to occur, the seventh stage (**"Taking action"**) completes the cycle with the implementation of the change. Further cycles can be invoked to handle the process of implementation as deemed necessary.

2.5.4.2 SSM issues and opportunities

The SSM has gained increasing acceptance as a methodology to support organisational change and improvement, particularly the more complex the situation. Whilst it may be viewed as another "problem-solving tool" to add to the quality tool-kit, it offers the potential to guide the process of continuous improvement. One strength of the SSM is its handling of the different viewpoints of a situation. Although no guidance is presented on the practical issues of how conflict should be handled, the SSM nevertheless provides a framework to direct the convergence of diverse viewpoints onto change-oriented action. However, the SSM, having developed through the experience of users, has highlighted a variety of issues, many of which have been untidily accommodated within the methodology.

One issue raised concerns how, despite recognising the distinction between the "problem-solving system" (context) and the "problem-content system" (1981), Checkland has permitted this distinction to become blurred when operating within the SSM. Although he has addressed to this by recognising, in addition to the participants, the political and social aspects of the situation, activity is confined to stages 1 and 2 (1989). Further, a culturally feasible "solution" suggests that the existing culture is a desirable culture, whereas it may be the culture which is the

root of the "problem'. Whilst culture may be handled within an iteration of the SSM, the SSM provides no indication of how these contextural issues will both shape the "problem-content system" and be shaped by it during the learning process.

The distinction made in the SSM between "systems thinking" and "real world activities" is potentially confusing. An alternative distinction can be made between individuals thinking about the situation and taking action in co-ordination with others. This is illustrated in the thinking underpinning the creation of models and the interaction that surrounds the creation of these models, e.g. the creation of models as a group activity. Thus, in applying this view to the SSM distinction, this suggests that thinking and action can be carried out in two modes: the "real world" mode, characterised by normal language and normal behaviour and the "systems thinking" mode, chartacterised by systems language and systems behaviour. This raises questions regarding the nature of activity in the "systems thinking" mode and of thinking in the "real world" mode. Further, confusion can arise about the distinction between systems language and normal language. The dictionary of this systems language is distributed in the writings of Checkland and his collegues (Checkland, 1981, 1989). Whilst systems language is used to invoke specific meanings and express the rules for using the SSM, the issues raised and discussed pertaining to the situation tend to be in normal language. Thus, in using the SSM to guide the change process, this raises the question of how "systems thinking" literate the participants experiencing the SSM need be. The need for "systems thinking" literacy is suggested if the meanings hidden within created models are to be appreciated. However, in practice, systems language will tend to be absorbed within the normal language used when proceeding through the SSM. It may be that this interplay between languages underpins some of the difficulties pertaining to models.

This leads to the issue concerning the contribution of other useful models to those conceptual models which are built using the "meta-language of systems". Checkland made an early distinction (1981) between "a conceptual model" (stage 4) and "a general model of any human activity system which can be used to check that the models built are not fundamentally deficient" [Formal System Model] (stage 4a) and "any other form which may be considered suitable in a particular problem" (stage 4b). The Formal System Model has nine components: purpose, measures of performance, decision making processes, interaction, boundary, resources, continuity, sub-systems and meta-systems (Checkland, 1981). It is unclear how sound the basis is for the Formal System Model to be viewed as "a general model".

Further, an alternative version of the Formal System Model is presented (Atkinson and Checkland, 1988) which incorporates a regulatory component in the conceptual model (this being the final conceptual model built - figure 2.12). This suggests that Checkland is abandoning stage 4a. Further, in expressing the problem situation (stage 2) another type of model (a rich picture) is presented. What emerges is the potential for confusion. The methodology appears to place emphasis upon the type of model to be created at any particular stage; attention focuses upon the nature of the model used and the transition from one model type to another. It does not appear to make explicit what is to be achieved; thereby restricting attention upon models to their usefulness when thinking about a situation and articulating a particular message. Consequently, the SSM appears inflexible when increased appreciation of the methodology leads to its modification (e.g. the editor's footnote in von Bulow, 1989). Indeed, although Davies (1988) makes the point that the value of the models is the support they give to debates about the situation, this is overshadowed by this on-going attention upon making distinctions about model nuances.

One interesting development is the introduction of a regulatory component into the conceptual model, this suggesting the need for the monitoring and regulation ("control") of operational activity behaviour. However, if the nature of this regulation is compared with other models of regulated activities (e.g. statistical process control, simple feedback control "systems", Viable System Model (Beer, 1979)) it raises the suggestion that this view of regulation is under-developed. The taking of "control action" suggests the desirability for an ordered state. It does not convey an insight into the richness of what constitutes desired behaviour and how it is to be achieved, through (self-)regulation or its lack of.

Whilst the SSM supports the handling of problematical situations, it has become an untidy approach in its maturing. The aforementioned issues highlight the potential for introducing more complexity into the situation and confusing rather than simplifying involvement. What is presented is the opportunity to learn from the experience of the SSM. The objective is the development of an approach which can handle the complexity offered by an organisation intent upon bringing about organisational change in a manner which is consistent with the quality ethos.

2.6 The need for consistency and coherence

The aforementioned issues present only an insight into the diversity of views and issues that pertain to the theory and practice of management. What is emerging, however, is a pattern. Increasing complexity and quicker responses within the market-place compounded by increasing recognition of its finite potential is giving rise to the realisation that change is an integral part of organisational life. Further, it can no longer be viewed that it is adequate to be good at what one does, one must be constantly striving to be better. This "one" no longer pertains at the level of the individual but concerns the whole organisation. But the organisation is now no longer the sole domain of a select group of managers. Unable themselves to bring about an improvement in the complexity of the organisation, they need to call upon each person within the organisation; each person, an expert, absorbing the variety and improving upon the complexity pertaining to their own position. Whatever the nature of the change, it can be expected to affect other features of the organisation in some (often unanticipated) manner (figure 2.2). Prominant amidst adopted approaches for handling change are continuous improvement programmes and the Soft Systems Methodology. However, it is becoming increasingly apparent that organisation pervading approaches for handling change tend to be inadequate, with failure being as common an event as success. Although the issues giving rise to successful change are appreciated in a general sense, what might work in one situation need not work in another. The question arises as how to handle the situation. What emerges is the need for a consistent and coherent way of thinking and communicating about organisational issues and an approach which supports the transition from vision to reality. One area which offers potential is Cybernetics.

CHAPTER 3
CYBERNETICS? A LANGUAGE FOR MANAGEMENT

Cybernetics is defined as

> "the science of communication and control in animal and machine"
> (Weiner, 1948)

Weiner used the term to name the way of thinking that was emerging as a result of the convergence of ideas from a number of scientists in the 1940's. They recognised that

> "there were certain principles or natural laws governing the natural behaviour of systems under control, which, regardless of the particular form or context of the system, were quite general and to which scientific expression could be given" (Beer, p255, 1966).

Cybernetics can be viewed as a general theory (Ashby, 1963) with its own language, which can be applied

> "to whatever field of study one cares to name: engineering, or biology, or physics, or sociology....." (Beer, 1967)

Although it provides both a language and a general theory for examining and discussing complexity, e.g. the complexity of management (Robb, 1984), many people do not appear to appreciate Cybernetics. The theory can be viewed as too abstract to understand or too difficult to apply. Questions arise regarding its relevance to day-to-day problems.

Boulanger commented in 1969 that Cybernetics

> "is a discipline that seems to be surrounded by a forbidding aura of mystery, arousing curiosity, intent and even some hostility."

The overview he presents and Crawford's discussion of management cybernetics in the same book do not make an understanding of Cybernetics any clearer. Further, this aura of mystery is exacerbated with the popular association of the word "Cybernetics" with science fiction, as reviewed in the book "The Cybernetic Imagination in Science Fiction" (PS Warrick, 1980). The comment is perhaps still true today, particularly with the recent appearance of such words as "Cyberspace" and "Cyberzone". The question "why has this state arisen?" is perhaps answered by

the lack of material available which will enable people to make the connection between the theory and their own realities. Cybernetics is possibly being misconceived as being distant from the reality as we view it. If one accepts that cybernetics has a valuable contribution to make, the task that then arises is to translate the theory into a format which is perceived as useful. This issue concerns how Cybernetics can help us cope with problematic situations. The concern of this dissertation is with those situations which arise within the context of the company.

3.1 The Viable System Model (VSM)

One venture at translating theory into a useful format has given rise to the Viable System Model (VSM) developed by Stafford Beer. The VSM aims to clarify "how systems are viable" (Beer, 1984). It permits insights to be gained into the complexity of organisations and the issues which can be viewed as problematical. This it achieves through its logic which establishes the necessary regulatory functions and communications to support viability. This logic is based upon Ashby's Law of Requisite Variety (Beer, 1984). The logic is presented in a diagrammatic format (figure 3.1) and explained in a number of books and papers (Beer, 1979, 1981, 1984, 1985). The logic is used to examine the actions and interactions, both formal and informal, of named entities which comprise the organisation. In this sense, the VSM permits us to model an organisational structure and in a manner which permits its effectiveness to be assessed. Further, this examination of interactions facilitates the modelling of the organisation's information system (Espejo, 1987a).

However, the VSM does not appear to be readily understood nor easily applied (Espejo & Harnden, 1989). The logic is disguised within its explanation, whilst is loosely defined in diagrams. Thus, the logic can be viewed as complex. This is aside from any debate regarding whether the logic is sound (e.g. Ulrich, 1981). Further, the issue of how to apply the VSM is the weakest aspect of Beer's writings. Nevertheless, there appears to be little doubt that the logic, as understood by others, does have useful application (e.g. the examples presented in Espejo & Harnden, 1989), this prompting discussion on the issues underpinning its use (e.g. Clemson, 1984; Rasegard, 1986; Espejo, 1987a & b, 1988c; Jackson, 1987, 1988; Flood & Jackson, 1988; Espejo & Harnden, 1989). Despite the complexity of the logic, simplistic interpretations (e.g. section 3.1.1) can be made which facilitate more widespread *appreciation* of the insights on offer from the VSM. However, an appreciation is not sufficient for its *effective use*. The raises the question of how

this logic can be translated into a format which facilitates its understanding and application.

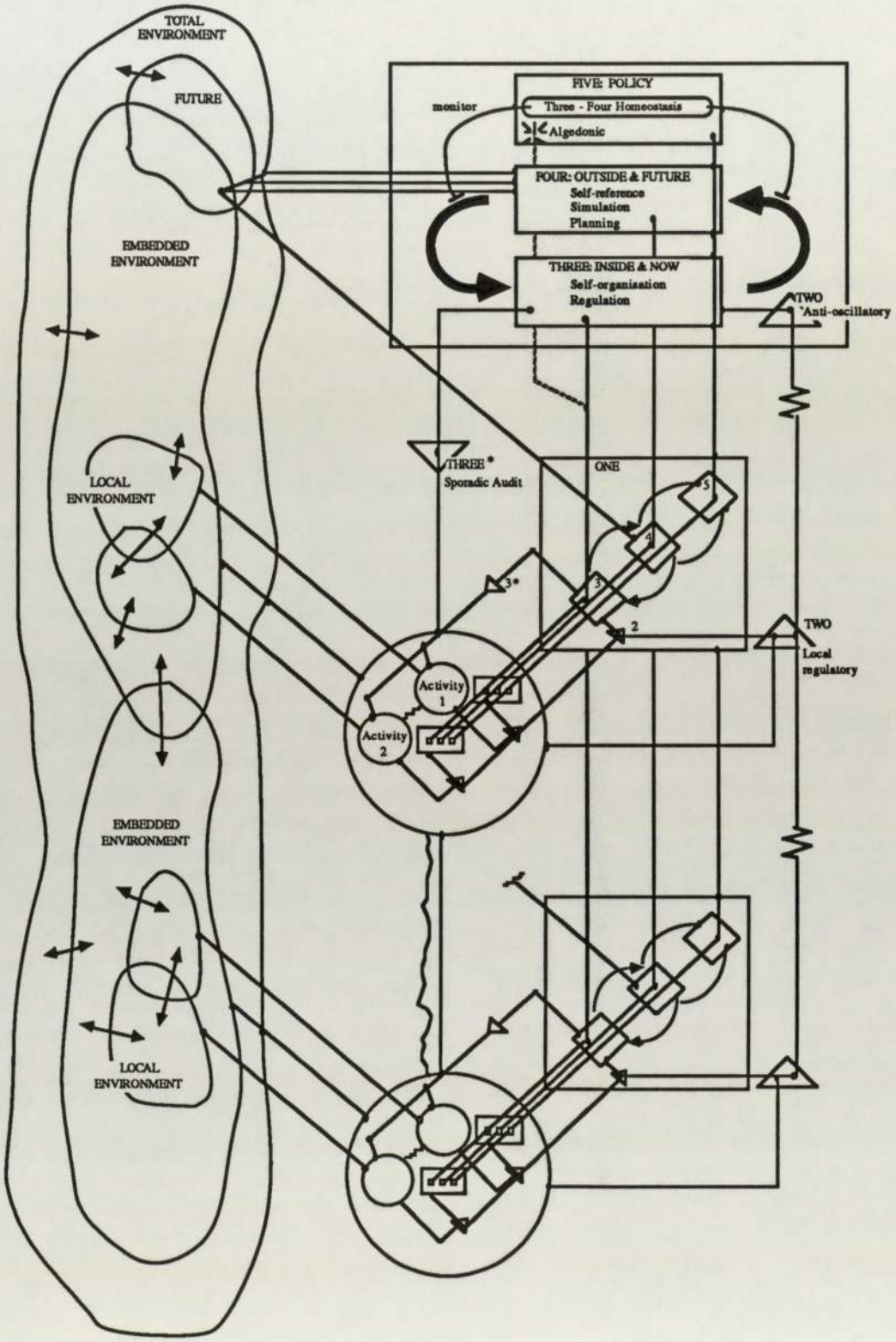


figure 3.1 **THE VIABLE SYSTEM MODEL** (adapted from Beer, 1984)

3.1.1 The logic of the Viable System Model (VSM)

The logic of the Viable System Model (VSM) attempts to establish "how systems are viable" (Beer, 1984). A system is defined

> " as a mental construct of a whole, for which it is possible to establish a set of interrelated parts that make up a perceived whole" (Espejo, 1989)

By defining the word *system*, it allows us to be more precise in what we mean and discourage its loose interpretation, e.g. Deming (p317, 1982) describes what he views constitutes the system, but leaves it to the reader to infer its meaning (section 2.4.1). Further, we can distinguish this system from a "system", which can be defined as "a formally defined process".

The system of interest here is that concerned with how people interact with each other. An observer of these people may distinguish a group of people interacting in a manner which is perceived as organised. The observed outcomes of the activities of this organisation may permit the observer to ascribe a purpose to the organisation. Indeed, this organisation may be identifiable from other organisations in terms of particular and perhaps unique characteristics. The observer may note that this organisation does not break up but continues to operate over time, evolving but still maintaining its identifiable characteristics. The observer may describe this organisation as a viable system.

The logic of the VSM (figure 3.1) permits the observer to establish those features of the organisation, actual or desirable, which contribute to its viability. More importantly it allows the observer to identify those issues that are likely to endanger viability. The logic allows the observer to model the complexity of organisations, establishing whether the necessary things are being done. The observer may note that each person in the organisation has a different view regarding the organisation. The organisation is a " set of different systems construed by participants who are constituting a shared situation"; in other words, it is a multisystem (Espejo, 1989). Having identified the issues emerging from an analysis of these views, it becomes a methodological concern regarding how these issues are handled (section 3.2).

The logic makes the basic assumption that organisations are entities composed of people, brought together to accomplish some purpose - they do something (Beer, 1983). This "something" can be described in terms of a transformation. It can be expected that this transformation, an activity, perhaps inferring a group of more

specific activities, is regulated in some manner, thereby reducing the likelihood of random behaviour. A transformation, regulated according to the logic of the VSM, constitutes a viable system. Beer has identified five fundamental functions (Beer refers to them as Systems) which collectively establish a viable system, identifying the necessary conditions for effective regulation.

At the heart of the viable system is a transformation (*SYSTEM ONE*) consistent with the identity of the system or organisation. This transformation can be unfolded to reveal those "activities necessary to produce the transformation" (technological activities"). Espejo (1987a) distinguishes these from primary activities: "those technological activities which "have regulatory capacity attached to them". If the capacity for regulation is not available, then that technological activity cannot occur within the organisation. The successive unfolding of the transformation reveals the structural levels. When this unfolding reveals primary activities it indicates the capacity of the organisation for regulation.

The logic pertaining to *SYSTEM ONE* indicates that it is composed of the primary activities of the next lower level of recursion, each primary activity itself being a viable system. However, Beer's writings present an apparent contradiction concerning what constitutes *SYSTEM ONE* (p132, 1979, p19, 1984, p132, 1985). The definition adopted here is that it is the "collection of operational elements" (p132, 1979). *SYSTEM ONE* is transformation of the system in question, this being composed of the group of primary activities that produce this transformation.

To complement the regulation provided within *SYSTEM ONE* are the regulatory conditions provided by *SYSTEM's TWO to FIVE*. Together, they support the simultaneous functioning of several primary activities in a manner which ensures their cohesion as an entity or viable system (figure 3.1). This viable system (system-in-focus), is itself a component of a *SYSTEM ONE*, but of the next higher level of recursion. What emerges is the embedding of regulatory conditions within regulatory conditions in such a way that there is always more than one level of recursion apparent at any stage in an analysis. We become aware of the significance of regulatory conditions relative to different levels. What we are interested in is both the degree of autonomy that each system has and its ability to adapt to new demands.

The autonomy and adaptability of each system is assessed by examining the regulatory conditions associated with *SYSTEM's TWO to FIVE*. However, we

need to be conscious of the abstractedness of these *SYSTEMS*. We are presented with an insight into regulation in a dimension which transcends conventional functional classification. Our conceptual task is to re-organise the grouping of organisational activities so that they relate to the abstractedness of the *SYSTEMS*. Thus the activities we will find attached to each of these *SYSTEMS* will not necessarily appear as a conventionally coherent grouping of activities, but as a set of activities which will tend to be found distributed throughout the organisation. The function of these *SYSTEMS* can be identified by the names of Co-ordination, Monitoring - Control, Intelligence and Policy.

Co-ordination (*SYSTEM TWO*) supports self-regulation within each of the primary activities and sustains their cohesion and stability as a collective (*SYSTEM ONE*). Co-ordinating mechanisms are directed towards reducing variability, facilitating the synchronization of events, the replication of actions and the predictability of outcomes.

However, it is unlikely that an unbiased overview of the whole operation can be achieved from within any of the primary activities. Self-interest is likely to over-ride the creation of fully effective co-ordination mechanisms. Further and more importantly, there is unlikely to be the means to comprehend the variety of the operations in a manner which permits attention to focus upon the issues pertaining to the behaviour of *SYSTEM ONE* as a coherent entity. This means is provided in its most basic form by *SYSTEM THREE* and *SYSTEM THREE-STAR*, the monitoring - control functions. The purpose of these functions is to ensure that "everything is under control" or stable, managing the response process to maintain this stability. However, what do we mean when we talk about control?

Control can be viewed as a concept pertaining to an observer with regard to an observed system. An organisation carries out a transformation. It is the person who carries out the activities. It is the person who generates the variety which absorbs any disturbances and maintains outcomes within acceptable limits. The person may amplify the variety he can handle by using technology to reduce the variety which can occur. But it is the person who constitutes the activity: an observer will perceive control of the activity as intrinsic to the person. The person, by means of ability and choice (the freedom of self-discipline), can produce outcomes which he views, as an observer observing his own actions, as acceptable. As a participant he may experience stability in how things are proceeding. He may assert that "everything is under control" and describe himself as autonomous.

However, a person often does not act in isolation but is a member of a group brought together to carry out a specific activity. Each person relies upon communication among those within the group (teamwork), so as to enable him to control his own activity in a manner that permits an optimum acceptable outcome to arise for the group activity. The participants within the group may experience stability. An observer of the group may perceive the group as self-regulating and control as intrinsic to the group. Both may assert that "everything is under control". However, the observer may perceive that the group is functioning in response to or in anticipation of the actions of others, producing outcomes, of which these other participants are the judges of what is acceptable. In this sense, control can be viewed as extrinsic to the group.

Control, as a state, is definable in terms of the acceptability of outcomes with regard to a target set (cf. Ashby, 1963) (Espejo, 1988c). Different states are distinguished during the act of observation by an observer. This can lead to an identified observed system being described as behaving predictably. Participants within situations continuously experience interactions that may be stable or balanced (cf. Maturana and Varela, 1975). As self-observing participants we think about what we experience. We rationalise with regard to our feeling of stability. The goals we ascribe to, tacit or otherwise, reflect our feelings of stability in each of our interactions. We tend to adjust our personal goals to maintain this feeling. Otherwise we feel uneasy. Consequently, control can be described as "not a unilateral enforcement of criteria of performance, but rather, the maintenance of a dynamic stability to tacitly accepted, more or less flexible, criteria of performance" (Espejo, 1989). We can consider control in terms of the interplay between "stability in the interactions among the participants" and the occurrence of acceptable outcomes for a prescribed system, conflating them when loosely expressing views regarding a situation. However, if we wish to be precise, control is clearly defined by an observer (or a self-observing participant) with regard to a specific action for which purposeful behaviour is ascribed in terms of the acceptability of outcomes.

An observer can describe the mechanics of control with reference to the interactions among participants, distinguishing three mechanisms: a communication channel, a transducer and a variety generator (Espejo, 1989). The first two mechanisms are concerned with ensuring that for each disturbance there is a *response*, with the emphasis upon communication. The variety generator is concerned with reducing the variety of *outcomes* and maintaining them within acceptable limits (Espejo, 1991). The distinction is based upon where the emphasis is placed - on the response or outcome. What is of interest is the identity of whom, within a given

context, is generating the variety to handle disturbances and maintain acceptable outcomes? This establishes the controller within that context. Nevertheless, despite the distinctions, these three mechanisms cannot be considered in exclusion to one another. Response variety generation must be complemented by communication.

Four communication channels can be identified, their combination of use indicating the style of management being used. The channel to support the co-ordination function (*SYSTEM TWO*) is supported by two command channels. Through the Corporate Intervention channel, edicts and rules are communicated. Accountability / responsibility is allocated / negotiated through the resource bargaining channel. Resources are provided with the expectation of specific results for which there may be rewards and penalties. If accountability for performance is detached from responsibility for resources, the command channels loose their effectiveness, forcing attention upon the co-ordination channel. An illusion of control is accentuated when heavy use of the command channels coincides with the fulfilment of expectations, giving rise to the confusion that control is all about command and the view that the VSM promotes autocracy. Verification of stability within *SYSTEM ONE* is provided through the monitoring channel (*SYSTEM THREE-STAR*). Its effectiveness reflects the reliability, timeliness and appropriateness of the information gathered. Deviance from expectations should take account of the balance between the long-term interests and the short-term.

The "art" of control can be viewed as the skilful use of these four communication channels in combination with effective variety generation in such a manner that maximises that autonomy and self-respect within *SYSTEM ONE* whilst maintaining its cohesion as an entity (the system-in-focus). However, what tends to arise is the emergence of individual management styles and the enactment of games, these potentially overriding the needs within *SYSTEM ONE*. Self-interest can be identified at a higher level.

Attention has so far focused upon what is happening within the organisation. However, attention must also focus upon what is happening with regard to the interactions between those within the organisation and those outside. The concern is with, not only these interactions that are occurring now, but also those that need to occur in the future, taking into consideration those interactions that are occurring outside the organisation which are of actual or potential interest to the organisation. The activities which attend to these interactions are performed by an Intelligence function (*SYSTEM FOUR*). Attention is likely to focus upon both issues of direct relevance (e.g. customer behaviour, competitive threats, technological

developments, legislative requirements) and issues of general interest (e.g. social and political developments, environmental trends and "world news"). The time scale of practical interest is likely to be that within which change can be effected, this reflecting the constraints imposed upon it from above (the metasystem). The performance of the Intelligence function will reflect its ability to understand itself, the system-in-focus and the interactions which are recognised as defining its environment, as well as its ability to act. An observer of an organisation may associate a planning department or a R & D facility with this function. However, any act of looking ahead can be considered as pertaining to Intelligence, but at which level of recursion?

Intelligence has no value unless its findings leads to decisions and appropriate actions. A complementary relationship needs to exist between Intelligence and Control, this creating an adaptation mechanism for the system-in-focus (*Three - Four Homeostat*). The basis of this relationship is the exchange of information and confidence in each other. Control informs Intelligence of the current state of play, whilst Intelligence presents Control with potential futures. Together they sort out their different views and establish what to do next. Control feeds the findings back through the organisation through its communication channels. A simple manifestation of this in a company is a regularly held (e.g. monthly) meeting between Sales/Marketing and Operations. Anticipated issues pertaining to organisational stability over the next operating period are discussed and actions agreed.

Monitoring the Intelligence and Control interactions is Policy (*SYSTEM FIVE*). Policy provides vision and direction for the system. It monitors the Intelligence - Control homeostat, soaking up the variety that it is interested in and also that which the Intelligence - Control homeostat has left unattended. Unable to digest all the information produced within the Intelligence - Control homeostat, it delegates detailed decision making to this mechanism. It provides closure to the viable system. It ensures that "the structural capacity of the organisation is used to the best of its ability" (Espejo, 1988b), selecting strategies from the options produced by Intelligence. Although Policy is able to take a panoramic view of the organisation and make decisions regarding the future of the organisation, a wrong decision can have serious consequences for the viability of the system. This raises the question of the competencies of those who perform the Policy function and suggests consideration of decision making mechanisms. Further, it can be asked what happens when the direction appears astray or lacking? Should management have the foresight or conviction to keep things going?

3.1.2 "But organisations don't look anything like this"

Confusing models with reality contributes significantly to the loss of value of the VSM as a diagnostic tool. Models do not represent reality but are interpretations of reality (Espejo, 1989). The VSM is a logic or "construct" (Espejo & Harnden, p 447, 1989). This logic is derived from an interpretation of reality based upon observation and analysis.

When we use the VSM, we need to unformat what we recognise as phenomena in organisations and reformat them consistent with the logic presented (cf. Harnden's transducer between the cognitive and operational domains, 1989). We are now working with a new, unfamiliar dimension. This is when we start to experience difficulties. We each now attempt to think in terms of the logic of the VSM, which we really don't fully understand. Further, we discuss issues with others using the language of the logic, a language which we tend to be unfamiliar with and which we tend to misuse by being loose in what we mean. In both cases, use of the VSM is not in terms of the rigour of the logic as intended but in terms of our loose interpretations. The transfer of the logic from one person to another has not been effective. The consequence is the diminishing of the VSM's diagnostic potential.

The VSM allows us to model interactions in a rigorous manner which permits their effectiveness to be assessed relative to the five functions for viability; these functions, their purpose and interactions being defined by the logic of the VSM. However, this becomes a complex model, accommodating many interactions. To simplify the task of modelling interactions it is useful to consider the interaction between only two systems and how stability is achieved. Using a template (Beer, 1985; Espejo, 1989) it becomes possible to gain a deep insight into the issues pertaining to a stable interaction, from the perspective of the low variety system, e.g. a manager, viewing a high variety system, e.g. the manager's department (figure 3.2).

We are concerned, not so much with the content or messages contained within the interactions, but with the structure (context) which supports these messages. Are they getting through and are they giving rise to appropriate responses? Does the structure support stability? It deals with the capacity of communication channels to handle message variety, transduction across system boundaries and the use of amplification and attenuation mechanisms. The focus of the logic is to achieve stability in the interactions, irrespective of how stability is defined.

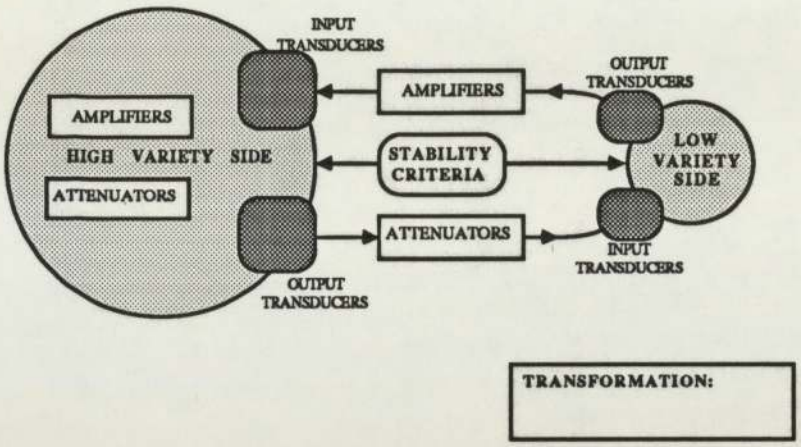


figure 3.2 **A VARIETY ENGINEERING TEMPLATE**
(adapted from Espejo, 1989)

The VSM is an elaboration of this template. The VSM is a template for modelling the numerous interactions in an organisation, in which stability is defined as viability. The VSM distinguishes specific functions which, through particular interactions, regulate a transformation. These functions tend not to exist in organisations as such (section 3.1.1), but are found distributed in a fragmented form throughout the organisation. Thus, whether we use the VSM in our thoughts or in our discussions, we must make the distinction between the logic of the model, the models (expressions of the logic) we create and that which we perceive as reality. One question we can now ask ourselves is whether we need to use the logic rigorously when we create our models. What are we trying to do? Does it matter? Further, when we reformat our model back to that consistent with our conventional view of organisations, we may start confusing formats in our interactions. This poses some interesting issues which are raised during the remainder of this dissertation.

3.1.3 A method for using the Viable System Model (VSM)

The previous section has highlighted issues concerning how the VSM is used. Espejo (1987a) has recognised the methodological weaknesses of Beer's writings and "offers methodological help in applying the VSM", raising the question of the study's purpose and distinguishing two modes of enquiry:

mode I: diagnostic - concerning the analysis of a real world organisation and
mode II: prescriptive - concerning the design of new organisational possibilities or "the organisational implications of alternative policies".

Having established which mode we wish to operate in, the question arises concerning how we utilise the logic. Espejo (1984) offers a five stage procedure :

Establish the organisational identity - what is the purpose of the organisation of concern?

Define the organisational boundaries - what are the parts (primary activities) of the organisation of concern and their relationships? Alternatively, what are the relevant variables (inputs, outcomes, disturbances) pertaining to this organisation?

Model the structural levels in an organisation - how does the complexity of the primary activities unfold? What does this reveal about the organisation's capacity for regulation?

Analyse the distribution of autonomy and discretion - how autonomous is each primary activity?

Study the regulatory mechanisms - how effective is the organisation?

What emerges is a model of the organisation we are interested in. Although, attention here is upon the modelling activity itself, Espejo (1984, 1987a) emphasises the need to appreciate both the different viewpoints regarding the purpose of the study and the different viewpoints of the organisation that emerge during the study. Of particular concern is the issue of organisational identity - what does the organisation do or, more precisely, what purpose is ascribed to the organisation and from what viewpoint? Further, we need to distinguish between espoused views and theory-in-use. Although he is not specific, he draws attention to the importance of the nature of the interactions which enable the necessary viewpoints to emerge, in a way that permits a useful study to result. Further, it is necessary to consider what happens with the insights that the VSM provides. The value of the model is not in what it can model, but in how it can help sort out organisational issues in problematic situations. Our attention now focuses upon how we address the situation. This has been addressed with the development of an approach for coping with or managing problematical situations. The issues raised concerning the effective use of the VSM now becomes merged with those that permit effective "problem solving" or the management of complexity. This approach is the Cybernetic Methodology.

3.2 The Cybernetic Methodology

The Cybernetic Methodology represents a significant development in the evolution of Cybernetics. It clarifies the epistemological underpinnings of Cybernetics and the VSM, whilst providing a coherent framework for helping us cope with problematic situations. It has been developed over the last decade by Raul Espejo. However, although it has been presented in a number of publications (Espejo, 1986, 1988a, 1989, 1990, 1991, 1992), its application has been limited (e.g. Bowling & Espejo, 1992).

3.2.1 The conceptual foundations for its development

The Cybernetic Methodology, although derived from the theory of complexity, has been influenced from several directions. The work of Heinz von Foerster (1984) and Maturana and Varela have influenced the development of the epistemological framework. This clarifies issues which, having been previously unattended, have drawn criticism from those (Ulrich, 1981, Jackson, 1987, 1988; Flood & Jackson, 1988) who have imputed their own interpretation of what Cybernetic is about. Checkland's Soft Systems Methodology (section 2.5.4), has provided insights into the structuring of problem situations (Wilson, 1984).

From Heinz von Foerster's (1984) insights into the physics of systems has emerged a view of reality which identifies an observer (or observing system) observing an observed system. This recognises that the observer interacts with the observed. During this interaction the observer develops a view about the observed whilst at the same time has an effect upon the observed. One question that arises concerns how the observer constructs this view in his mind. What is cognition? The reply presented is that cognition can be viewed as a "recursive process of computation" whereby descriptions are computed of descriptions.

A similar path can be identified from the work of Maturana and Varela. Their efforts "to understand the organisation of living systems" (1975) has enabled them to develop a view of reality from which has emerged the concept of the autopoietic system - a self-maintaining system. The logic they present provides a coherent framework which complements that of the VSM: whereas the VSM highlights the functions necessary for viability, the autopoietic system focuses upon the relations which define an entity. What is significant about their work is the distinction they make between an entity and its living and an observer's view of this entity living,

making reference to the domains of operation and cognition (information) and their interplay via a consensual domain.

Checkland's Soft Systems Methodology (1981) has emerged from research into the handling of ill-structured problem situations using systems concepts. The conventional "hard" approaches for dealing with problem situations failed to recognise that each situation could be viewed from different perspectives. The question that arose concerned how these different viewpoints could be managed so that "desirable and feasible" action results. "A main outcome of the work is a way of using systems ideas in problem-solving which is very different from goal-directed methodology. It emerges from the research experiences as a systems-based means of *structuring a debate*, rather than as a recipe for guaranteed efficient achievement" (Checkland, 1981). The methodology presents a process for learning "about a complex problematical situation" which is directed towards "taking purposeful action in the situation aimed at improvement, action which seems sensible to those concerned." (Checkland, 1989).

3.2.2 The emergence of the Cybernetic Methodology (Espejo, 1991)

In presenting the Cybernetic Methodology, Espejo (1991) develops his argument commencing with a look at how problems are handled. Approaches which adopt a single viewpoint stance are rejected as inadequate since problem situations usually involve more than one person, these giving rise to different views regarding the situation. Each person constructs their own view about a situation, this mental construct being called a system (defined in section 3.1.1). When a person communicates, that person names the system that is being mentally construed and in doing so tacitly ascribes purpose to the real world situation which is holding his attention. Difficulties arise when different meanings are attached to the same name. In this situation different names are required.

All organisations contain people who share situations. Espejo, recognising that a group of people can share "a domain of experience and consensually co-ordinate their actions in relation to these experiences", identifies a group viewpoint, defined as "a community of individuals who have common purposes or co-ordinated intentions." However, each person, from their own perspective of the situation, construes many different systems. Since no two perspectives can be exactly the same, each system is unique. Following this emerges the concept of a multisystem - "a set of different systems construed by participants who are constituting a shared

situation, for which multiple names are necessary". The organisation is a multisystem. He concludes that for problems to be solved in a multisystem a methodology is required.

The "first draft methodology" presented is derived from Checkland's Soft Systems Methodology (SSM) (1981). Checkland has recognised the need to take account of multiple perspectives when problem solving and presents an approach for "structuring and focusing" the necessary debates so that "desirable and feasible" change results. The emphasis of this approach is upon the content of the debates, the learning that occurs and the changes that ensue. The first draft focuses upon this learning cycle, stripping it down to four necessary activities (The Learning Loop - figure 3.3). Checkland himself later independently recognises this basic structure within the SSM (Checkland, 1989). However, Espejo's ensuing argument reveals that the weakness of this first draft is its failure to appreciate the complexity of the situation - "it is not enough to focus attention on the immediate interactions through which problems are manifested, it is also necessary to focus attention on the context of these interactions."

Espejo examines complexity of a situation and how it can be managed by drawing upon both the black box construct, as an aid for understanding the issues of variety, complexity, and stability, and Ashby's Law of Requisite Variety (Ashby, 1963). A distinction is made between variety and complexity, the first pertaining to the "number of states logically possible for a situation as defined by a particular viewpoint", whilst the latter is "the number of states that a particular viewpoint will tend to distinguish in the situation as defined by the 'privileged' viewpoint (i.e. the viewpoint ascribing purpose to the situation)". Using the black box as a metaphor for the situation, we model the black box to explain our perception of its behaviour, i.e. the relationship between inputs and outputs. However, we cannot know the contents of black box. Thus, the management of the black box is concerned, not with the processes within the black box, but with the outcomes, i.e. "how to pull the right input strings to achieve the desirable behaviours". This utilises the distinction between output states and output patterns over time (outcomes). We describe the black box as stable when its behaviour "is in principle predictable from knowledge of the inputs". Thus, the management of complexity for a given situation is the maintenance of the outcomes of the situation within an acceptable range for each of the situational participants and thus the maintenance of stability in the interactions among these participants. One task for the manager is to establish what this acceptable range is. Ashby's Law of Requisite Variety establishes the necessary conditions for effective management of complexity, leading us to

distinguish between "communication processes and simple control processes" (section 3.1.1).

Although the complexity of a situation has been defined as the number of states distinguished by a viewpoint, the viewpoint will be interacting with other participants in the situation, discovering new states. Thus, the complexity will be continually changing for any viewpoint. The "perceived complexity of a situation is a structural property of the organisation - i.e. of the common space inhabited by the different viewpoints in the multisystem." Espejo is now focusing upon the issue of interactions, identifying the roles of the participants for a named system. Further, the concept of complexity and its management can now be developed into a technique for the study and design of interactions - "variety engineering". An observer can assess the stability of an interaction by examining the communications between two viewpoints, expanding this study to examine the effectiveness of an organisation. This returns us to section 3.1, where the Variety Engineering Template and the Viable System Model are introduced. We are now at the stage where, by interpreting a problematic situation in terms of its complexity, it is possible to engineer mechanisms so as to improve the interactions within the situation. This gives rise to the activities of the Cybernetic Loop of the Cybernetic Methodology (figure 3.3).

To summarise, although the Cybernetic Methodology specifies a learning process leading to effective action (The Learning Loop), this is viewed as inadequate for the handling of complex situations. Concern arises over the adequacy of the communications among the participants of a complex situation, these participants defining the organisational context of the situation. The argument is presented that if the cybernetics of the context (The Cybernetic Loop) is inadequate, good conversations cannot ensue, the necessary debates will not happen and the resulting action will be inadequate. Inadequate participation by those within the situation is likely to lead to action which produces outcomes over which hangs doubt regarding their acceptability. The "solution" to the "problem" is therefore reduced in its effectiveness. A Cybernetic Loop therefore underlies all problem situations. "The design of effective organisations is a precondition for effective problem solving; it lifts constraints affecting the capabilities of problem owners at the same time as enhancing their problem solving space."

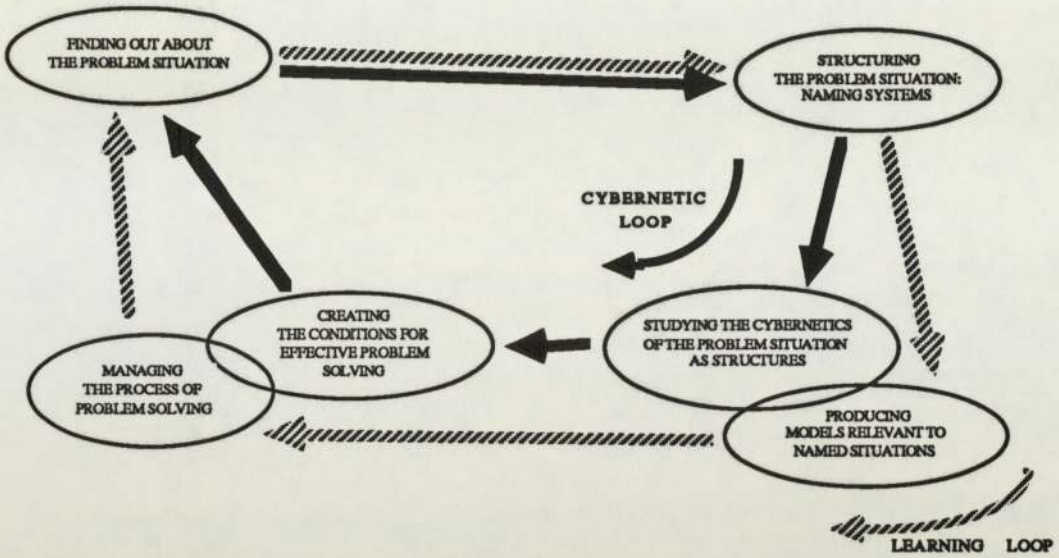


figure 3.3 The Cybernetic Methodology (Espejo, 1986)

3.2.3 An overview of the Cybernetic Methodology

The Cybernetic Methodology is a methodology for dealing with complex problematical situations. It

> "advocates the need to support
> the interplay of content and context in the operational domain of the participants, and
> the interplay of the observed and the observing systems in the operational domain of an observer."
>
> (Espejo, 1992)

The context of a situation is defined by those participating in the situation. The content (meaning) emerges as an outcome of the participants interacting linguistically. The distinction is made between the operational domain, constituted from the interactions of the participants, and the informational domain, pertaining to the mental constructs of the individual. An observer in observing an observed system perceives its complexity, distinguishing states (e.g. black → grey → white), identifying relations (e.g. regulatory, environmental), determining properties (e.g. noise, movement, weight) and ascribing purpose (e.g. identity). This perception of complexity is a function of the observer's interactions with other observers, this community of observers constituting an observing system. However, observers, as participants in the situation (the observed system), affect, through their interactions with other participants, the outcomes of the situation (the behaviour of the observed system).

3.2.3.1 A set of activities

The Cybernetic Methodology (figure 3.3) addresses this state of affairs by recognising six activities which if adequately attended by the "problem solver" will enhance the effectiveness in bringing closure to the situation from the perspective of all participants.

The cycle commences with an awareness that there is a problematical situation. The first activity (*Activity 1*) is concerned with finding out about the situation, generating a rich picture of the situation. This can be viewed as the data gathering stage. Espejo recognises two issues to be aware of. The first concerns the need to distinguish between "espoused theories" and "theories in use" (Argyris & Schon, 1978). The second issue concerns the ability to "detect gaps and inconsistencies in the data". Both may be indicative of problematic issues.

The second activity (*Activity 2*) attempts to structure the complexity of the situation and focus attention using the process of naming systems. Espejo (1991) has developed Checkland's approach for naming systems, distinguishing between descriptions of a "real world transformation as perceived or intended by a viewpoint" and "a hypothesis concerning the eventual improvement of a problem situation" (figure 2.4). Two types of names can be distinguished, organisational names (an organisation) and issue based names (an issue of organisational concern). By using the mnemonic TASCOI, the transformation of interest is identified and the participants producing the transformation established. Checkland (1989) provides an insight into the process of naming systems. He suggests that, instead of attempting to select the most relevant name from a choice during the first iteration of his methodology, many possible names should be entertained. The relevant name will emerge after a succession of quick iterations. Espejo informs us to beware of four pitfalls when naming systems:

- being unaware of the assumptions implied by named systems,
- producing names that are too general (uninsightful) or too detailed (forecloses relevant options),
- converging too quickly (inhibits insightful names from being generated),
- accepting too readily the appreciation of one viewpoint.

Attention can now focus upon the distinction between the context of the situation named (The Cybernetic Loop) and the content (The Learning Loop).

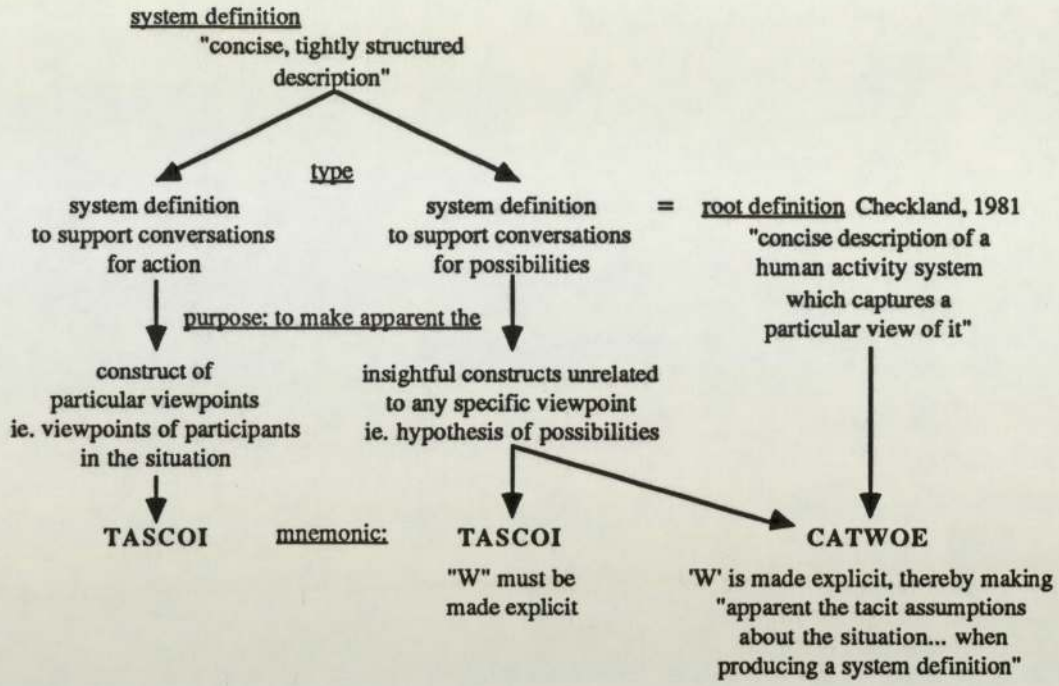


figure 3.4 **Naming Systems** (derived from Espejo's text, 1991)

The Cybernetic Loop entails two activities, these being directed towards creating an organisational structure to support the necessary communications for dealing with the situation, i.e. to facilitate insightful conversations. Although no organisational change may ensue, an awareness is at least created "of the organisational framework in which the problems being posed arise".

Activity 3 is the study of the cybernetics of the situation as brought forward in the organisational name. The aim is to identify the participants/groups in the situation, their roles and the nature of their interactions. From the study of the interactions, as presented in section 3.1.2, should emerge "models of the communication and control mechanisms". This activity can be interpreted as the planning stage in the methodology, considering such factors as the "systems", procedures, tools and expertise, this being extended if required to establish time and cost implications.

During *Activity 4*, the insights provided by the models are used to effect organisational change, whereby the conditions are created which support effective problem solving. The importance of this activity is that it is at this stage that the systemic feasibility for change is established, i.e. there is an '"effective operational domain' for problem-solvers 'to create issues of concern' and 'to implement' the change implied by these issues'" (Espejo, 1992). This enhances the likelihood that the necessary interactions can and do actually happen.

The two activities of the Learning Loop are directed towards the content of any communication and the resulting action which permits the situation to be viewed as closed. It supports the generation and appreciation of options and focuses attention upon an effective response to the situation.

Activity 5 is the act of producing models relevant to the named issues of concern. Although models can be categorised in different ways (e.g. Edwards, 1985; Braat & van Lietrop, 1986), Espejo makes the simple distinction between "notional" models, which "establish the logical activities that appear necessary to produce the named transformations", and "descriptive" models, these establishing "the corresponding activities perceived in reality". Although models as "representations of reality" support the analysis of a situation by a single viewpoint, this view is questioned when there are a number of viewpoints. The models can then be recognised as presenting "interpretations of reality" (Harnden, 1989).

As we move into *Activity 6*, managing the process of problem solving (or managing complexity), the concern is with the interactions of the participants. These interactions should be focused upon three tasks; developing appreciations of each other's viewpoints, agreeing upon "desirable and feasible change" and implementing the change. In appreciating each others views, it may be recognised that it is to everyone's advantage to produce jointly agreed change. It is in these conversations that the models can become powerful "linguistic devices to support communications", in other words, support the development of appreciations and the orientation of views (cf. Harnden, 1989). This is illustrated with the use of a business forecast in a boardroom meeting: business forecasts can be modelled interactively on a PC to support on-going conversations between directors. It is also at this stage that the participants negotiate what is culturally desirable, feasible and acceptable. However, the emphasis is not upon the agreement over any ensuing action, but upon the stability of the interactions among the participants. The outcome of this activity is closure to the situation.

Unfortunately, the closure of one situation is likely to reveal other situations and other participants and so the cycle repeats.

3.2.3.2 Learning

One central and interesting feature of this methodology concerns the issue of learning. Learning can be viewed from two perspectives - the individual and the organisation. Individual learning requires both the ability and the willingness to learn. However, the question arises regarding the property of organisational learning - how can we recognise it (or its absence)?

Organisational learning can be defined with regard to the maintenance of acceptable outcomes for the participants as a whole (i.e. stability of the organisation) (cf. Argyris & Schon, 1978). However, we can study it with reference to a response set. In the following scenario, each unity, as a member of an organisationally closed system, possesses a set of all the responses which permits that unity to maintain its outcomes within a target set and hence maintain its interactions within the system without upsetting the particular pattern of interactions occurring throughout. It is assumed that this set of responses can absorb all disturbances so that no unacceptable outcomes arise. The system is stable. Should a disturbance arise for which there is no suitable response in the response set, two options arise. The unity can generate a new response to absorb this disturbance, which may require an adjustment to its interactions, which in turn can lead to instabilities in interactions throughout the system and require adjustments to these interactions if stability is to be restored to the system. Alternatively, it can ignore the disturbance, this leading to an unacceptable outcome and giving rise to an instability in its interactions. Stability in these interactions is then restored by another unity, whose response leads to adjustments in the interactions throughout the system, eventually leading to system stability.

An observer of this behaviour can ascribe several modes of learning. The first concerns the learning by the unity of the ability to select the appropriate response from the response set and hence maintain stability in its interactions and hence within the system. The second concerns the learning by the unity of the ability to generate a new response so as to maintain stability in its interactions, though this will not necessarily maintain stability within the system. A third mode can be introduced, this being described as the ability of the unities to collectively generate a new response so as to maintain system stability, this implying communication between unities. Although the full implications of this model cannot be unravelled here, several issues are raised.

The first mode raises the issue of training the person to carry out the routine activities associated with a particular role within the organisation. The second mode highlights the significance of using individual initiative for "solving the problems" pertaining to the role, but reveals the potential disturbance to operational continuity, these "solutions" perhaps having an affect upon other activities. The third mode emphasises the interactions among people, learning from each other's experiences, thereby reducing the likelihood that an unsuitable response occurs. This third mode can be considered in terms of error correction loops, an approach developed by Argyris & Schon (1978) to present a theory of organisational learning. They introduce the concepts of "single-loop" and "double-loop" learning to describe the error correction loops associated with organisational theories-in-use within a "framework of norms for performance", distinguishing whether the response includes a change in these norms (double-) or not (single-). However, Espejo, recognising "weaknesses in interpersonal interactions" which manifest as games and deceptions, indicates that these weaknesses hinder effective organisational learning, whether single- or double-loop, and suggests the desirability of managing conversations. Thus, by generating sound organisationally acceptable responses, this enhances the likelihood of maintaining organisational stability.

One significant feature of these three modes is their association with the organisational structure. It is apparent that the learning process cannot be separated from the cybernetics of the learning situation. Thus, if an organisation as a unity is going to learn it must establish a structure to support this learning - to support the exchange of knowledge. An observer should be able to identify interactions which are indicative of this exchange and hence of organisational learning.

3.2.4 Implementing the Cybernetic Methodology

Having established what the Cybernetic Methodology is, the question arises regarding its use - when, how and by whom. Although insights will emerge from the case studies presented in this dissertation, Espejo provides some support.

It should be clear that the methodology can be used as an aid to deal with any problematic situation. It provides us with signposts, to stimulate our thoughts and prompt us to ask meaningful questions and do useful activities. It facilitates thinking strategically about situations, supporting systemic insights and hence taking into account factors beyond the immediate concern. It focuses our attention upon acting operationally, bringing closure to each problematic situation. The more complex the situation, the more likely is its value to be appreciated, especially

where the organisational context is unclear so as to cloud the issues. One specific application to consider is the Cybernetic Loop as content of the Learning Loop - the process of learning how to study the cybernetics of a situation and create the conditions for problem solving, with the context being defined as that within which this learning occurs.

It may also be apparent that the methodology should not be used rigidly, systematically working through each of the activities to arrive at a "solution". Instead, the methodology is flexible, with interplay between the Cybernetic Loop and the Learning Loop, recognising that there is no "solution", just an on-going process. Many iterations are possible, each iteration reflecting a sequence of learning cycles, each cycle re-establishing issues of concern and context, perhaps learning from previous cycles. The methodology is also recursive. By identifying the context of one situation (a multisystem or organisation), it is possible to establish this context within a meta-context and also unfold this context revealing sub-contexts. With each context can be established associated issues. With this opportunity to proliferate complexity, it becomes apparent that bringing closure to a situation is not necessarily clear cut. One instance where it is clear cut arises when the "problem owner" deems that no more activity is to occur, irrespective of the views of the other participants in the situation. However, what may then happen is the redefinition of the situation with new problem owners coming forward and the process starting up with a fresh iteration.

The issue concerning the users of the methodology presents an interesting dilemma. The process as presented in figure 3.3 can be viewed as simple, but it disguises what may appear to be a horrendously complex body of theory, which, without an appreciation of, would lead to an inadequate use of the methodology. Although the participants in its use would likely benefit from its use, the question arises regarding who would control the process of using the methodology. Espejo addresses this dilemma by identifying the role of "analyst". The analyst is the methodology expert. The analyst's task is to act as catalyst or facilitator for the activities in the operational domain (*Activities 1, 4 & 6*), creating the conditions for and managing the conversations, as well as to control directly those activities in the informational domain (*Activities 2, 3 & 5*), bringing forth insights derived from the expert modelling of the situation. However, the analyst, to be successful, will also require an ability to interact with the people in the situation itself, drawing out views and supporting the participants to enrich each others appreciations. In doing this, the analyst must distinguish between his role as observer of the situation and

participant in the situation, otherwise the analyst is likely to present himself to the participants in a unclear, confusing manner.

Checkland (1989) presents a useful insight from his experiences with using the Soft Systems Methodology (SSM). He highlights the need for participation emphasising the importance of the conversations. However, although he recognises the value of the skilled SSM practitioner as a facilitator, he views "the most important aim of such a person is to give away the approach, to hand it over to people in the problem situation, to leave behind not only some specific action taken but also the process by which the decision on that action was reached." The point has already been made in the previous paragraph which indicates concern over the transferability of the Cybernetic Methodology and the danger for its inadequate use. However, Espejo concludes that "the methodology is not only for the expert analyst, it is for all the participants in a situation". All the participants in a situation are problem solvers.

Espejo distinguishes two sets of problems associated with the implementation of the Cybernetic Methodology. The first set relates to the Cybernetic Loop and concerns difficulties arising in the interactions of participants, manifesting as interpersonal games and inadequate communication. These can be described as variety engineering problems, being recognisable with regard to the Variety Engineering Template (figure 3.2) as Performance (LVS transduction and variety handling), Environmental (attenuation) and Response (amplification) problems.

The second set of problems concerns the Learning Loop, of which three types can be distinguished, these being recognisable with regard to the "management loop for a Black Box" as: Situation (black box) appreciation problems, Target set problems and Regulatory (model) response problems. Situation appreciation problems arise when we confuse the distinction between appreciating the different viewpoints about a situation and producing models of the situation. A viewpoint develops an appreciation through interpersonal interactions, this leading to the situation (black box) being redefined. A viewpoint producing models of the black box does not enhance his appreciation of the situation (black box), merely his confidence in its predictability. Similarly for target set problems confusion can arise with regard to the distinction between the target set being "a fluid space of acceptable outcomes" for the participants and a referential subset (of selected outcomes or goals) monitored by individual viewpoints. Whereas the former is concerned with stability, the latter is concerned with control. Espejo makes the insightful comment that, "the target set is about that which the viewpoint perceives is not possible not to achieve, without creating for itself problems with other viewpoints". Regulatory

(model) response problems can arise when we confuse the models we hold to represent a situation (models for action) with the tacit models we use as linguistic devices. For the former, the concern is with the relevance of models as an aid for implementing action. With the latter, the concern is with sharing these models, i.e. distributing them among the participants, so that then they can be effectively used as models for action. Distribution is a function of the communications between the participants, which in turn is a function of the organisation.

3.3 "Monitoring-control" revisited

A logic for modelling interactions and an approach for handling problematical situations have been presented which provide a coherent and consistent framework for addressing organisational situations. However, this presentation has emphasised the qualitative aspects of the situation, underplaying the quantitative aspects. However, it is often by looking at numbers that we can appreciate whether actions and interactions are functioning as expected. Further, it is often by looking at numbers that we can anticipate possible future actions and interactions.

It is by taking measurements we can determine how well actual outcomes match requirements (acceptable outcomes) and so are able to comment about how controlled the situation is and take appropriate corrective action; extrapolating into the future to anticipate / predict possible future outcomes, match these with expectations and take action to prevent possible loss of control. A state of control can be ascribed when acceptable outcomes arise (section 3.1.1). Deming's insight into process behaviour (section 2.4.1) suggests that we can affect this behaviour by addressing process variability. We can gain an understanding of Deming's insight using the concept of a black box model (figure 3.5).

Disturbances to a black box (process or activity) can give rise to "faults". The person, whether generating the variety (response) to handle the disturbance or communicating the need for a response to the person who can deal with the disturbance, monitors the acceptability of outcomes from the black box and thereby is able to determine the impact of each disturbance. Thus, the behaviour of the process can be appraised, focusing upon specific features of the outcomes (e.g. quantity, quality, time and cost) and using some basis for evaluation (e.g. stability criteria, critical success factors, order winning criteria).

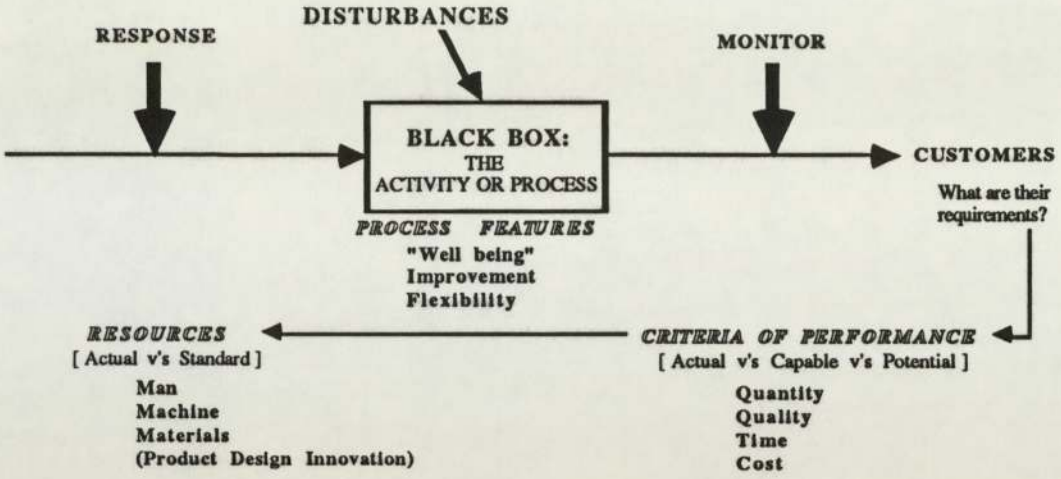


figure 3.5 Monitoring - Control of the Black Box

The resulting response can be viewed in different ways. Deming places emphasis upon the removal of disturbances. However, an alternative view is to release the latent properties of the process. Whilst Deming blurs this distinction when effecting process control and improvement (figure 2.6), this offers an insight into the monitoring of process behaviour. The capability of the process can be evaluated under conditions of minimal disturbance. However, its potential can be evaluated in terms of the ability to harness that which is latent within the process. This introduces a means by which performance can be evaluated (figure 3.6 - Beer, 1979; Espejo & Garcia, 1984).

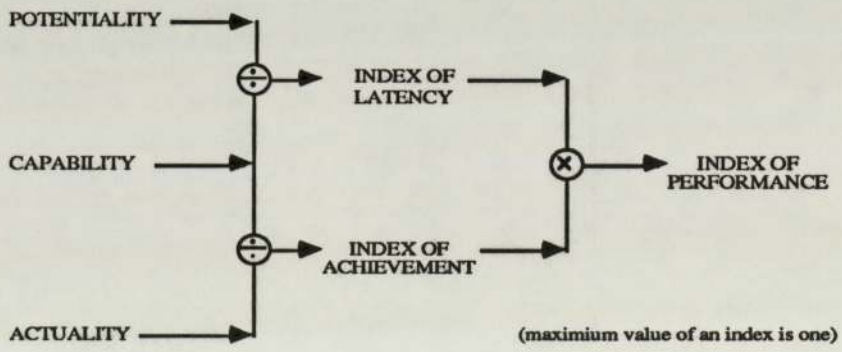


figure 3.6 Evaluating performance

The focus upon the process permits us to gain an insight into three aspects of the process: its "well-being", improvement and flexibility. It prompts us to such questions as: how stressful is the activity? how much improvement can be made in the transformation of resources into accepted outcomes? how much variety can the activity handle?

The response will be action that affects in some way the resources at hand (e.g. man, machinery, materials): men "warned off" or their skills developed, machinery reset or fine-tuned, materials accepted and inspected or better quality selected. Although product design innovation is presented as a resource, it reflects the skills, technology and materials accessible to the process. It is brought forth since it is a significant issue which can be easily overlooked.

An alternative way to evaluate process behaviour process is to compare the actual resources used against a "standard". Whilst this offers insight into the variability of the process, it assumes that we can identify those aspects of the resource which provide meaningful insights into the process's behaviour. Alternatively, we may compare actual resources used against outcomes on a per unit basis, this suggesting how efficient the activity is.

What is emerging are different means for gaining a quantitative insight into the behaviour of a process and the effectiveness of regulation. However, whilst the use of measures can help the person to control a process, there is great potential for their misuse. Difficulties arise when the measures are used in a manner which alienates the person from the activity. Whilst it is important to identify the right measures and ensure that their determination is based upon acceptable techniques (e.g. statistics), it is also necessary to have the conditions which support their effective use. This has already be illustrated in the context of SPC in section 2.4.1.

3.4 Coming down from the ivory tower

To conclude this chapter, it is proposed that Cybernetics and the framework presented should not remain in the domain of academical debate as perceived to lie by those who fail to understand its application. The view that Cybernetics is complex, academical and out of reach of "reality" should be overturned. Cybernetics should be viewed in a similar light as, say, financial accounting. It provides a **theory** (logic) for handling, not numbers, but distinctions - supporting their analysis. It is provides a **language** for conversations - enabling appreciations

of different viewpoints to be developed. It provides a **framework** for identifying possibilities and establishing action. What is required is the effort to understand all this, in the same manner as required to unravel all the conventions used in financial accounting, including their ambiguities. Cybernetics can be defined as the science of management. It provides the language for management.

This is demonstrated in the logic of the Viable System Model (VSM). The model presents an insight into what is referred to as Total Quality or alternatively is viewed as good management / business practice. It allows the characteristics of a Total Quality organisation to be established. It achieves this by recognising the autonomy of one distinguishable viable system - the person - "the person is responsible for the quality of his work". Further, the VSM provides guidelines regarding how this person should be managed. Indeed, it provides guidelines for how the whole organisation should be organised.

Further, since life is full of disturbances, we spend a lot of time trying to overcome all the problems we face. This is the case in the most smooth running organisation, with the bonus here being that organisational problems tend to be more complex than personal problems - there are simply more people involved. Much of our time, particularly within organisations, is spent sorting out problems. The concept of Total Quality suggests that we attempt to prevent problems rather than fix them afterwards. But how?

Now that we can be specific about a system in terms of what it does, its participants, its behaviour and hence the effectiveness of its regulation, we can clarify Deming's insight into the relationship between "faults" and "the system". We can define the appropriate black box(es) for the observed output states and establish who has managerial responsibility for these. We can use the available techniques to support this (e.g. the "quality control tools" - Barker, 1989). These tools are used as part of a "problem solving framework" or "improvement process" which results in closure to the identified situation (e.g. "the Shewhart cycle", section 2.5.2). These permit the situation to be modelled in a manner that allows the issues of concern to emerge and be analysed. Further, Barker, in registering the need to complement the "seven old tools" with "seven new tools", recognises the existence of softer and more complex "problems". Problems with buildings and machinery can be dealt with by improving maintenance amongst other things. However, problems tend to involve people and it is these people-related issues that are less easily resolved.

Whilst the quality control tools can significantly contribute to appreciating the issues, the Cybernetic Methodology provides the framework which can handle the complexity of the issues pertaining to the people in the problem situation. The models produced using the tools can be accommodated within the Cybernetic Methodology, as can any model, e.g. the VSM. Indeed, Barker recognises the value of these models not only for analysis but also to support discussion. Nevertheless, whilst the Cybernetic Methodology is a learning based methodology with the emphasis upon action, it is distinctive from other problem solving approaches in that it also addresses issues pertaining to the context of the situation, i.e. these people-related issues. Thus, it ensures that the conditions are supportive for the use of such tools: such issues as an understanding of the tools, senior management commitment, communication and self-management. The Cybernetic Methodology reveals itself as a powerful "problem-solving" methodology.

By drawing upon the issues presented in this chapter, the remainder of this dissertation will attempt to demonstrate the utility of Cybernetics, in particular the Cybernetic Methodology, by focusing upon the specific management issue of quality and organisational change.

CHAPTER 4
OBSERVING AN OBSERVING SYSTEM OBSERVING AN OBSERVED SYSTEM

4.1 Introduction

A situation, by virtue of it being complex, may overwhelm those beholding the situation. Further, the difficulty of knowing what to do in a situation can be compounded by not knowing what role to take. This is particularly relevant in the research situation, where a key task is to ask the right question. The dilemma facing the researcher is how to find this question, never mind the ensuing dilemma of trying to effect an insightful response. Underlying the researcher's quest is the need for effective interactions with those who can support this quest. What is required is a framework which structures the situation in such a way that brings out the relevant issues, identifies the participants and permits attention to focus upon action that will dissolve the situation. This framework is provided by the Cybernetic Methodology. However, the question arises as to how it can be used.

To use the methodology, the user should be aware of his relationship with the situation. The user can be viewed as an observer (observing system) observing the situation (observed system) (ref. section 3.2.3). The observer, in discussing the situation with other observers, is defining aspects of the situation. These discussions can be recognised as either those about the situation (conversations for possibilities) or discussions leading to action within the situation (conversations for action). These discussions, in turn, help to clarify the role of the observer, by establishing whether the observer is a participant in the situation and, if so, what this role is. What emerges is the recognition that in a situation, two generic systems can be identified: an observing system and the observed system. What is of interest is the interplay between these two systems. This is particularly relevant in the context of research since, even in physical sciences, there is recognition of the affect that an observer can have upon the behaviour of his subject.

This chapter presents an illustration of how the Cybernetic Methodology can be used. In doing so it discusses issues concerning multi-disciplinary research practices. It also examines the attempts to improve practices within a manufacturing site. However, by using the Cybernetic Methodology it becomes possible to examine how it supports

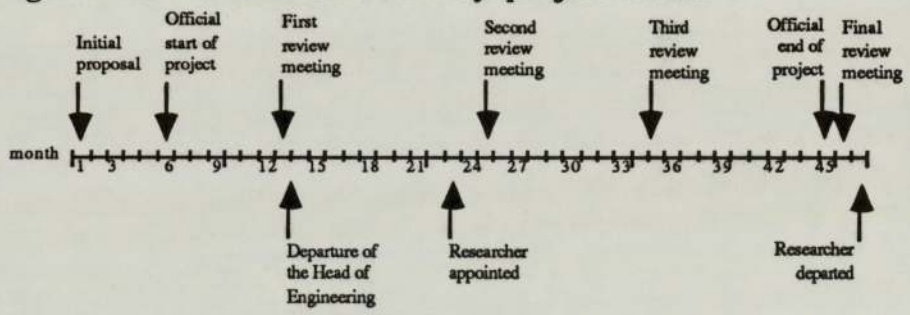
"the interplay of content and context in the operational domain of the participants, and
the interplay of the observed and the observing systems in the operational domain of an observer."

(Espejo, 1992)

4.2 An Observing System

A research project is, by its very nature, an observing system observing some enticing behaviour in an observed system. The following research project offers itself as an example of how apparently straight forward research disguises issues which often tend to be taken for granted. Although the project commenced seventeen months prior to the appointment of a researcher (figure 4.1), this account of the project is based upon the researcher's translation of the views of research participants as expressed in documentation and interviews and the researcher's subsequent experience with the project.

figure 4.1 A timescale for key project events



4.2.1 A problematical situation

The recognition of a problematical situation and the examination of its potential for a research programme was carried out by three research proposers, in correspondence with two research sponsors. The outcome was the acceptance of a research proposal and the award of funds.

4.2.1.1 Finding out about the situation

Whilst the process of how the situation was recognised is inaccessible, the origin of the research proposal could be traced back to conversations among the original research proposers and sponsors two years prior to the researcher's appointment. They recognised an opportunity for

> "automated quality data collection... together with techniques of statistical control, can be used to create an environment where the correct quality information is available to the appropriate person at the right time, and in which automatic process control may be used to improve quality levels."

However, they identified the problematic issue as being one in which

> "the methodologies of this type of quality control system are at present undeveloped and there are few, if any models to which a company may refer to develop its own system."

4.2.1.2 Structuring the problem situation: naming systems

The task of structuring the problem situation and naming systems is a key activity within the Cybernetic Methodology. However, whilst Espejo clearly specifies the form of this name (section 3.2.3.1), it is apparent that in our daily interactions we loosely name systems, without appreciating what we are doing. The potential for confusion arises when a name is brought forward. The image that we each associate with that name may differ from the image that the person intended which bringing forth the name. The danger lies in our assumptions when bringing forth names since, unless we are clear as to what we mean, these names may lead to activity which is contrary to common sense, e.g. the charge of the Light Brigade. Thus, whilst we use names in our everyday language, Espejo's "naming systems" provides a means to reduce misunderstanding and to develop appreciations of each others viewpoints.

Thus, we can consider the research proposal as a named system "supporting conversations for action". It identifies the intended transformation and the likely participants of the project. It goes further by incorporating descriptions (models) of both the proposed activities and the anticipated project organisation. Consequently, the project objective was defined as being

> "to develop both techniques and methodologies for the total management of quality in a manufacturing plant."

However, the words "total management of quality" offered a variety of interpretations, these underpinning ongoing debate about the scope of the research. Nevertheless, the core of the project was the development of computer-based tools ("systems") to support quality control. It was intended that these tools would be developed within the collaborating company, by the proposers and researchers in partnership with the intended users. During the compilation of the original proposal, the list of proposed activities identifying the key issues enabled the anticipated project organisation to be established. This identified the people required, what they would do and how the project would be managed. Further, collaboration with a company had been secured, with its role being defined.

4.2.2 The Cybernetic Loop

The participants in the project were identified in the proposal as:

Head of Engineering ("A"):

to "provide the experience and guidance required on the programme, together with [technical] expertise".

Head of Business School Research ("B"):

to "co-ordinate the contribution of the Management Department", as well as personally make a technical contribution addressing the organisation / management issues.

Engineering Leader ("C"):

to "perform the bulk of the research on the engineering aspects of the project. In addition he will co-ordinate the programme with the industrial collaborators and the Department of Management".

The people filling these three roles were the original project proposers. However, following the tragic departure of the Head of Engineering early in the project, his involvement was replaced by that of his replacement. Other participants were:

researcher ("D"): to address the computer technology issues.

researcher ("E"): to address the process instrumentation issues.

Seven other members of staff were identified who would make a technical contribution to the project as required (including the two people who would later fill the role of "helmsman" ("G")). Following the first review meeting it was agreed that a researcher ("F") be appointed to carry out the research into the organisation / management issues relating to the project. The delay in this appointment allowed for the other two researchers to make progress with the development of the technology.

This researcher would be supported by the "helmsman". Further, a local company had consented to collaborate in the research, offering itself as a "guinea-pig", appointing one manager to represent the company and liaise with the project team.

The presentation of the project organisation / management in a written description format provides the reader with the illusion that due consideration has been given to these issues. The organisation as presented appears to be adequate. However, is it? What assumptions do we take for granted which perhaps we shouldn't? How do we establish what questions we should be asking to assess the soundness of the organisation described? What is likely to happen in practice?

Whilst an organisational chart may be useful in addressing these questions, it tends to focus attention upon reporting lines. The project has to achieve a defined purpose within a given period of time. The project has to remain viable for that period of time, in the face of disturbances. It is not adequate to solely define roles and responsibilities. The question arises as to what interactions are required and how they are to happen. In presenting the project organisation in the alternative format of the VSM, it becomes possible to develop a better insight into the adequacy of what was proposed and highlight issues for concern.

The VSM (figure 4.2) reveals the researcher's view of the project organisation soon after his appointment. The objective (content) of the research has been decomposed into six activities. These activities have been distributed among the researchers: activities 1 to 4 were under the management of the engineering proposers, activity 5 under the management of the Head of Business School Research and activity 6, it requiring the near completion of the other activities, being undecided. What is interesting is the creation of project boundaries which mirror those of the educational organisation. This was enhanced by the location of the management researcher in a separate building from the engineering researchers (cf. TJ Allen's research reveals the deterioration of communication over increasing distance - Roberts, 1977). The view was held that the management researcher should belong within the Business School research unit, thereby pooling these researchers together to stimulate cross-fertilisation across projects. It was also viewed that such an arrangement would maintain the Business School proposer's control over the research into the management issues.

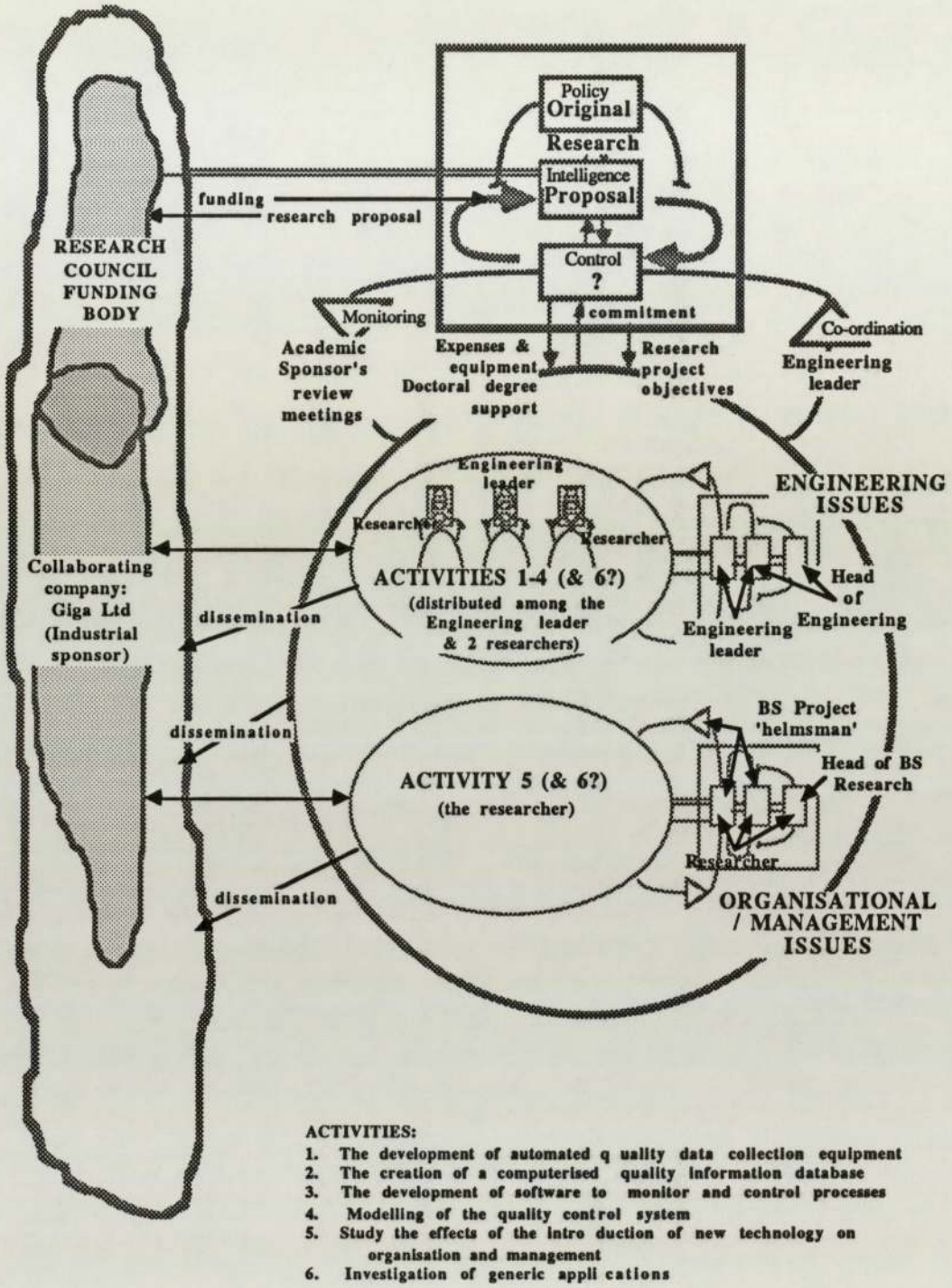


figure 4.2 Observing the observing system

From a regulatory viewpoint, the potential capacity for regulating the project is at three levels. The first is the management of the project as a whole, whilst the second is the management of the two distinct entities, engineering and management. The third level is the self-regulatory practices of the researchers, this tending to be a widely accepted research "norm". In practice, regulation concentrated upon the first level during the start-up of the project, whilst by the early period following the researcher's appointment attention focused upon the second level. As the project approached its end the emphasis was towards self-regulation, with the departure of the Engineering leader six months prior to the project end exacerbating this. The illusion of the project "team" constituting an organisation was shattered if one examines the "team" in terms of a set of organisationally closed interactions. The fact that interactions were not happening suggests that teamwork had simply not been established.

When viewing the project as a coherent whole, a number of interlinked questions arise. The first concerns the vision and direction of the project. Examination of the initial research proposal indicates that the initial vision and direction of the project was clear. Whatever mechanism was used to establish this, this involved the research proposers. Further, the proposal suggested that "guidance" or leadership for its constancy belonged to the Head of Engineering. However, upon to his departure and replacement, the question arises as to who took over this task.

The second question concerns the monitoring-control of the distinct research activities. All researchers self-managed their own work, the incentive in each case being registration on a Doctoral programme. However, there were dependencies between the research activities, raising the question of how they should be managed. Recognition that the management research was distinct from the engineering research led to it being "controlled" by the "helmsman", this complementing the "control" of the engineering research by the engineering leader. Further, two threatening issues were surfacing by the time of the management researcher's appointment:

- delays in developing the technology suggested that it might not be completed within the following eighteen months, and
- it appeared that neither development nor implementation of the technology would take place within the collaborating company.

Although project management techniques (e.g. PERT, CPM) may have been useful in clarifying what was to be done and by when, highlighting critical points and monitoring progress, they were not used. Consequently this raises the question as to how the delays were managed and how the implications for the remaining

activities were re-appraised. Whilst the engineering activities were strongly inter-related and could be informally co-ordinated by means of the proximity within the work environment of the engineering researchers, was the work environment to informal? Further, though the management research could be viewed as a separate research activity, its progress was dependant upon the overall progress of engineering. Attempts to improve integration by means of project meetings failed due to the occurrence of these meetings being irregular and infrequent. Instead, co-ordination was primarily by means of informal interactions among the researchers themselves, though this was ineffective since there was a lack of appreciation of the contribution that management research could have upon engineering research and vice versa. Social interactions were minimal. The question arises whether in the absence of any natural cohesion within the project team, mechanisms could have facilitated the development of this elusive cohesion.

This leads to the third question highlighting the significance of the adaptation mechanism thereby ensuring consistency between vision and events, particularly in the event of disruption to the research process as transpired.

Whilst rich interactions ensued between the collaborating company and the management researcher, the interactions between the collaborating company and the engineering researchers did not result in the requirement of technology being developed and implemented within the work-place. Further, this raises the question of what interactions came into play to follow upon this failure, since this was one of the two threatening issues that were threatening the whole basis of the research project. It also leads to the question regarding the management researcher's appointment. Did the project proposers fully appreciate what was happening and had they a contingency plan for the researcher upon the realisation of the two threats? These issues raise the question of how the project was reviewed by the project managers, whether the acceptability of outcomes was renegotiated and if so how? This issue is highlighted by the academic sponsor's request at the third review meeting for an implementation of the "system" within the work-place and a study of its impact to be made prior to the final meeting.

Meetings to discuss the research were held on an ad hoc basis with months passing between successive meetings. Attended by the Head of Business School Research, the Engineering leader, the management researcher and the "helmsman", they provided the main opportunity for conversations for possibilities. However, the content of these conversations tended to focus upon the management research and led to more exploratory issue-based activity by the management researcher. These

conversations also revealed the differences of opinion between the management researcher and the Engineering leader on the content of the management research, which in turn led to strained relations and poor interaction, this reducing to a formal level. There was no mechanism to effectively handle the individual viewpoints and effect a "group viewpoint". Other conversations may have ensued between Head of Business School Research, the Engineering leader and the new Head of Engineering, but if they did, they were not translated into a vision which was communicated to the other researcher.

When the project was reviewed by the sponsors at their review meetings (figure 4.1) the rift between the two groups of activity was apparent. Attempts to address it were through the content of the management research. But this was carried out without a vision for the project as a whole, nor with an adequate appreciation of all the research issues. Consequently, difficulty was experienced in establishing what this research was to be. In the event, since the interactions deteriorated rather than improved, with the two groups operating independently of each other, these attempts could be viewed as unsuccessful.

4.2.3 The Learning Loop

The research objective was defined as

> "to develop both techniques and methodologies for the total management of quality in a manufacturing plant."

Within the proposal, this objective is unfolded within the detailed plan of the issue-based activities. The plan identifies six activities each of which opens to reveal further activities This model of the research activities was presented as an indented list (figure 4.3). By viewing this list in a similar manner to viewing the description of the project organisation (section 4.2.1), it becomes apparent that this list fails to make apparent the relationships between the activities. Indeed it fails to convey any indication of how sound this list is as a coherent package of achievable activities (cf. Checkland's Formal System Model - section 2.5.4.1) nor of the necessary assumptions. Consequently, the dependency of activity five upon activities one to four is not apparent. The question is not prompted as to what happens if the first four activities fail to produce the necessary conditions for activity five to proceed. Thus, whilst this model of the issues would have been used to orient conversations about the content of project during the project negotiation process, the question arises as to its usefulness as a device to orient conversations during the lifetime of

the project. One alternative approach which can stimulate thinking about potential issues is network planning (e.g. PERT, CPM), identifying those logical activities necessary to achieve the objective and possible constraints.

1. The development of automated quality data collection equipment.
2. The creation of a computerised quality information database.
3. The development of software to monitor and control processes.
4. Modelling of the quality control system.
5. Study the effects of the introduction of new technology on organisation and management.
    a: An investigation and review, using discussions and observations, of current management objectives as defined by the Giga parent company and the satellite plant under investigation, the management structure which has been formed to achieve those objectives, with special reference to the competitive environment which seeks to exert external pressure on the internal activities of the plant, and the labour force as a present system influencing the desirability of implementing automatic quality inspection systems.
    b: An investigation of information definitions as a total quality management concept, using, as an approach, Stafford Beer's cybernetic management principle in order to provide a model which, given the size and structure of the company, can be carried out within the goals and aims of the research project.
    c: An assessment of the extent of the achievement of company objectives already defined, the organisation of the work force relative to job satisfaction, earnings, selection and training. A study of the interaction of the work force to the researchers/developers in a continuing process of technology transfer, using company statistics as a basis for analysis.
    d: The derivation of views of management structure in terms of quality management and information systems, and the extent to which these are directly or indirectly changed as result of automated quality control systems.
    e: The production of a case history of developments in technological change to show: success routes and barriers to acceptance in the industrial/academic interface, the interaction of academic/industrial interface on the development and maintenance of technology and its transfer to the work environment.
6. Investigation into generic applications.

figure 4.3 **An abridged version of the detailed research plan** (expanding only those activities relevant to the management researcher)

Since the aim of the project was to learn about "both techniques and methodologies for the total management of quality in a manufacturing plant", the question arises as to what had been learnt.

From a Engineering perspective, the challenge of integrating new technologies to produce a novel application of the "system" gave rise to the development of a prototype "system" in the laboratory. As appreciations of the issues developed, the way the "system" was viewed shifted from "computer-based tools to support quality control" to "a "system" which provided quality related information". The indicated a shift in orientation from technology to information, though this did not appear to reflect in a greater appreciation of the contribution from management

research. The "methodology" that emerged centred upon the creation and use of IDEF models to guide the definition of the "system" requirements.

From a management perspective, it was not possible to examine the impact of the "system" since it was not implemented in a work environment. This created the dilemma for the management researcher as to what to do. The learning process that this entailed proceeded through several iterations of understanding the situation, identifying issues, developing models about these issues and using these models to support conversations about possible activities. One specifically requested activity involved acquiring an insight and creating models about the conditions which would support the use of the developing database, though these models were not subsequently used. The final iteration concluded with the activity of producing reports. Nevertheless, during this process insights were gained into the use of the VSM as a analytical tool to support organisational analysis and also the issue of "Total Quality Management".

Although insights were provided into the use of specific tools and issues relevant to the development of the technology, no coherent methodology emerged which could guide a user through a learning process. Further, what is apparent is that since the connectivity between some of the project issues was weak, this led to outcomes which weakened the coherence of the project as a whole. There was no "group viewpoint". This is reflected in the publication of papers about specific issues, but not in the presentation of a paper which indicated the contribution of each of the issues to that of the project itself. This is also reflected in the final report which presented an "integrated" view of the learning, but disguises the differences of opinion that existed on the relative merits of the approaches used.

4.2.4 Discussion

The Cybernetic Methodology is presented here as a framework to guide the examination of a multi-disciplinary research project. By using the methodology it has been possible to make the distinction between the context in which the research was carried out and the content of this research. Whilst this has permitted attention to focus upon issues pertaining to one or the other, it has recognised the interplay between them. Thus, we have been able to examine the effectiveness of the conditions to support the research, in terms of the interactions occurring and the manner in which the research activity was regulated. Also, the content of the research was examined in terms of its coherence and whether the intent was achieved.

Although the project members succeeded in accomplishing a variety of tasks and the project was deemed a success by the sponsors, it is suggested that the project was actually a failure. The lack of organisational coherence prevented its overall aim, as initially defined, to be achieved. The mechanisms to handle the disturbances and maintain acceptable outcomes were inadequate. This is particularly relevant when considering a mechanism to deal with the delays and the inability to transfer technology. Whilst it may be suggested that the acceptability of outcomes was renegotiated in light of the events, this pertained to specific activities within the project but not with regard to the vision of the project as a whole. One cannot be changed without considering the implications upon the other. Instead, the initial vision was reduced to several "stand-alone" issues. Symptoms that manifested included not only an apparent absence of a sense of purpose of what the project was about *as a whole*, but also the poor quality of interactions and a general lack of appreciation of the nature and contribution of each other's work. Whilst there was success in presenting the right image of the project to external people, this could be described more as a political issue, rather than as an expression of actual coherence.

4.3 The Observed System

The observed system is that which is observed, here being the organisation of a manufacturing site operated by a multinational company. By taking the position of an observer observing this observed system, two issues can be addressed. The first concerns the nature of the models that the observer can generate to understand and analyse both the organisation and the issues of interest within the organisation. The second concerns what the observer can learn about the issues of interest, in this case, how a company experienced and learnt from its attempt to pursue quality.

4.3.1 The rich picture

A manufacturing plant, operated by a Fortune 500 company, was observed by a researcher over a twenty-one month period. The plant was set up by a team which included the acting site manager at the start of the observation period. Their intention was that it develop a culture which attempted to reflect the best that could be offered in terms of management theory and good management practice. This pilot operation created for the parent company a "model" organisation which could be used to evaluate the contribution of such an approach to the business. Observation of the plant by the researcher commenced two years after the first

production run, by which time the desired culture had been entrenched into organisational daily life.

4.3.1.1 Observations from a pilot greenfield site (July-August, year 1)

Located in the Bristol area, this component manufacturing plant was one of a number of world-wide locations for a subsidiary (Giga Products) of a large multinational company (Giga International). However, this plant was distinguished from the rest through its adoption of an open and participative style of management. This was a radical departure from the more authoritative and bureaucratic style of management traditional to the company. Further, the site had a degree of autonomy unknown to other sites, giving the site greater control over how it achieved clearly defined objectives.

4.3.1.1.1 A sense of identity

The desired ethos and behaviour for the site was espoused in "The Bristol Way... the way in which we want to run this business" (figure 4.4). The Bristol Way was the first site manager's vision of how the site should function, this being influenced by the experience of Westinghouse Electric Corporation (Edmondson et al, 1985). Soon after the site started up, The Bristol Way was handed over to the employees for them to develop, implement and maintain.

The intended management style is indicated by the statement:

> "Treat people as if they were what they ought to be, and you can help them become what they are capable of being".

What is significant about "The Bristol Way" is that this name captures the sense of identity of the site which the formal company name lacked. With growing self-awareness, this sense of identity matured and The Bristol Way, presented in the form of models, developed and was updated. This name clarified how things were expected to be done, highlighting the importance of people; "people like to work, enjoy responsibility and are capable of self-direction and control" (based upon McGregor's Theory X - Theory Y, 1957).

figure 4.4

THE BRISTOL WAY
CORE BELIEFS

WANTS

Way in which we want to run this business
(developed with / by technicians)

THE BRISTOL WAY

TREAT PEOPLE AS IF THEY WERE WHAT THEY OUGHT TO BE, AND YOU HELP THEM BECOME WHAT THEY ARE CAPABLE OF BEING

* Values the traditional Giga beliefs and practices that have produced safety excellence both on and off the job
* Operate a profitable business with continuous improvement in quality and service
* Not "top" heavy in management
* Won't stand over people or police them
* Develop an atmosphere of trust
* Develop interesting and long term careers for core people
* Provide technical "ownership" of areas (modules) with responsibility and accountability through self-managing teams and individuals
* Team leadership via "star model" [or other developed rota duty sharing]
* Technicians run the daily operations, with managers resourcing as necessary
* Develop empathy (understanding of the other person's problem) through appreciation of internal customer / supplier relationship of modules
* Develop a spirit of solid team work, high quality and productivity but still an atmosphere where people enjoy the job and have fun

In contrast to The Bristol Way, a more formal business oriented view of the organisation was presented in the Bristol Mission (figure 4.5). Whereas the former was viewed to pertain to everyone on the site in terms of behaviour, the latter was viewed as solely relevant to both on- and off-site management, defining the site's purpose and how it was to be achieved.

figure 4.5

BRISTOL MISSION
(year 1)

Our mission is to be a highly competitive, low cost producer of high added value products in order to become the preferred supplier to customers in Europe, but with a main focus on developing partnerships with major UK customers through creative use of the identified strengths within the Bristol environment. The principles are:

COST

- Drive low fixed cost operation, enabling adjustment of break-even to market situation, producing earning even under adverse conditions.
- Focus on high added value manufacturing in-house through flexible manufacturing processes; outplacing low added value component manufacture as high quality vendor partnerships are developed.
- Maintain drive for high span of managerial resourcing, via self-managing team concepts, releasing professional resources for creative thrust.
- Use on-site / off-site contracting for supplemental skills to support business.
- Drive towards zero inventories via in-house controls, supplier partnerships / JIT, off-site manufacture, etc. Develop self-sufficiency in local material flow systems, compatible with main central systems.
- Optimise processes and design products for highest material yield

MARKET FOCUS

- Provide zero defects, on time delivery products, to be recognised as preferred supplier (TQM thrust) to customers throughout Europe.
- Focus on major UK customers and their sub-contractors who can benefit from our local presence, flexibility and creativity (developing partnerships).
- "Forward integrate" by developing products for our partners, along with other *company* core businesses.
- Widen the range of products available through Bristol, via development / production, to meet customer needs.

CREATIVITY

- Develop flexible, creative, commercial and technical resources to meet business needs.
- Develop self-sufficiency in our people.
- Optimise use of locally creative talents (polytechnic / university)
- Be faster on our feet than competition - respond quicker to customer needs with our commercial systems and product customising capability.

TWO KEY PRINCIPLES

Values the traditional *company* beliefs and practices that have produced safety excellence both on and off the job.

Operates a profitable business with continuous improvement in quality and service.

4.3.1.1.2 Practices

The primary activities of the site are indicated in a simple model (figure 4.6). Within the site could be identified seven activities. Each of the activities were viewed as modules or stand alone businesses, each uniquely characterised. Whereas five production activities were recognised as primary activities, production itself was not recognisable and was not regulated as such. Further, we tend to unfold primary activities in the spatial domain, but tend to overlook the temporal domain, Thus, within the production primary activities, shifts were organised when required. Within process A_2 a further six primary activities could be identified, these representing individual work-centres (figure 4.7). In addition to the production activities was a recently started-up pre-production "new product development" operation, it being expected that this would develop into another of the site's

production activities. Also offered by the site was a product "problem solving" service for the design of customer-specified products to satisfy specific requirements, though this involved only a few on-site personnel. Reflecting the value-added criteria for in-house activities (figure 4.5), plating, viewed as an essential part of the production process was contracted to a specialist plating company. Process A_1 was in the process of being transferred to the site, it being a relatively new business experiencing rapid growth, but also significant difficulties.

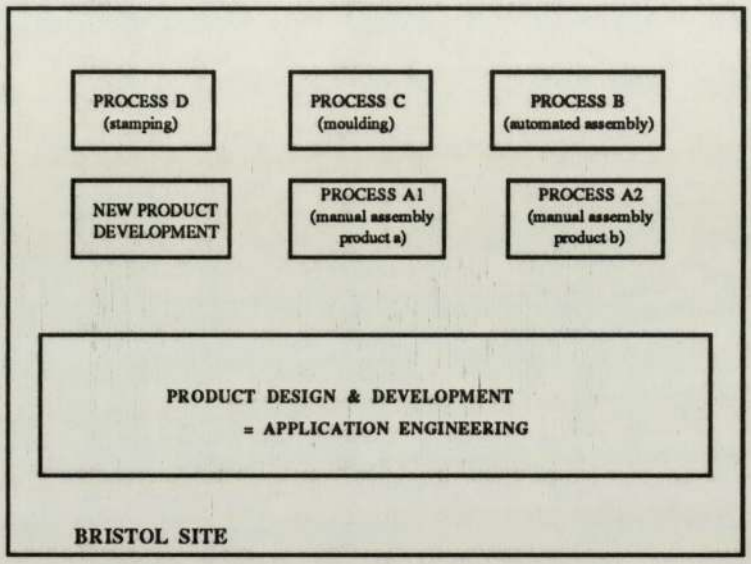


figure 4.6 A primary activity model of the Bristol site

A simple flow-chart illustrates the relationships among the distinct production activities (figure 4.7). A limited number of component part numbers (approximately 30) supported the production of a large range of product part numbers (,ooo's). In-house moulding (process C) and routing flexibility in process A_2 enhanced the variety of product which could be supplied at short notice. Activity within the pre-production product development operation focused upon the development of the processes. The transfer to the site of process A_1 presented planning with the new task of handling a large number of component part numbers to produce a limited range of product part numbers.

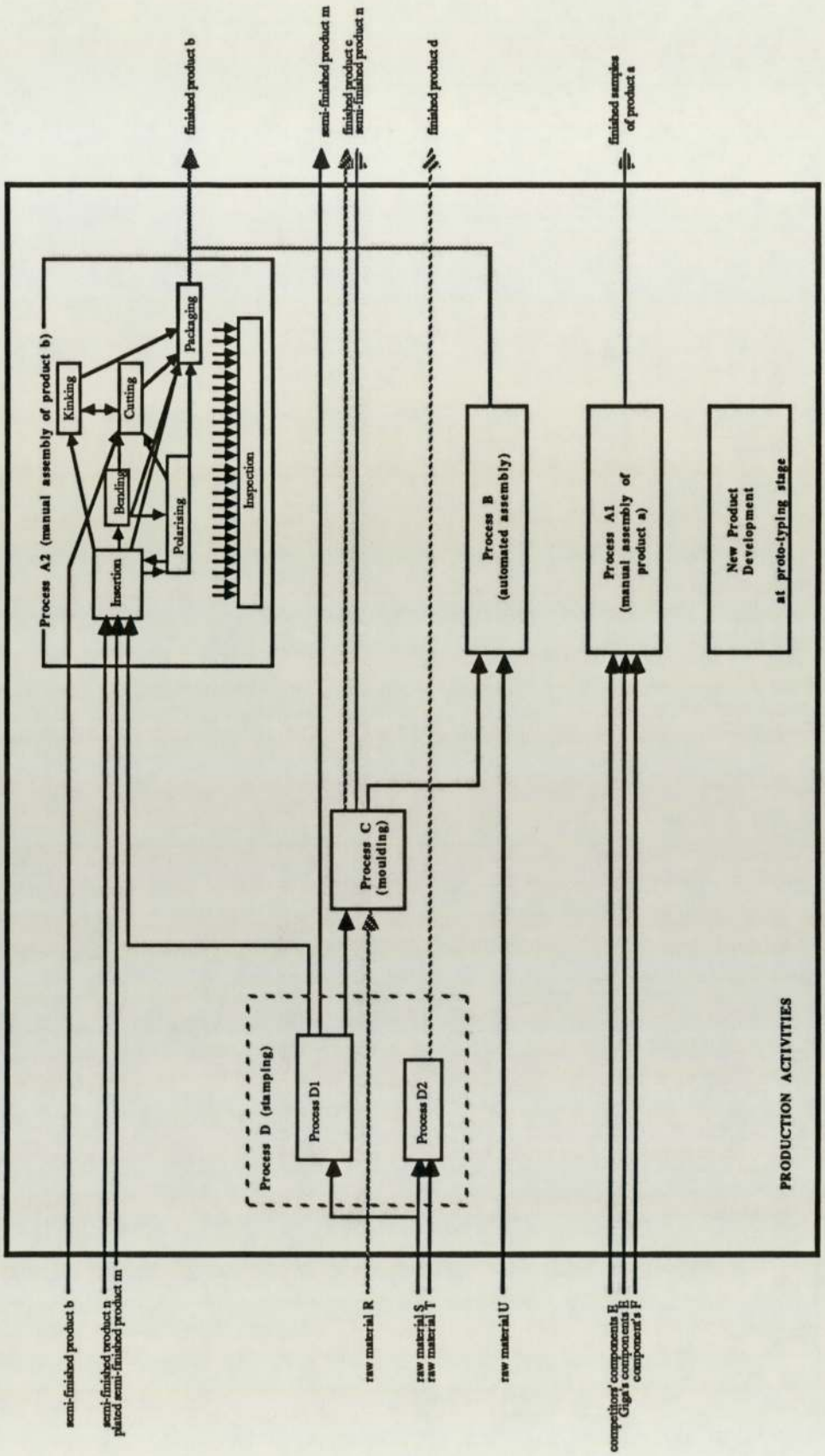


figure 4.7 A flowchart of the production activities

The site's organisation to support these activities is presented in a traditional format in figure 4.8. This provides one interpretation of the site's "reporting" structure, revealing the different roles and functions recognised. However, this chart gives no indication of the richness of the roles (e.g. figure 4.9) nor of the nature of the relationships, particularly within the larger organisation of the corporation. It disguises the complex matrix organisation into which the site was fully integrated. Further, it disguises the underlying organisational ethos, espoused in the site "statements" (figures 4.10, 4.11 and 4.12) and manifested in the openness promoted by the open-plan layout. Recognising this, the site manager discouraged the use of the traditional format, instead preferring to present the organisation in a manner illustrated in figure 4.13. However, uncertainty existed about who to approach for "managerial" assistance when difficulties arose. This was highlighted by the unclear responsibilities of the manufacturing Resource and the process engineering Resource with regard to processes B, C and D, this often leading to the technical manager being ensnared. A similar ambiguity could be identified with regard to product engineering, involving the technical manager (expertise) and the application and production engineering Resource (responsibility). Further, process A_1 was being managed by the off-site marketing division with no-one on-site being assigned responsibility for it.

The site's organisation, viewed as two tiered (figure 4.10), was organised into functional modules of self-managing teams, composed of full-time technicians, with temporary contractors providing the slack (figures 4.11 and 4.12). The modules are designed as semi-autonomous "business" areas, taking responsibility for day-to-day activities. Responsibility for each module, including budgetary responsibility, was assigned to one of the "Resources". The Resources, led by the site manager, formed the site's business team and formally met weekly.

The Resources relationship with the modules was to provide guidance and leadership, avoiding authoritative control by edict. Despite the efforts of the Resources to foster teamwork, an "us and them" attitude developed among the technicians and contractors. This was exacerbated by the technicians assuming a supervisory role over the contractors and the contractors being excluded from core company activities, e.g. morning "rack-up". Further, some of the technicians preferred a more traditional management style, whilst not all the Resources acted in the espoused manner, as symbolised by the retention of the title of manager. The ethos traditional to the corporation was latent within the site.

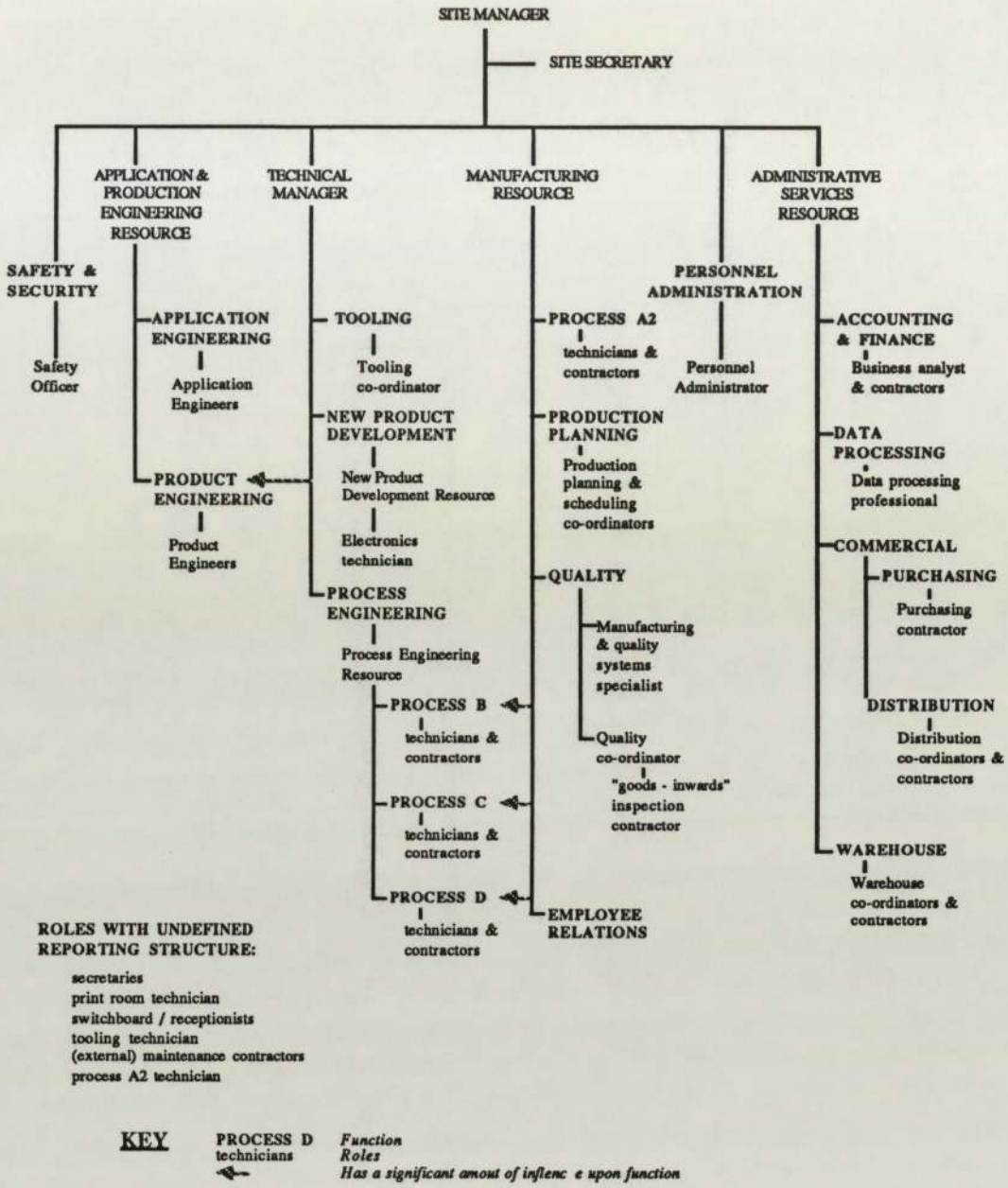


figure 4.8 Organisation chart (July - August, year 1)

figure 4.9 Overview of "Management" roles

SITE MANAGER
"to control and direct all functions of the operation of this plant"
TECHNICAL MANAGER
"to support the technical move of experience, equipment and process to the site"
"involved in all kinds of technical things" (i.e. essentially a problem solving activity)
PROCESS ENGINEER
"to provide technical support in most of the process and production areas"
"to provide leadership for problem solving in the work areas"
"to assist with training"
NEW PRODUCT DEVELOPMENT RESOURCE
"essentially a co-ordinatory role... " to ensure that the necessary people are informed of developments and brought together when required; similarly ensuring equipment is in-place when required
"to provide electronic engineering expertise"
MANUFACTURING RESOURCE
to provide "leadership for all aspects of production and production control" (planning, scheduling and quality)
"to advise on personnel issues"
"ADMINISTRATIVE SERVICES RESOURCE"
"to direct, communicate, make decisions and administrate"
"to advise... or find the expert who can advise"
"to look after the day-to-day running of the area"
APPLICATION ENGINEERING AND PRODUCT ENGINEERING RESOURCE
"to define and solve customers technical requirements by providing solutions"
"to encourage a self-managing outlook in the Application Engineering team"

figure 4.10 Organisational Approach: key features

Structure

2 strata: P & M Managers & Professional ("Resources")
T & A Technicians and Administrative ("Ownership boundary")

Environment

T & A
* Self-managing teams via core beliefs / core skill developments / "star" tool for leadership
* Technicians "own" the plant - run daily operation
* Absolute flexibility, no demarcation between skill lines - yet skill knowledge respected
* 3 shift rotating system with no supervision on shift (shift patterns developed by technicians)

P & M
* Less hierarchical
More collegiate / professional
* Resources; Guide; Lead; Motivate; Referee
* Management visible and accessible (open plan)s)

All employees are salary roll
Employee benefits "harmonised"

Modular Approach

Clearly defined semi-autonomous "business" areas
Each module understands internal customer / supplier requirements
Clear association of people with their module needs

figure 4.11 Self-managing teams

* by module / retain core (specialist) skills
* by shift depending upon module
* goals ("what" part of star) set by Resource / Manager for team
* duties shared by star / no straw bosses"
* teams decide
  - shifts required
  - vacation coverage
  - overtime necessary
  - request resources (contract people, additional training, specialist help, materials via Resource / Manager)
  - leadership / duties rota (star)
* team representatives report daily (in plant rack-ups**)
  - production performance and problems by shift
  - personnel (overtime, absence, contract operators, vacation, problems, etc.)
  - safety performance (incidents, injuries, problems, etc.)
  - quality concerns or follow up
* team / individuals participate in selection process (interviewing for new core technicians)

NB. ** 2 rack up's held daily:
morning - with Plant Manager / staff / technicians / material control / scheduling
afternoon - with production control / technicians / material control / scheduling

figure 4.12 Self-managing teams: "star model"

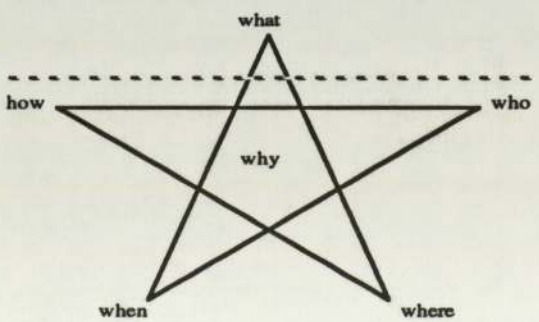
This is a model which provides a framework for organising people's efforts increasingly in a self-managing way whilst retaining the elements of accountability which are essential in any multi-functional business.

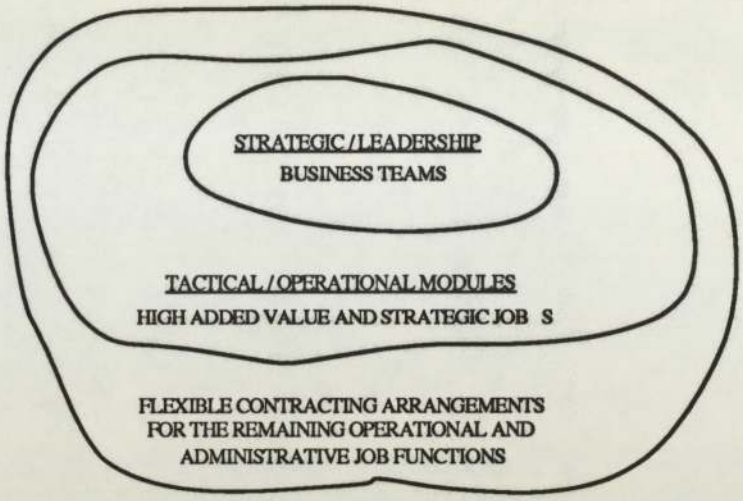
PREMISES
* many support activities can and should be delegated to the lowest level in the organisation where the knowledge and skills exist
* small groups and also ad hoc task forces made up of those people most familiar with the problem / issue can frequently resolve the problem / issue rapidly and effectively
* the output of the works of the self-managing teams has to be focused towards the greater purpose in alignment with business purpose
* accountability is an important element in an efficient organisation

The star model is a framework which attempts to depict a networking arrangement which provides guidance in organising orderly group roles around some purpose.

The five points of the star indicate the essential activities which have to be attended to in carrying out work towards the purpose.

e.g.
WHAT - managing
WHO - people, personnel
WHERE - location / environment; safety, plant, equipment, etc.
WHEN - planning
HOW - activities, actions, operations





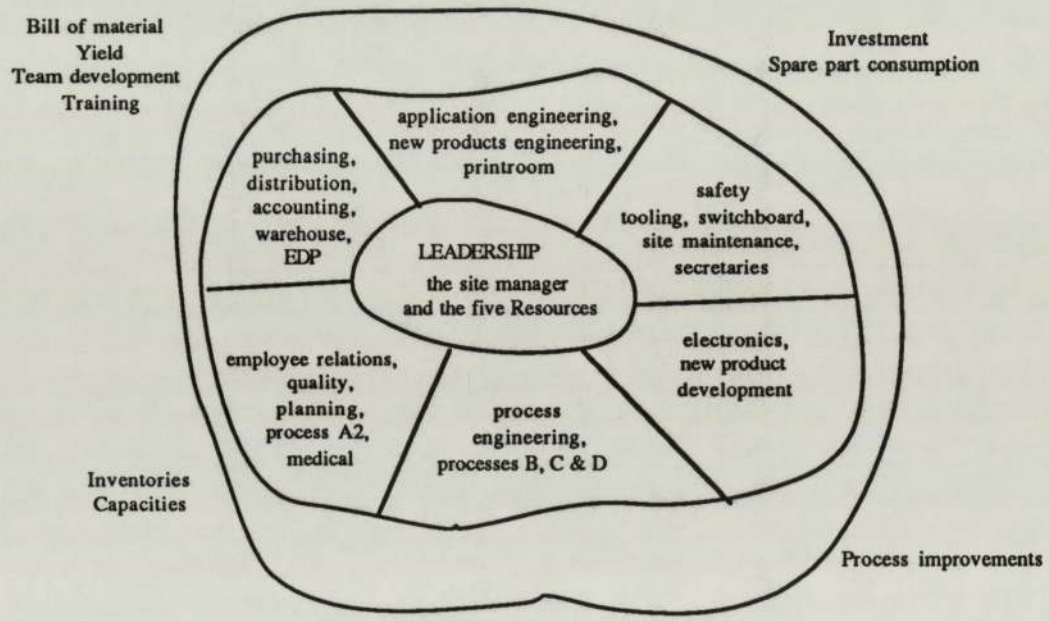


figure 4.13 The organisation chart used for presentations (July - August, year 1)

A map of the activities to support the primary activities provides a simple descriptive overview of the issues pertaining to the site (figure 4.14). It illustrates the site both as a closed loop of interactions experiencing perturbations and as a system open to information. It also illustrates the degree to which the site is integrated into the corporate organisation. A more detailed analytical view is presented of the production activities (figure 4.15). The two activities in bold type-face are the primary activities with the other activities being regulatory. Packaging is viewed as integral part of the product, protecting the product when it is not in use. The scale and diversity of regulatory activities required to support these primary activities is illustrated in figure 4.14. Further, they indicate only those activities and interactions that are observed to occur on a routine basis. They provide no indication of higher level regulatory activities that support the cohesion of these activities, e.g. management meetings. They disguise the variety inherent within each of the activities and within the interactions. Although stability in the interactions is desired, there is no indication of what the criteria are to create this stability and whether it is being achieved. Discussions with the manufacturing Resource indicated that interactions within the self-managing production teams were not always stable, particularly for the larger teams. The emergence of an "elitism" attitude in several teams also created instability but amongst the teams.

Whilst figures 4.14 and 4.15 indicate the scope and nature of the interactions they also permit the distinction to be made between manual "systems" for interaction and those based upon information technology. They reveal the interplay between the two highlighting opportunities for the further development of information technology (e.g. inspection). Further, figure 4.14 reveals the integration of the site into the corporate organisation via this information technology network; two major "systems" were being used. An under-utilised MRPII "system", ACS, supported many of the tasks connected with Production Planning, Control and Scheduling. This was fed by customer order data from the COP, which was used primarily by the Giga Sales and Commercial functions. Other "systems" provided finance and accounting support. Electronic mail, exploiting this network, was extensively used for all types of communication.

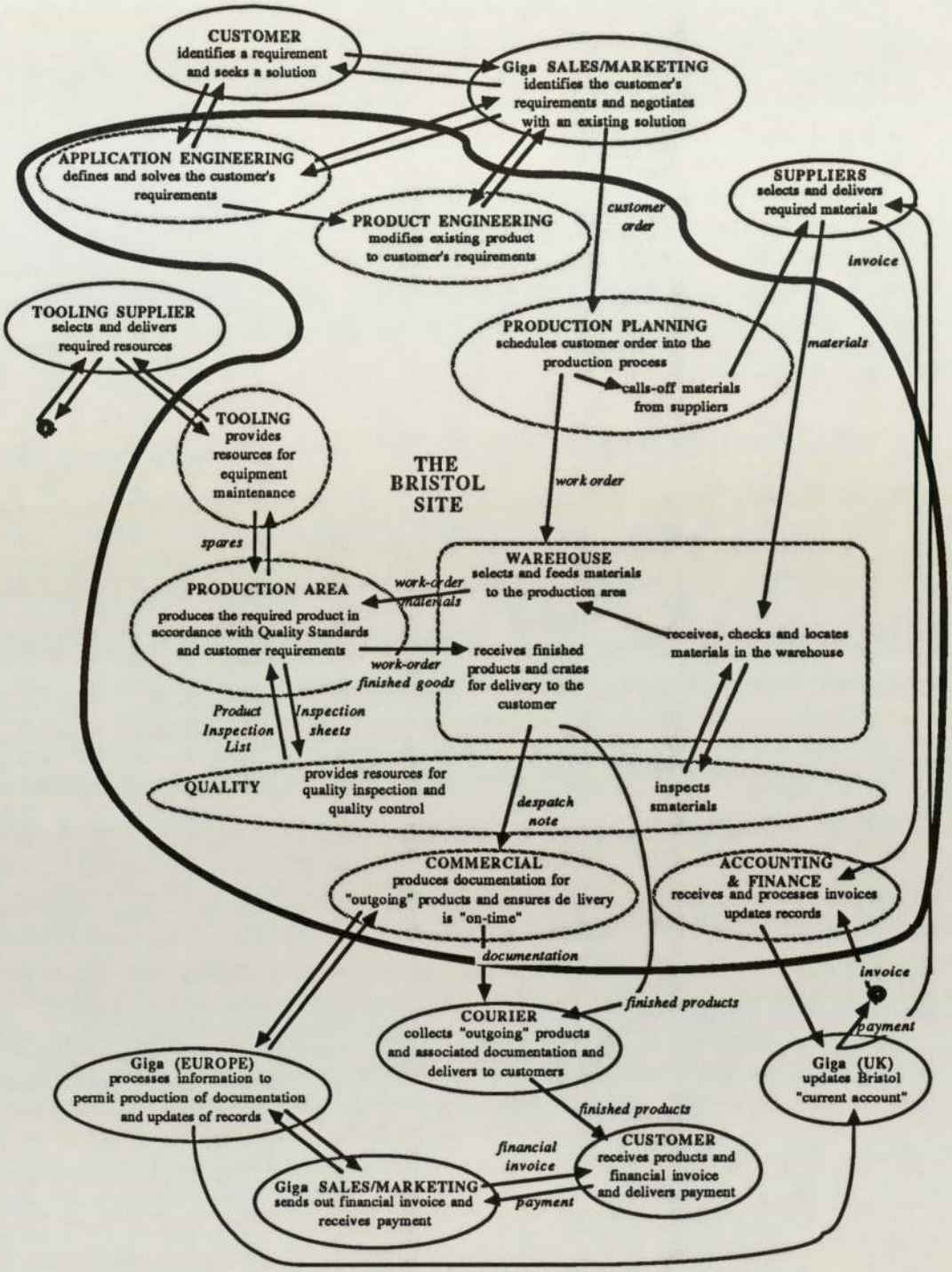


figure 4.14 A model of the key activities at the Bristol site

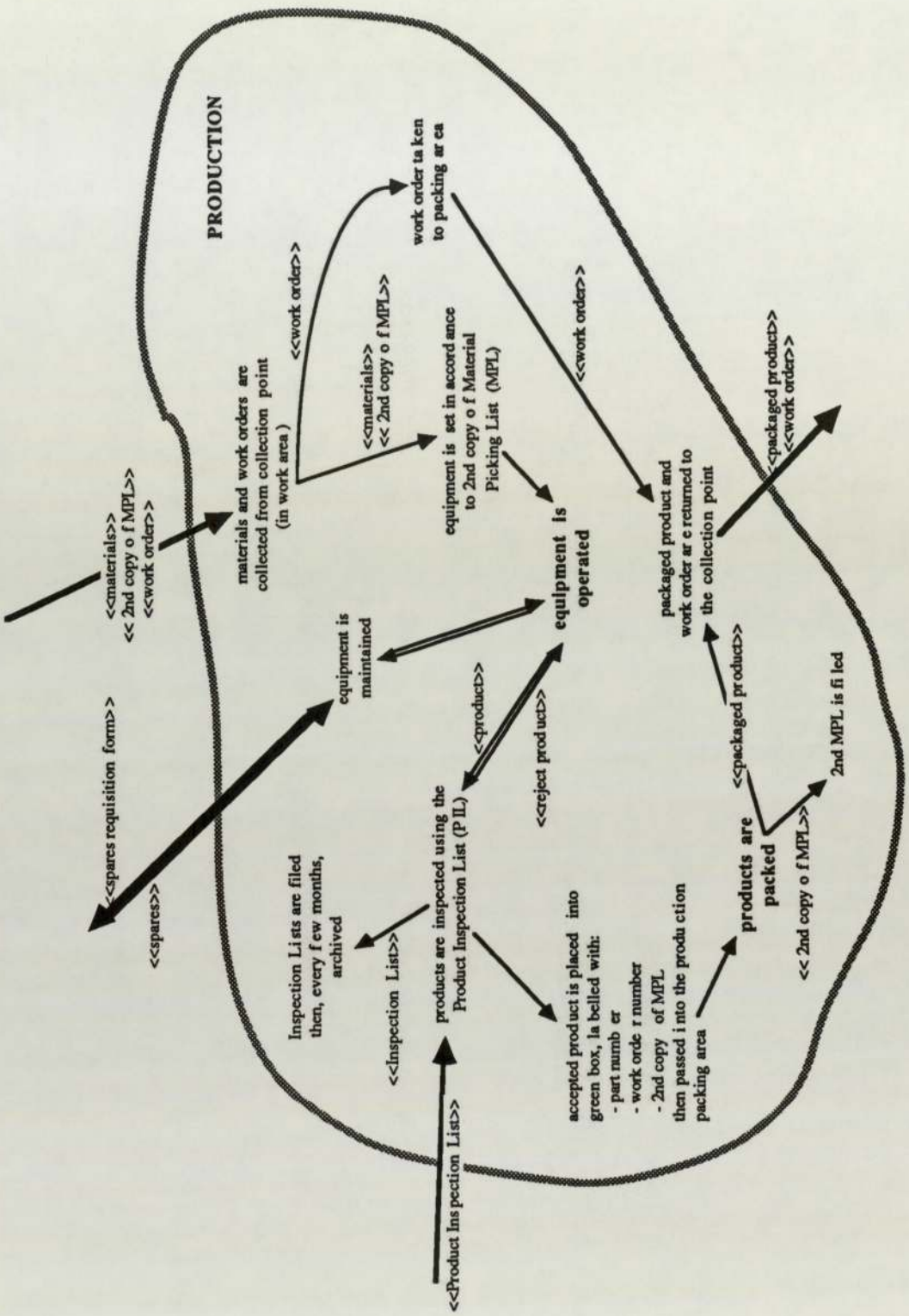


figure 4.15 Key activities within production

To support the cohesion of the site's interactions and activities, a variety of regular events were held.

Each morning, representatives from each of the modules, together with the Resources, met for 10 to 15 minutes to report the highlights and events for the preceding 24 hours and anything of interest that people should be generally aware of. Chaired by the site manager, this "rack-up" followed a formal agenda:

Safety and security; People; Visitors; Quality;
Production - percentage of capacity;
New project progress;
Production planning and scheduling;
Materials handling;

As a self-regulating act to verify conformance to the ethos pertaining to safety and quality, audits were routinely carried out by site personnel throughout the site.

Four committees met monthly to discuss operational issues and consider solutions to current problems. Membership was open to all site employees, including contractors, though there existed a core group of attendees led by an elected chairman.

The main committee was the Central Safety and Quality Committee, chaired by the site manager or his stand-in, the technical manager. This discussed issues pertaining to safety and quality in the plant, in order to originate, guide and co-ordinate the overall safety effort. Minutes from this were sent to other Giga sites and the European Business Committee of Giga (Products - Europe).

Input was received from three supporting committees chaired by elected representatives: the Programmes and Activities Safety Committee, which aimed "to encourage safety awareness and participation over and above normal site programmes", through the soft selling of safety using presentations, events and competitions; the Rules and Procedures Committee, concerned with issues regarding operating and safety procedures and the contents of the Safety Manual: the Equipment Procurement, Installation and Pre-use Inspection Safety and Quality Sub-committee, concerned with new equipment, to decide whether modifications were required for new equipment to meet Giga safety standards and to consider calibration and logistical issues.

Early into the observation period, a "Process & Hazards Committee" was established

> "to guide and co-ordinate activities relating to prevention of process related incidents on- and off-site".

The need for this committee arose due to the complexity of the processes associated with the new product development and its use of hazardous chemicals.

The site manager monitored the site's performance using a variety of measures (figure 4.16), these being gathered together by business analyst. The prime measure of the site was the "10/15" goal; 10% profit after tax and 15% return on investment. The site was viewed as viable by Giga's senior management if it met this requirement. However, the autonomy of the site pertained solely to limited Control over operational issues within the constraint of corporate policies. This was exacerbated by a complex reporting structure arising from the company's matrix organisation. Both Policy and the Intelligence-Control homeostat were located elsewhere within the organisation. The site had no influence over revenue generation other than by ensuring that the product was technically superior to that of competitors. The site could only affect the "10/15" goal" through its costs, but only a few of the Resources, including the site manager, dealt with costs. The site's autonomy was expressed through The Bristol Way.

figure 4.16 "Monthly Highlights" report

ISSUES:

Safety:	
Environmental incidents:	
Quality:	returns (% sales value), PPM1, PPM3 (ref. figure A.9a), number of complaints, highlights.
People:	indirect, direct, temporary / contract.
Yield:	percentage.
Production:	semi-finished, finished.
Shipments:	quantity.
On-time shipping:	quantity, value; early / on-time, late, overdue at month end.
Plant costs statistics:	materials, direct labour, salaries, depreciation, fixed costs, period expenses.
Inventory:	raw materials, semi-finished / work-in-progress, finished product, spare parts / packaging.
Cost reduction programme:	highlights.
Individual manager's reports:	highlighting the issues of the previous period.
Graphical and tabular information:	PPM performance, returns (% sales value), sales, manufacturing costs, distribution costs, selling expenses, technical expenses, variances, investments, manpower.

One key operational measure of particular interest to Giga's senior management was the site's ability to meet customer deadlines. Failure to meet a deadline was identified daily on the ACS with a "Late-To-Acknowledge" (LTA) being registered. The LTA was triggered when goods were shipped from the warehouse late. LTA was recorded in the currency local to the location of Giga's European financial centre. Customer Complaints were also monitored, being formally recorded on a daily basis by European Planning then transmitted via ACS (the Daily Complaints Report). However, an unofficial memo tended to be sent to the relevant site at the time the complaint was made using the electronic mail. The delay inherent in the formal "system" provided the affected site with a day's forewarning of the "problem", giving them the opportunity to commence investigation and corrective action. When on-site "problems" became visible through the in-place measures, off-site management intervened.

Other corporate events included the monthly meetings of both Giga (UK) and Giga (Products - Europe) attended by the site manager.

Although the integration of the site into the corporate organisation reveals one unclear network of interactions, an alternative network of interactions is that concerning the relationship of the site with its suppliers. The interactions required by the site to develop and maintain a relationship with a supplier are illustrated in figure 4.17, incomplete as it is. The supplier, a small plating company (Femto Ltd), held a stable relationship with the site. In a manner similar to that describing the site, the supplier can be described using organisational charts, process models and descriptions of roles and issues (e.g. Appendix B). Further, a closed network of interactions can be identified for the supplier. However, our attention focuses upon the interplay between the two closed networks of interactions. Although figure 4.14 provides an insight into this interplay, a richer picture is presented in figure 4.17, revealing the hidden complexity that underpins a customer-supplier relationship (ref. section 3.1.2).

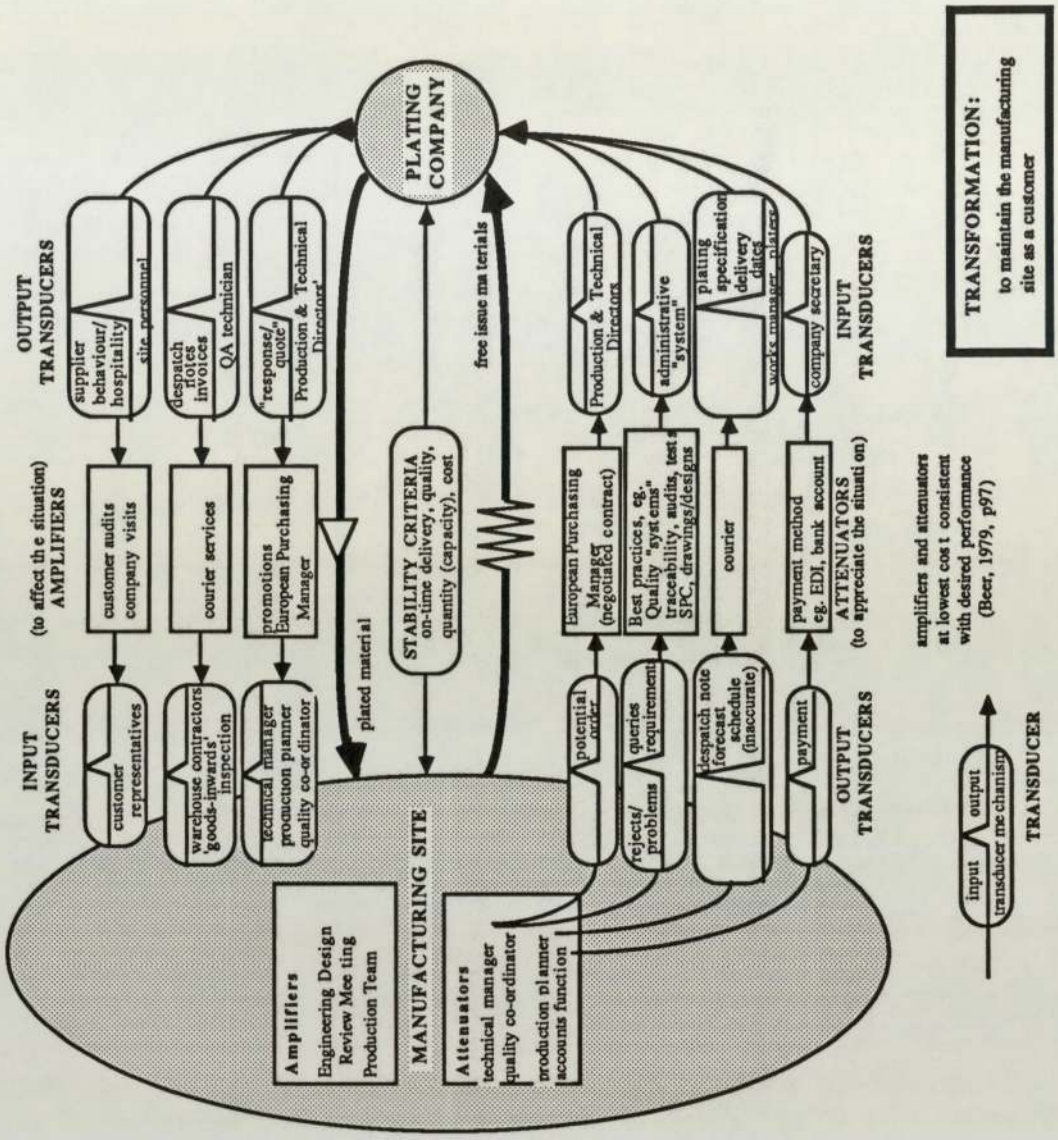


figure 4.17 Customer-supplier relationship

This diagram identifies a number of channels. What is proposed is that underpinning a customer-supplier relationship are a set of logical or necessary channels which tend to characterise such relationships. What distinguishes one relationship from another are the channels that exist and the way that these channels are aggregated together. Issues addressed by one person within a small organisation may be handled by many different functions within a large organisation. Further, whether channels are present or not depends upon the richness of the relationship. Consequently, the aggregation of channels between the two organisations can characterise their specific relationship.

Thus, when we examine the Giga - Femto relationship (figure 4.17), we can identify eight channels, embracing transducers, amplifiers and attenuators. Each channel may indicate an aggregation of channels and which can be labelled according to their function, e.g. to permit delivery, to support payment, to enquire about requirements.

Although the site interacted directly, particularly on technical issues, corporate policy for commercial transactions was implemented through specialist functions such as European Purchasing. From Femto's viewpoint this increases the number of people dealt with and can give the illusion of bureaucracy. The stability criteria of quality, on-time delivery, capacity and cost were integral to the image of the Femto. Other criteria may have existed which may not have been recognised or expressed. From the site's perspective, late deliveries and poor quality generated unnecessary disturbances and could potentially affect the site's interactions with its customers. However, due to the intense competition experienced by the site, cost was also an important issue in its supplier selection decision. Nevertheless, the site did not have a vendor appraisal "system" and thus found it difficult to evaluate the effectiveness and reliability of its channels and the ability of the supplier to feed and maintain these channels as required. The situation from the site's viewpoint was exacerbated by the site being "tied" to internal supplier sources over which it had little control.

The site's poorly developed relations with its external suppliers was contrary to Femto's desire for good customer relations. The company's pride in its expertise was supported by its desire to reduce costs through involvement at the design stage, but this was not take up by Giga. Femto provided its own delivery service, significantly enhancing this though the use of courier services. It found that forecasts provided by the customer permitted the company to develop its own crude forecasts of workload. However, inaccuracies in the customer forecasts translated into these workload forecasts. Further, resistance to customer involvement could occur when customers attempted to impose their own "systems" into the company, this reflecting the view that in these instances customer attention was perhaps misplaced.

4.3.1.2 The need for on-going improvement

The site had attempted to present itself as a "role model" of good organisational practices. Its success is suggested by virtue of the site's continued functioning, with it being permitted considerable more freedom to act than was traditionally accepted within the corporation. However, the contrast between the traditional

organisational ethos of the parent corporation and the innovative ethos of the site provided some friction at their interface. Nevertheless, the site, portrayed through The Bristol Way, had established itself within Giga as a quality organisation. This was despite it not being certified to ISO9000, though this issue was being addressed.

Though there had been significant achievements, the view was held that there was all lot of room for improvement. Thus, within the Bristol Way was a statement outlining the site's view towards quality (figure 4.18). This places emphasis upon creating the conditions to enable individuals to take responsibility for quality. Another statement identified what these conditions would be (figure 4.19), whilst a third statement outlined the issues that would be addressed (figure 4.20). However, the emphasis was upon the manufacturing processes (figure 4.21) with no corresponding statement for the supporting functions. During the twenty-one month observation period, a variety of events occurred in support of these statements. Whilst the story of these events is detailed in Appendix A, a critical analysis of the improvement process follows here.

figure 4.18 The Bristol Way - Quality Mission

TO:

provide our customers with products and systems which will meet their specified and implied standards of performance, reliability and quality

IN A WAY THAT:

gains leadership and excellence in the field of component system design, manufacture and distribution

SO THAT:

we can continuously improve our competitive position within the component systems market

PRINCIPLES

Continuous improvement of quality is a result both of management action and total involvement of all personnel. This is necessary to sustain the growth and profitability of both our business and, consequently, our customers' businesses. To do this we should be guided by the following principles:

we will create an environment which values and recognises quality and innovation, increases individual involvement and teamwork and makes full use of talents

we intend to improve our capabilities through education and training to improve the quality of our activities in the drive for excellence

we will develop understanding of our internal and external customer's current and future requirements and meet those requirements better than our competitors

figure 4.19 Quality Approach: key features

Building an environment where "quality" operation can thrive through:

ORGANISATIONAL APPROACH:

Giving process ownership (authority / responsibility) to people closest to the value adding chain from raw material to finished product

Developing a mission that focuses the thoughts and actions of the organisation towards the goal

MANUFACTURING APPROACH:

Putting in place strategic process building blocks that are readily understood by the organisation

KEY CUSTOMER / SUPPLIER PARTNERSHIPS:

Trying to better understand our customers' needs so that we can better serve them

figure 4.20 Quality Improvement

CONFORMANCE TO ISO9000

Provide formal objective evidence of conformance to quality standards

INTRODUCE SPC

Define process most suited to SPC

POLYTECHNIC PROJECT

Develop systems for quality control

SAFETY TO QUALITY LINK

Improve quality system awareness via quality teams and committees

BATCH ID

Traceability throughout production process

figure 4.21 Quality manufacturing processes at Bristol

OUR QUALITY MANUFACTURING THRUST IS TO BE:

fully engineered
well documented
properly tooled
under statistical control
based on well operated and maintained equipment
safe

USING MATERIALS THAT ARE:

100% quality
delivered just-in-time
i.e. supplier partnerships

AND RUN BY PEOPLE WHO ARE:

well trained and follow documentation
using their brains
committed to the Bristol Way
feeling 100% responsible for their product quality
i.e. our technician teams

4.3.2 The Cybernetic Loop

Since quality is an integral aspect of organisational life, it may be expected that the conditions to support quality and its espoused continuous improvement manifest within the existing organisational mechanisms, with additional specialist support being provided by a quality function. However, whilst a quality function did provide specialist support, in turn, supported by a corporate European Quality Assurance Team, the question arises whether these conditions existed?

Since there was only limited access to the wider corporate organisation within which the Bristol site existed, organisational mechanisms were identifiable for only those primary activities pertaining to the site (figure 4.22). The effectiveness of these mechanisms was inhibited by the unclear responsibilities of the business team. Responsibility for the control of activities was clarified in January, year 2. Further, on-going difficulties experienced with the larger self-managing teams reflected a lack of understanding of team-work processes, despite the assistance of expertise. The role of the Resources to provide leadership within the teams was marked by the Resources being renamed Leaders. At the level of the individual, the technician - contractor divide undermined the morale of the contractor. This divide conflicted with the view of the individual being responsible for quality. Contractors were progressively given access to previously excluded events. One issue which emerges concerns the ability of those to do the task, both in the technical content of situations and in the handling of people, inexperience or lack of ability inhibiting progress. Communication, whilst not being a serious issue, was viewed as being open to improvement. Further, the compounding of events, both planned and unplanned (Appendix A) led to administrative difficulties, revealing a lack of both understanding of the in-place "systems" and ability to modify these "systems", especially the MRPII "system", to accommodate change.

Thus, the organisation to support the functioning of the site was potentially dysfunctional, this manifesting in the incidents that ensued. Nevertheless, the question arises whether the organisation was capable of the improvements it espoused, these placed under the umbrella of "quality". This can be evaluated by considering three issues: direction, monitoring-control and adaptation (ref. section 3.1.1).

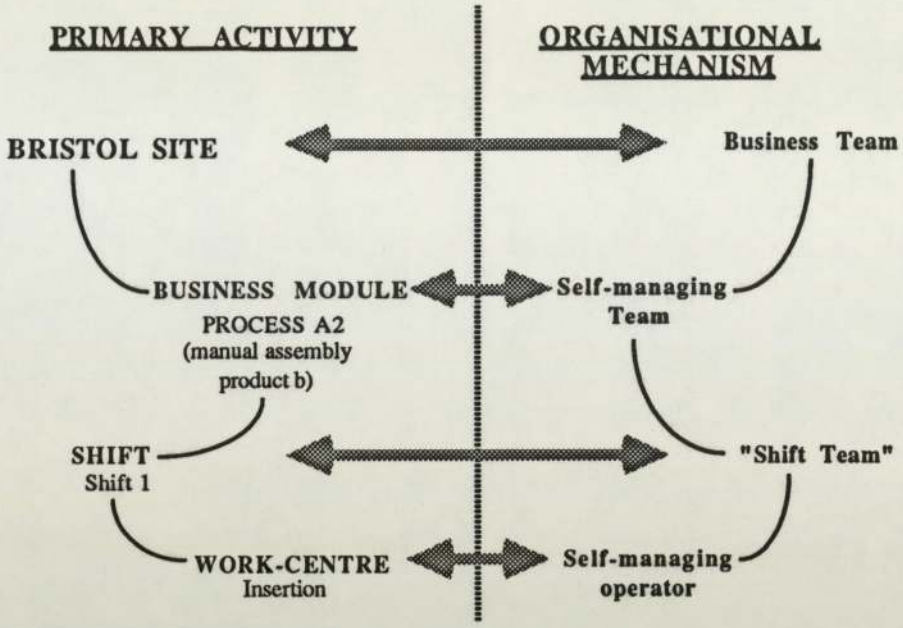


figure 4.22 Organising for viability

4.3.2.1 Direction

At a corporate level, despite the rhetoric (e.g. in the annual financial report), there was lack of evidence of corporate commitment to quality. This was particularly noticeable if a comparison was made with the profile that safety had as a corporate issue. This raises several questions. Did corporate management appreciate the demands required of the organisation for it to succeed in pursuing quality? Was the organisation learning from its success with safety and using these insights so as to make progress with quality? The apparent lack of any direction was highlighted due to it not being evident: nothing appeared to be handed down and absorbed in the mechanisms and attitudes within the organisation. This raises the issue of corporate responsibility for quality and the means by which they express their commitment.

At the level of the site, the attitude from above could be perceived as "get on with it". Nevertheless, the Bristol Way provided the site with a vision of quality (figure 4.19). However, the question arises as to how this vision was to be realised. The arrival of a new site manager (Sept, year 1) offered the site leadership. Further, the clarification of roles and responsibilities led to the recognition of the value of leadership. However, the distinction could be made between the leadership offered and the need for site and team leadership. On offer was a site manager "leading" "leaders" who could each be "leading" a number of distinct teams. This raises the

question of what behaviour should be expected from a leader, particularly in the context of quality. What would summon someone to follow?

A year later, the site manager reflected that perhaps site management, including himself, were not committed enough. This was expressed in the leadership for quality being a part-time affair, with this role being transferred from the manufacturing Resource to the technical manager then to the site manager himself, who, in turn, upon his departure eighteen months after his arrival, handed it back to the manufacturing Resource. This part-time status manifested in quality taking second place to the primary tasks of those assigned with quality. Further, it transmitted the message of lack of commitment and low priority. This was highlighted by the on-site profile of safety and the full-time status it received through the safety officer. The site manager also recognised the lack of a strategy, establishing the process by which improvements would be achieved. Whilst he accepted responsibility for this, the mechanism to bring this about needed to involve the business team as a whole. However, other than the brief weekly meetings, there was no mechanism for the business team to discuss strategies for the site.

Direction for quality is perhaps least identified at the level of the self-managing team / module, whereby the team lacks the ability to set direction for what it can achieve, despite it being effective in achieving set tasks. The prevailing view was that team leadership was not desired from within the teams, instead being provided from outwith the teams by the renamed "Leaders". Nevertheless, in the smallest team much was achieved, with the team organising themselves to free-up time for their vision of their process to be realised.

At the level of the individual, whilst quality was the responsibility of everyone, individual quality aspirations were suppressed by the weak team quality ethos. Further, the technician - contractor divide did not contribute to promoting the quality ethos.

4.3.2.2 Monitoring-control

Irrespective of the vision, the reality of what occurred was a series of unco-ordinated activities. Emphasis appeared to be placed upon improvements within the production areas, underplaying the potential for improvement of the "systems" supporting the administration of the primary activities. Indeed, improvements to the MRPII "system" appeared to be viewed as distinct from "quality related improvements".

The monitoring of site events, in particular quality could be viewed as effective (e.g. morning "rack-up", monthly highlights, internal audits). However, with all this information, the question arises as to whether this led to improved control. It appears that the site was predominantly reactive in approach, with time taken up with "fire-fighting". This was reflected in the measures which took prominence, these indicating failure after the event: customer complaints ("escaped" defects) and PPM (end-of-process sample). Whilst data was collected on a daily basis (at the "rack-up") offering insights into how the site was behaving, i.e. within acceptable limits or not, this data lost its value by not being used to establish what was inhibiting better performance, which in turn failed to lead to improvements.

Consequently, the teams, if they met targets, could be expected to be satisfied with their achievements. They were "in control". The inspection data they collected was used to monitor that process performance was within tolerance and to clarify issues raised by customers after the event. The incentive to improve was, with the odd exception, not driven by the data they collected and the "problems" they experienced. This was exacerbated by the use of "old" equipment and irregular maintenance practices within the production teams. Instead the incentive was artificially promoted through the Continuous Improvement Team and a suggestion scheme (section 4.3.2.3). The emphasis upon self-management and teamwork did not uniformly translate into improved practices. Whilst a small team of three made significant progress in the development of inspection technologies, this was not reflected in the larger teams, composed of up to twenty technicians and contractors.

SPC was viewed as a desirable tool to be introduced but its introduction was slow. But, the question arises whether it would have made significant difference, since effort was already being made to collect data, but this effort was not being utilised to translate this data collection exercise into something that would yield information which could lead to improvements.

At the individual level, the ability of personnel to achieve improvements was inhibited by wide variability in their individual capabilities and also by the inexperience of many "new personnel" with the company's practices. Further, although practices tended to be guided by documented procedures, these "systems" were generally poorly understood. People did not appreciate how they fitted into the "systems". Also, poor understanding of the IT "systems" led to their under-development and the creation of manual "systems". Awareness of what was happening within the company improved with the new site manager, though this

did not result in more useful information for the individual. Not only were personnel not necessarily able to appreciate the value of information and take appropriate action if relevant, but mechanisms to distribute "problems" to the appropriate person were haphazard. Further, the technicians were expected to supervise the work of contractors as well as to inspect the quality of the product. Whilst self-management was an espoused feature of the site, this was hindered by individual abilities, practices and "systems". Thus, the quality message failed to make an impact.

The quality team, whilst providing a service, assumed control over the production of quality related information. However, they were not in a position to take effective action based on this information, instead being limited to "recommending" that others take action. However, those in a position to take action often did not appreciate the significance of the data. The transference of goods-inwards inspection from the quality team to the warehouse team, did little to improve the warehouse team's use of the information. What resulted was the failure to translate data collection practices into improvement orientated action.

4.3.2.3 Adaptation

Although amendments were made to both the site's mission and vision (the Bristol Way), this was directed towards clarifying its purpose rather than indicating a shift in direction. For the site, change was about how to improve how the mission was achieved. The Bristol Way, espousing the vision of how this was to be done, focused attention upon the behaviour of the individual and the role of all personnel in supporting continuing improvements and so improve competitiveness. Whilst change was accepted as an on-going feature of the site, the question arises as to what mechanisms were required which would transform this vision of continuous improvement into reality.

Whilst the monitoring - control mechanisms regulated how the primary activities function "now", adaptation mechanisms (the Intelligence - Control Homeostat) are required to effect "what might be". Change must take place both in the view (the models) people have of the primary activities and in the primary activities themselves. While the first involves the unfolding of the vision and the setting of new criteria of acceptable behaviour, the second concerns the actuality of effecting the necessary changes within the situation. This involves both the removal of disturbances and the development of those preferred properties latent within the

process (section 3.3). Further, attention should also focus upon how to regulate the change process and thereby enhance the likelihood of its success.

Two mechanisms which could be expected to accomplish this were the Design Review Process and the business team.

The emphasis of the Design Review Process was upon the setting and production of acceptable outcomes based upon customer requirements, but within a context which extended beyond the site to incorporate those functions within the wider organisation of the corporation. Whilst customer needs were translated into customer specifications by the application and product engineers, the question arises about the effectiveness of the processes which transformed specifications into designs then products. The design review process provided the opportunity to design quality into both the product and the processes that transformed materials into product. However, whilst this provided an opportunity for improvements to the existing "system", its immaturity as a mechanism within the company failed to take up this opportunity.

The emphasis of the business team was upon the interplay between the acceptability of what was happening now and the future but in the specific context of the site. However, the team rarely met together for sufficient duration in which such issues could be discussed. Consequently, there was no on-going process to devise, enact and revise a coherent strategy pertaining to the development of the site as an entity. Instead, compressed into irregular weekend reviews emerged issues for action, for which there was no mechanism to ensure the action on the issues.

In place of this a Continuous Improvement Team was created (Feb., year 2) to identify opportunities and create Task Teams to establish and implement appropriate action. Membership was composed of the business team and representatives from all site functions. Although it functioned in parallel to the other on-site Committees, it provided a forum for much discussion but failed to result in the "mobilisation" that was intended, leading to deterioration in its support and over the ensuing year.

With the absence of a mechanism to translate the vision into an actionable strategy, there was nothing to be transferred to the individual teams to guide them in terms of what could be achieved. Whilst one small (three man) team engaged in innovatory practices, this was not widespread. Generally the teams confined their own meetings to the day-to-day monitoring-control of the team's activities. Whilst the individual had to "freedom" to give expression to any views of "what might be",

this was frustrated by the lack of any "system" to deal with these views other than the suggestion scheme run by the Continuous Improvement Team. The ineffectiveness of team adaptation mechanisms led to lack of development of both the teams and the individual. Although training was introduced, the conditions were not fully supportive to effectively translate this training into improvements. Training did not appear to be provided as a coherent package thereby meeting the needs of the individual, the teams and site.

One issue which is highlighted by its omission is that concerning the improvement of supplier relations. Supplier appraisal and partnerships were poorly developed, exacerbated by the involvement of corporate functions. Nevertheless, although difficulties were experienced with poor quality goods and late deliveries, this did not appear to be viewed as an issue offering an opportunity to improvement.

The quality function, supported by the European Quality Assurance Team, although providing technical service to the site, failed to effectively facilitate the improvement process. However, whilst this may have been expected from them, it has to be questioned whether they had the ability to facilitate the process. Further, the question can be asked whether the quality function permitted management to abdicate responsibility for managing improvement as an intrinsic feature of their business.

4.3.2.4 Summary

Despite the creation of an organisational format which utilised "best practices" and was potentially supportive for making the transition from the vision and mission to reality, the site failed to create mechanisms which ensured the necessary conversations that would led to action. The direction was potentially strong and monitoring-control mechanisms appeared potentially powerful. However, they were weakened by the inadequacy of the site's adaptation mechanisms to link the two.

Change, an accepted feature of organisational life, was not handled as an issue intrinsic to the functioning of the site, instead appearing to be "allowed to happen". Improvement was not addressed as an issue intrinsic to the management of the site, instead being handled as an additional issue requiring attention. This was exacerbated by the apparent emphasis upon the production (value-adding) processes (figure 4.21), thus underestimating the contribution and potential of the administrative "systems" in enhancing this value added. Further, people were being

treated in a manner which conflicted with the ethos of the site. There was no extension of the site ethos into suppliers, suggesting that these interactions were inconsistent: one behaviour for "inside" and another for "outside". Importantly, the corporate ethos transcended the site ethos, with little visible indication of corporate support for the site ethos. The fact that the site was allowed to continue to operate may have vindicated The Bristol Way, but it did little to motivate on-site personnel. "Systems" were introduced but their acceptance by users was slow.

The incidents experienced were symptomatic of both the inability to adapt to change and the underlying lack of appreciation of the required conditions to support change. The consequence was the dilution of the impact of the enthusiasm and energy for improvement.

4.3.3 The Learning Loop

Among the issues identified relevant to the pursuit of quality and continuous improvement, five were perceived as meriting special attention (figure 4.20). Attention focused upon tools (SPC, the polytechnic project and batch id) and standards (ISO9000), also recognising the opportunity to learn from the corporation's success in handling safety and to transfer this learning to quality. However, this suggests a lack of appreciation of the necessary conditions to support quality, i.e. the necessary interactions which would support the effective use of these tools and adherence to these standards.

Further, progress in each of these five areas was poor (e.g. SPC / batch id were not introduced, ISO9000 was not achieved), suggesting that those involved (e.g. the quality function, the European Quality Assurance Team, the business team, corporate management) did not sufficiently understand what required to be done to achieve results. Consequently, they were not in a position to be able to create the necessary conditions to support progress. This led to a lack of impact from "projects" started. This is illustrated with the learning associated with the polytechnic project, involving the development of technologies to support control of product quality.

The opportunity existed to develop "systems" which would facilitate self-management. However, this did not succeed with explanations being expressed:

> "many of us haven't seen anything visible yet" (site manager)
>
> " a little bit overcomplicated for what we wanted... it tended to take a long time to run through from start to finish with the package"
> (Quality Systems Specialist)
>
> "Certainly, our proposed system wasn't 100% perfect... <<the technical problems>> were not insolvable, but which would have required... considerable amount of investment... also a tendency to think that the application was quite possibly, too sophisticated and needed to much installation." (Engineering leader)

Whatever the reason, the question is raised regarding the mechanisms used by the site to manage the process by which their requirements were transferred into "systems" they could use, from the viewpoint of the site. The absence of mechanisms to handle this process raises the issues of the commitment of site management to the project and the attitudes of individuals. However, their co-operation suggested that the issue was not so much a question of commitment, but a failure to appreciate what they could learn.

Thus, irrespective of whether the issue was the Design Review Process, offering opportunity for reviewing all issues pertaining to the provision of a customer service, the installation of SPC or meeting the requirements of ISO9000, the learning process was ineffective. The question can be asked as to what degree the data collection processes (e.g. PPM, customer complaints, inspection) were directed towards being seen to be doing the right sort of things rather than to provide the basis for improvements. This raises the question as to the commitment of individuals to effecting improvements. Further, whilst individuals may have learnt about issues through experience, informal conversations or formal training sessions, the conditions were not supportive for ensuring the necessary interactions in which on-going conversations could ensue which would lead to continuing action. Thus, not only did the site fail to learn, manifesting in a lack of improvement, it failed to create the conditions to support the learning process. The organisation appeared not to know how to learn.

4.4 The interplay between the Observing System and the Observed System

The previous two sections (sections 4.2 and 4.3) have presented insights into the complexity associated with the on-going events of two systems named the "observing system" and the "observed system". However, whilst these two systems may function independently of each other, this is not the case, leading to the situation in which a researcher, as a member of a community of researchers (the observing system) is interacting with the manufacturing site (the observed system), both as an observer and as a participant. What arises is the interplay within both the observing system and the observed system and also the interplay between them. By examining this interplay we can gain an insight into how learning within one system can affect not only learning within the other system, but also the conditions within which this learning takes place. What also becomes apparent is how conditions within the observed system can inhibit learning within the observing system. We can start to appreciate the contribution of this interplay to the complexity inherent in a situation.

4.4.1 A model of the situation

Within the situation constituting the research project a number of key participants can be distinguished in both the observing system and the observed system (figure 4.23). The researcher, as an observer of an observed system (the collaborating company), was a member of a group of observers (the research group), who in turn were employees of an educational organisation. Other participants were the research sponsors, who included the collaborating company (the observed system). These participants constituted the observing system. Within the observed system could be recognised the collaborating company, which was a sub-unit of a multi-national organisation. However, other participants within the observed system could be identified, these being the members of the research group who were attempting to develop and introduce a prototype technology into the organisation, the researcher and the "consultant" ("H"). Although not represented in the model, a supplier to the site was later identified. The provision of a consultancy service by "H" did not infringe upon the research activities and again had clear objectives.

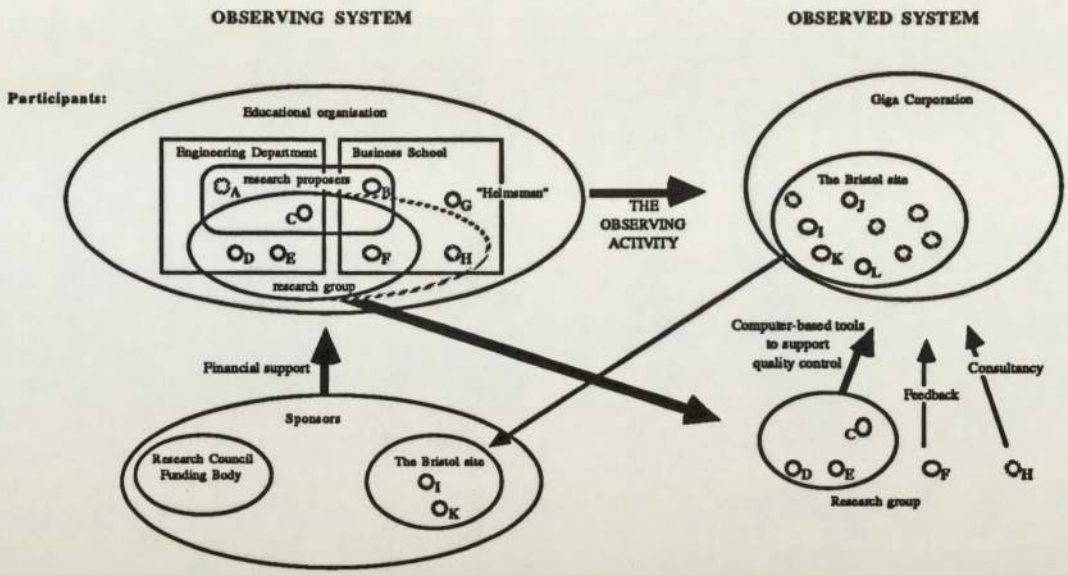


figure 4.23 The key participants in the situation

Individuals are identified by small circles and an attached letter, this identifying the person. The people are grouped according to distinguishable organisations. Two situations are presented, named the Observing System and the Observed System. Certain people act out roles in both situations, this indicated with the arrows. The person identified as "A" withdrew from the project at an early stage, with his role being filled by the new Head of Engineering. "H" participated in the project at an early stage then withdrew. He was later contracted by the company as a consultant. "C" co-ordinated the project, in terms of administration, liaison with the Research Council and significant meetings. "B" delegated his involvement in the project to the role named "Helmsman", this providing support and guidance to "F" (the researcher). After five months, this role was transferred from one person (who had early involvement in the project) to another person (who was unfamiliar with the project).

4.4.2 The researcher's dilemma

The difficulty faced by the management researcher upon taking up his appointment within a multi-disciplinary project team, was in establishing an acceptable programme of research that could be accomplished within the time-frame of two years. Whilst the research proposal loosely structured the problem situation from the perspective of the project team, the activities proposed for the researcher seemed at odds with events. Since the researcher was operating within the boundaries of the research proposal and therefore the proposal provided the researcher with the basis from which to explore relevant names, both organisational and issue-based.

4.4.2.1 What to research? the interplay between the content of the observer's observations and the context of the observed system

The expectation of those within both the observing and the observed systems, this being clearly defined at the outset, was that computer-based tools ("systems") to support quality control would be transferred from members of the research group to the site users. The role intended for the researcher, as defined in the research proposal, concerned the technology and were directed towards observing behaviour in the observed system: those interactions between the research group and the company which supported the technology's development and transfer as well as the impact of the new technology within the company. In other words, the content of the researcher's activity concerned the context of the technology's development, transfer and implementation, this involving the activities of the other researchers' and the company.

However, a distinction could be made between the context espoused for the development, transfer and implementation of the technology and the actual situation. Indeed, events did not unfold as anticipated in the research proposal. Eight months after the researcher's appointment, "C" announced that, in the absence of any foreseeable technology transfer onto the site, the prototype development, which had been on-going for some time, would take place (i.e. continue) within an Engineering laboratory of the observing system.

Since the anticipated interactions supporting its development, transfer and implementation were not occurring, the context for the technology had been tacitly redefined. The context presented was not consistent with that underpinning the project objectives and was inappropriate for the researcher's research. Since the context was the intended content of the researcher's research, this created the dilemma of what was to be the revised content of the researcher's research. As an observer, the researcher could not affect the observed system. However as a participant within the observed system he could influence events, in particular, create the conditions (context) to support the transfer of the technology, if this was both feasible and desirable. This brought into question the anticipated role of the researcher with regard to both the observing system and observed system, this highlighting the nature of the content of his research.

4.4.2.2 The role of the researcher: observer and/or participant?

The researcher was clearly a participant within the observing system. The question arose as to his role with regard to the observed system: participant and / or observer .

Whilst it was unclear whether the researcher was a participant in the observed system, it was assumed that his role involved observing events within the observed system. Indeed, access was freely made available to those within the company. The question arose regarding whether he could, should and actually participate in the events of the observed system. The concern of the researcher and colleagues within the Business School was of being dragged into addressing issues which were of value to the site but of no research value. This raised the question of what issues would call upon his participation within the observed system? The researcher was not in a position to effect the desired events concerning the technology within the site. Further, no issues were raised which called upon the researcher's participation. Instead, participation was confined to the researcher's interactions with site members in the course of his enquiries. This provided site participants with the opportunity to clarify their understanding of what they were doing and how they fitted into the organisation.

Thus, whilst it became apparent that there was no formal role for the researcher as a participant within the observed system, it was assumed that the researcher's role was as an observer of the observed system... or was this so? The context of application of the technology was the observed system. But, since the technology was not applied in this intended context, the accepted observed system held little interest, since it could not contribute meaning to the application of the technology. Whilst the site offered itself as an observed system, the question arose as to what the observing system could learn from the site. However, this required that the observing system was clear as to both the content and context of its observations.

4.4.2.3 "the interplay between context and content in the operational domain of the participants"

The context shapes the content which in turn shapes the context. Although this interplay can be recognised, the question arises as to whether we can make use of this interplay to accelerate the learning process. The context of the researcher's research, identified by the research project, has already been described in sections 4.2.2 and 4.4.1 and was accepted as unchanging. Instead, it was expected that the

content of the research would fit within the given context. However, this created the dilemma of what this was to be. The process of discovering this was aided with an immature use of the Cybernetic Methodology focusing upon the learning loop as described in section 4.2.3.

What emerged were a series of models which highlighted a variety of issues, these being used to orient discussions about possibilities, culminating in several reports. However, it is suggested that these models were poor since they were not adequate enough to quickly establish a specific course of action. The researcher was too busy learning existing knowledge about the issues to be able to produce useful models that would present fresh insights. Although the site provided the researcher with the opportunity to link this knowledge with practices, there was no available "expertise" to accelerate this learning process. Although not considered at the time, the option that could have been considered was the addition of external "expertise" to the project team, though whether this was feasible or desirable was another issue. In this manner, the context shaped the content of the researcher's research, but this in turn did not lead to changes in the context.

Within the observed system (sections 4.3.2 and 4.3.3), it is apparent that the issues that surfaced as problematical were partly a consequence of an inadequate context to handle these issues. Recognition of this, not by the observer of the site (the researcher), but by the site's participants led to an adjustment within the context. However, the adjusted context was still inadequate for handling the issues raising questions about what context could support these needs.

Whilst section 4.4.2.1 suggested that the context of one person's interests can be the content of an observer's interest, an alternative view of the context - content interplay has been presented but with regard to a participant. It is the act of participation that effects change in context and content, not the act of observing. The context - content interplay reveals how the desire to develop the content can lead to the creation of an appropriate context. (cf. the strategy - structure debate: Hall & Saias, 1980).

The antithesis is where an inflexible context constrains the development of content. Although this constraint is apparent with regard to the efforts of the site to pursue improvements, it is more subtly presented with regard to the content of the management research. This antithesis underpins Espejo's development of the Cybernetic Methodology.

4.4.3 'the interplay of the observed and the observing systems in the operational domain of an observer"

This title when rephrased [the observed system, as the content, and the observing system, as the context, from the viewpoint of an observer, as a participant] has already been discussed (section 4.4.2.3). However, there is an alternative perspective. An observer from within an observing system observing aspects of an observed system, may affect the observed system during the process of observing. This affection, unintentional or deliberate, implies participation within the observed system. This suggests that the interplay between the observing and observed systems reflects the ability to make the transition between observer and participant.

4.4.3.1 The interplay between the content of the observer's observations and the content of the observed system

The researcher's attention focused upon the site's pursuit of quality, attempting to learn from its experience. Although it took time for the researcher to appreciate what was happening, the researcher quickly gained insights into the functioning of the various parts which were transferred through informal conversations to members of the observed system - the site. However, whilst this improved the general awareness of these people, it was not targeted towards any issues perceived as problematical to the site. Further, no-one on the site recognised how they could utilise these insights as part of their learning process.

One incident illustrates the weakness in the site's learning mechanisms. The quality systems specialist, in an attempt to improve each person's awareness of their fit into the organisation, set about the task of getting everyone to examine their relationships in terms of customers and suppliers. The process was a repeat of one carried out by the researcher a few months earlier, although the emphasis reflected different aims. The experience gained from this process was not used to improve the effectiveness of this second exercise, which progressed very slowly and did not lead to any further activity.

The lack of interplay between the observing system and the observed system suggests a lack of appreciation by all of how the insights gained by the observer (researcher) could be transformed into action which would benefit the site. A report by the observer was not appreciated for the message it communicated, this lying hidden within its "academic" writings. In addition to this communication difficulty, the observer lacked both understanding (i.e. poor models) of the issues which were

concerning the site and the experience of these issues in other contexts. Thus, the observer was unable to make the transition from an observer to an effective participant with those within the site, this manifesting in no formal participatory role within the site. To varying degrees, these weaknesses were applicable to the site members, who, as observers of their own situation, developed poor models of both how the site actually functioned (i.e. the models used were not appropriate to the application. e.g. numerical "representation" of the site's effectiveness) and of how the site could function in an optimal manner (i.e. a theory of effective organisation and information management). Consequently these poor models hindered the effectiveness of the site members (as participants) by restricting the richness of their conversations about improvements, this giving rise to inadequate action.

4.4.3.2 The interplay between the context of the observer's observations and the content of the observed system

The strategy adopted by the site was to sponsor the formation and activity of a research group to investigate an issue which was perceived as offering opportunity to the site. The research group provided the site with an additional resource pool with which to enrich the learning of the site. The issue of sponsoring research, from an observed system viewpoint, can translate into the influence that the observed system can have upon the context of the observing system in terms of whom to recruit, what to do, managing progress, etc..... It may lead to a member of the observed system becoming a member of the observing system to develop expertise about the issue of concern. However, this did not appear to present itself as an issue in terms of the continuity of the project. Instead, as has been recognised, the site failed to receive the initially anticipated benefits from this research.

4.4.3.3 The interplay between the context of the observer's observations and the context of the observed system

The interplay between the two contexts arises when a person or group participates within both contexts either "officially" or by "interfering". It raises the issues of self-interest and commitment and where they lie. It creates the dilemma of how these are to be resolved, introducing the issues of ethical behaviour and hidden agendas. It may be that an observer is unable to gain an adequate appreciation of the context of the observed situation and may resort to becoming a participant within the situation so enable this. The question arises whether participants within the

observed system are aware of the researcher's dual role of participant and observer of what they are doing.

An alternative view is that of the management of the research process. Whilst this activity was carried out by the research proposer's, the question arises as to how the site was to manage its interests in the project. One scenario could have been where the manager, liaising on the site's behalf, project managed those activities from which it expected outcomes. This could have raised questions which included: was the manager a member of the project team, how would the manager and the proposers jointly manage, would the manager manage with regard to the interests of the site or the research, how would the project management be incorporated into the management of the site. In the event the project was marked by the absence of such involvement.

4.4.4 Conclusion

Distinctions have been made between observing and observed systems, observers and participants, context and content. These distinctions provide a simple basis upon which to penetrate the complexity of a situation. Whilst we may place emphasis upon the context - content distinction when using the Cybernetic Methodology, these other distinctions permit us to make more demanding use of the methodology. The emphasis has been placed upon the interactions among participants in an observed system as observed by an observer, who is a participant within an observing system. It should be noted that attention has concentrated upon the technical content of these interactions. The social and political aspects of an interaction, whilst are acknowledged here, have not been elaborated upon here. This is beyond the scope of this dissertation and offers an opportunity for comment at a later date. Nevertheless, we can penetrate the complexity of the situation, not only to develop an appreciation of and take action about the issues which are of interest to us but also to appreciate and act with regard to the issues which may hinder this.

Consequently, we can contest how effective we are as observers observing a situation, thereby establishing those issues that affect this. We can query how effective the transition is between observing a situation and participating and effecting change within the situation, thereby developing the ability to make this transition. We can examine the adequacy of the conditions to support change, thereby creating conditions that will support change. We can challenge the issues that are brought forth as being problematical, thereby introducing alternatives.

Further, we can determine whether the change has succeeded or not, establishing reasoned explanations why this has been so. What is presented is a methodology which supports the challenging of assumptions, not at a superficial level but at a depth which exposes both personal and interpersonal weaknesses.

CHAPTER 5
ORGANISATIONAL CHANGE AND THE CYBERNETIC METHODOLOGY

The process of bringing about change in an organisation is a daunting challenge. Recognition that there is a lot of ineffective activity and waste within the organisation leads a manager to consider two options:

Ignore this in the hope that things will sort themselves out or

Do something about it.

If the latter option is chosen, the question arises regarding what to do.

"Models" of possible approaches were presented in section 2.5. However, although a model is useful to provide insight into what should be done, the difficulty arises when trying to make the transition from model to actuality. In the following account, the efforts to bring about change within a small manufacturing company are examined from the perspective of a participant (analyst). Four distinct phases were distinguishable, each characterised by a distinct approach for dealing with what was perceived to be the "problem". The final approach uses the Cybernetic Methodology.

Each approach is examined using the framework of the Cybernetic Methodology. An insight is provided into different aspects of effecting organisational change, highlighting the contribution of models in the realisation of change and suggesting the strengths and weaknesses of each approach.

5.1 An introduction to the company

A small manufacturing company, over a period of eighteen months, experienced a series of efforts to improve how things were done within the company. The mission of the company is encapsulated in the phrase

"to grow profitably as a world class manufacturer".

The company was organised on a Divisional profit-centre basis, these reflecting the key functions of Sales, Production and Engineering (figure 5.1). It was the managing director's view that these three functions were culturally different. The five Sales Divisions were organised in a manner which supported the three distinct

product families and three recognised geographical areas. The style of management was reflected in the open layout of offices, with staff sitting next to directors.

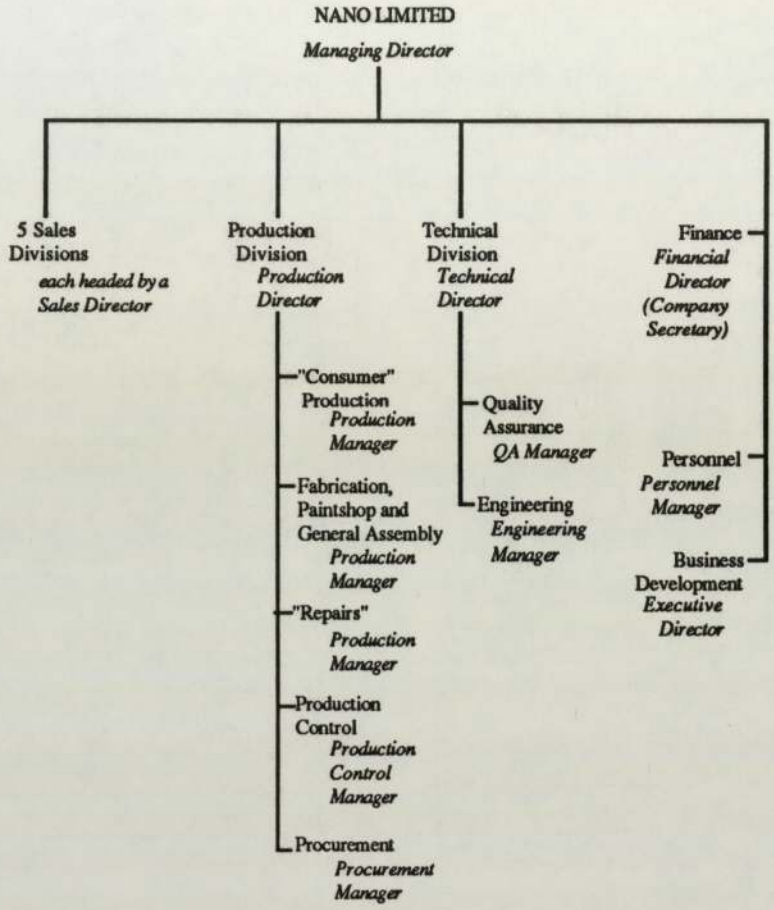


figure 5.1 An organisational chart for Nano Ltd

The situation within the company during the first six months of this period was viewed in the following terms:

Strengths:	Weaknesses:
Flexible work-force	Lack of clear direction
Technical expertise	Little strategic thinking
Good facilities	Poor planning
Strong customer base	Inadequate training
Good image with customers for products	Poor sales infrastructure
Ambitious senior management	Unreliable information systems
	Problems do not get adequate attention
	Things do not get finished

The managing director held the general view that "things were out of control", highlighting in particular the issues of quality and material control within the Production Division. This Division employed 60-70% of all employees, the remainder being located mainly within the Engineering Division.

Concern had been expressed regarding the role of the Quality Assurance function. It had successfully earned the company the award of BS5750 Certification. However, it viewed its primary role as auditing the product, processes and quality "systems", which was reflected in its image as a "policing" function. Eighty-four categories of information were filed, with little analysis being done. Further, despite the company view that "everyone had responsibility for quality within the company", few people appreciated what was meant by quality or were able to do anything about quality. Nevertheless, people were good at "quick fixes".

5.2 Different approaches - a chronological summary

The company had a tradition of being an early adopter of new ideas, though these tended to be short-lived. This "flavour-of-the-month" approach gave rise to a cynicism amongst the longer-term employees. Nevertheless, a fresh attempt to address the aforementioned issues commenced with the activities of an analyst ("change agent") to affect an improvement in how things were done on the key production line (Approach 1). Six months later, following initial successes, a Business Development Unit was created with the task of improving the activities of the company. This initially consisted of the analyst and a director, but increased in number over the ensuing period. At the same time, attention focused upon the activities of the Production Division, focusing upon the inadequacies of the existing computerised information system. Discussions among the directors led to the decision to replace the system with a MRPII system. For the following five months a programme of activities was pursued, involving all within Production and Engineering to change attitudes and create the conditions for the introduction of the new system (Approach 2). However, this was abandoned following lack of visible progress and the increasing doubts regarding the appropriateness of MRPII and the justification of its cost. This was replaced by another programme, under the supervision of external consultants (Approach 3a). The new aim was to improve the various "systems" within Production and Engineering. However, after five weeks, the consultants departed. The two directors now heading up the Business Development Unit adapted the consultants' approach and pursued it for the ensuing

eight months with the same aim of improving the "systems" within both Production and Engineering (Approach 3b). After two months within Engineering it was questioned whether this approach was appropriate and whether the wrong issues were being addressed. This gave rise to a change in emphasis and a new approach (Approach 4).

Attention during this period focused mainly upon the activities within the Production and Engineering Divisions, with the Sales Divisions being little affected by the events. However, the underlying short-lived attention-span and desire for early results dogged the efforts as one approach was superseded by another. At the end of the eighteen month period, the Business Development Unit was disbanded and the exercise stopped.

Two patterns can be discerned. The first concerns the Production Division. The initial efforts focused attention upon the people working on the production line. However, progress was constrained by the weaknesses of the in-place "systems" throughout the company. Subsequent attention focused upon these "systems", with the initial view that new "information technology" was required. However, this was later viewed as too big a step and inappropriate, with attention reverting to the "systems" themselves.

The second pattern concerned the Engineering Division. Engineering was viewed as a primary activity, providing an engineer-to-order customer service as well as an R & D facility for new products. Despite some attitudes to the contrary, Engineering was not to provide Production with a support service, it being open to Production to seek support externally. Although there were weaknesses with the "systems", it was questioned whether the emphasis upon the "systems" was appropriate. Attention shifted upon the people and their ability to perform the various tasks required within Engineering.

5.3 Bringing about change within Production

The Production Division, characterised by its apparent routine and predictability, performed a diverse set of activities centred around the three distinct product families. It was organised in a manner which gives the appearance that management responsibility is unevenly distributed (figure 5.2), this resulting from the non-replacement of a departed production manager who had responsibility for the General Assembly area. Each production manager had two or more supervisors reporting to him, who in turn each could have up to twenty operators. A high level of faults and the inaccurate and unhelpful information characterised production, though the scale of this was unappreciated due to lack of information.

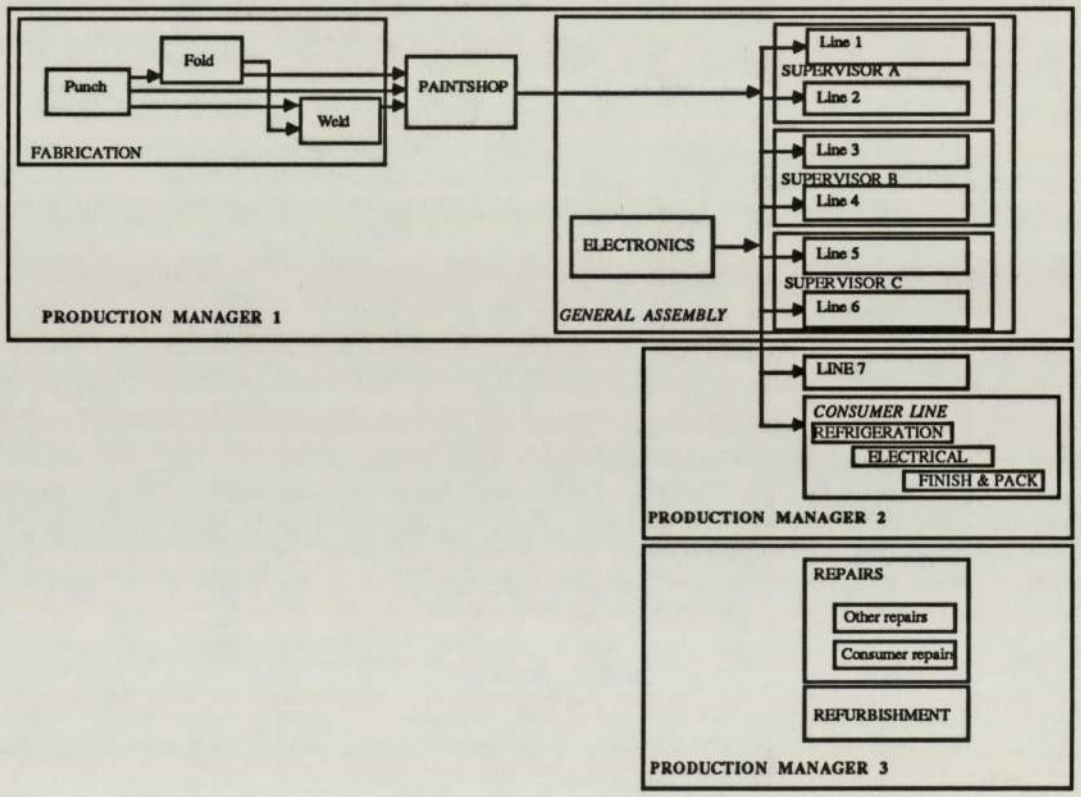


figure 5.2 The primary activities of the Manufacturing Division

5.3.1 Approach 1 - creating the conditions for problem solving

5.3.1.1 A problematical situation

The analyst's task was to seek out and effect opportunities for improving the performance of the "Consumer" production line, a high volume seasonal assembly operation which supported a significant part of the total business. Prior to being able to discuss improvements it was necessary for the analyst to develop an appreciation of the production line. A model of the line (a more detailed version of figure 5.3) was created, this serving as a device both to help the analyst learn about the line and to orient discussions with the supervisors, manager and director. This model was complemented by the use of available quantitative data to establish the line's behaviour. The central issue underpinning ensuing discussions was the high level of defective units being produced. These discussions involved all personnel concerned with the line, including the production director.

Inefficiencies for this line were magnified relative to the other low volume production lines, indicating that even small improvements could give rise to significant cost savings. A high level of defective units were being produced. Operator audits and rework stations did not discourage on-line faults from occurring. An end-of-line audit was carried out on sampled units in a specifically designed testhouse. Sales were developing a "system" to monitor customer complaints about defective units that had escaped the inspection process. This raised the issue of who had ownership for quality. One major hurdle was the abundant competence for "fixing problems", but not at eradicating them. Another major hurdle was the authoritarian style of management that pervaded the company. A third hurdle was the lack of appreciation that the line supervisors had for identifying, collecting and using quality orientated information. Little could be done with regard to the first two hurdles, but the third was actionable.

The analyst settled upon the task of establishing the means whereby faults were more readily identified, understood and addressed. This centred upon the ability of the supervisors to identify and manage the issues pertaining to the defective units. The situation could be viewed at two levels:

- the problem experienced by the analyst of how to put in-place a mechanism which reduced the level of defects and
- the problem experienced by the line personnel of how to reduce the level of defects.

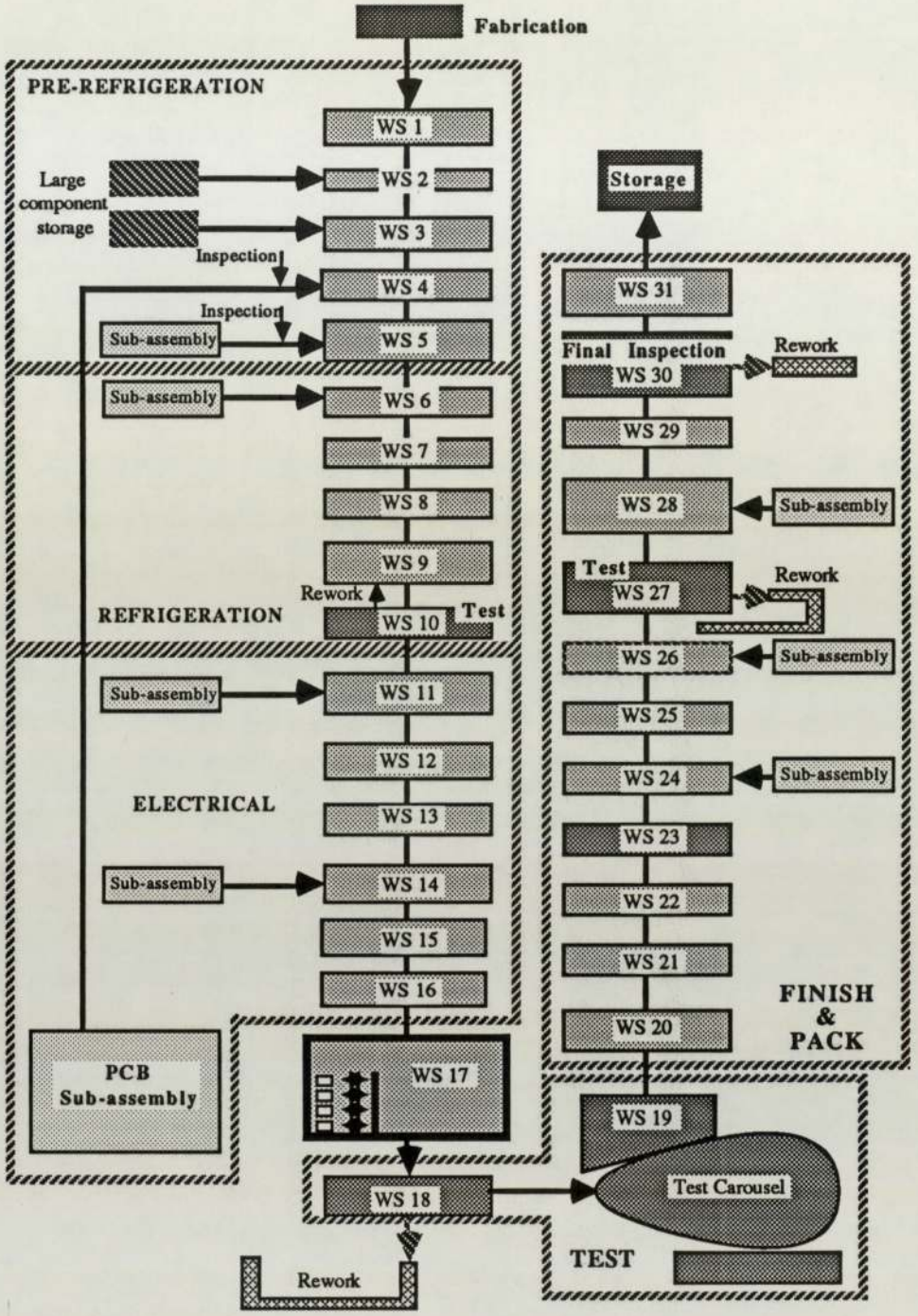


figure 5.3 The consumer production line

The approach adopted by the analyst to address his own problem is outlined in table 5.1.

table 5.1 Improving quality on a production line - approach 1

Transformation	To effect a "system" for improving quality on the "consumer" production line
Actors	The "change agent" (facilitator) and the supervisors
Customers	The "consumer" production line operators and management
Owners	Production director, (production manager?), supervisors, the "change agent"!
Duration	May to November
Regulatory mechanisms	Unplanned, evolving objectives: emphasis is upon participation and co-operation
Process	Understand the situation (map the situation and quantify the behaviour), simulate the intent and use the simulation to persuade the owners to adopt
Accomplishments	Greater appreciation by supervisors of the value of information for identifying and pinpointing disturbances (line stoppages, on-line faults) A simple system to highlight significant disturbances and translate these into actions which either eliminated the disturbance or reduced its impact Identification of disturbances that were outwith production line-management control. These tended to be associated with material control. Ownership for continuous improvement by the production director, this leading to fresh and more extensive initiatives owned by production management, including the contracting of a training consultancy .
Difficulties	Inability to gain the full support of the production manager Slow and inefficient process The "change agent" lacked direction, leadership and authority and was unclear regarding responsibility Poor visibility of progress (unplanned)

5.3.1.2 The Cybernetic Loop...

The content of the analyst's problem was the context of production's problems. The success of the problem solving "system" reflected the ability of the analyst to create the conditions to support both the introduction of the "system" (section 5.3.1.2.1) and its use for problem solving (section 5.3.1.2.2).

5.3.1.2.1 ...the conditions to effect change

The personnel who were to be directly affected included the line supervisors, line manager and production director. Over the period, the analyst developed a working relationship with these people, thereby securing their trust and commitment. This process was not regulated, instead being allowed to advance at a rate which enabled people to appreciate and accept the views being revealed. Thus, although this process was slow, the conditions were created so that open conversations about possibilities and action could freely occur.

5.3.1.2.2 ...the conditions to support problem solving

The analyst redesigned the production line "system" to create the conditions to support problem solving and presented it to the production director distinguishing between:

Problem solving:	Conditions:
Define the process:	Define the people affected:
process flow diagram	roles
existing information/data	responsibilities
Establish the measuring system:	Establish the problem solving
critical success factors	organisation:
	steering committee, problem
	solving teams
Pin-point the problems	Implement this organisation

The distinction was being made between the problems experienced on the production line and how these would be handled (cf. Learning Loop from the perspective of line personnel) and the organisation of the people who experienced these problems (cf. Cybernetic Loop from the perspective of line personnel). Despite the director's reservations about the readiness of his personnel to be organised into problem solving groups, he accepted the general programme. His concern was about the ability of his people to handle the task of problem solving.

The ethos underpinning the proposed "system" was that problems were prevented rather than rectified. This indicated that attention should focus upon the processes that were giving rise to defects. To achieve a state of prevention, problems had to be identified and appropriate action taken to ensure their non-recurrence.

Attention commenced with the process, the production line (figure 5.3), focusing upon how the flow between workstations could be better regulated. By regulating the flow using a "pull system", bottlenecks could be identified, thereby highlighting problems to trained supervisors. However, this required a low level of rework for it to flow smoothly. This was supplemented by a "system" which was introduced throughout the production areas. Problems experienced were logged onto flip-charts located beside the line for all to see. Having been brought to the attention of the supervisor, it was his/her responsibility to ensure that they were brought to the attention of the appropriate person for solving them. The problems identified were

transferred to supervisor logs, of which copies were regularly sent to the production director.

The functioning of these "systems" focused attention upon the roles of the operators and supervisors and the necessary skills required. The concern of the production director was that the supervisors and the production managers would be unable to handle this situation. Consequently, he both led and closely monitored the implementation of this "system", ensuring that problems were indeed being closed off and were not recurring. Over time, as the production director gained experience of their competencies, he became more appreciative of possible opportunities. This resulted in a long-term production strategy and new initiatives, though these were temporarily disturbed by the later company-wide activities (sections 5.3.3 and 5.3.4).

For six months, the analyst worked closely with the supervisors, developing their appreciation and use of problem solving tools and techniques of quality (e.g. Barker, 1989). From this emerged an appreciation of the skills desired in a supervisor and operator. The lowest potential level for autonomy was the operator, but it was questionable whether the operators had the necessary expertise to act independently as part of a process. Further, there was a wide variance in the skill levels due in part to the use of seasonal operators. The accepted unit was the supervisor-operator partnership, with the operator as the actor and the supervisor assisting to support the development of both the process and the operator (figure 5.4). The emphasis was upon operators and supervisors to develop appropriate mechanisms to enhance within the workstation both co-ordinated actions (e.g. layout, tools, jigs) and the co-ordination of these co-ordinated actions (e.g. standard operation, status card, maintenance programme, data collection logs). This required both skilled operators capable of carrying out these improvements and able supervisors who could provide the necessary support and not dictate. A production engineer was made available to assist these supervisors. The Nissan (Sunderland) production supervisor role was used as a benchmark. This raised the question of the best means for developing these skills.

A more formal programme of training was adopted for the supervisors, using a specialist training consultancy and involving all managers. The supervisor was to become responsible for issues which included work-place organisation, recruitment, training and motivation, process control and improvement. Information and documentation were key issues. One concern was the transferability of classroom theory into the work-place, the success of which was viewed differently

by senior management. For the operators, there emerged an induction programme followed by a training programme centred upon an in-house "school". The role of production manager, examined but not acted upon, did start to receive the attention that it required. However, this was still inadequate, since it impacted upon the development of the supervisor role; the supervisor often reverted to former practices when under pressure. Clarification did emerge at a later date (section 5.3.3.3.3).

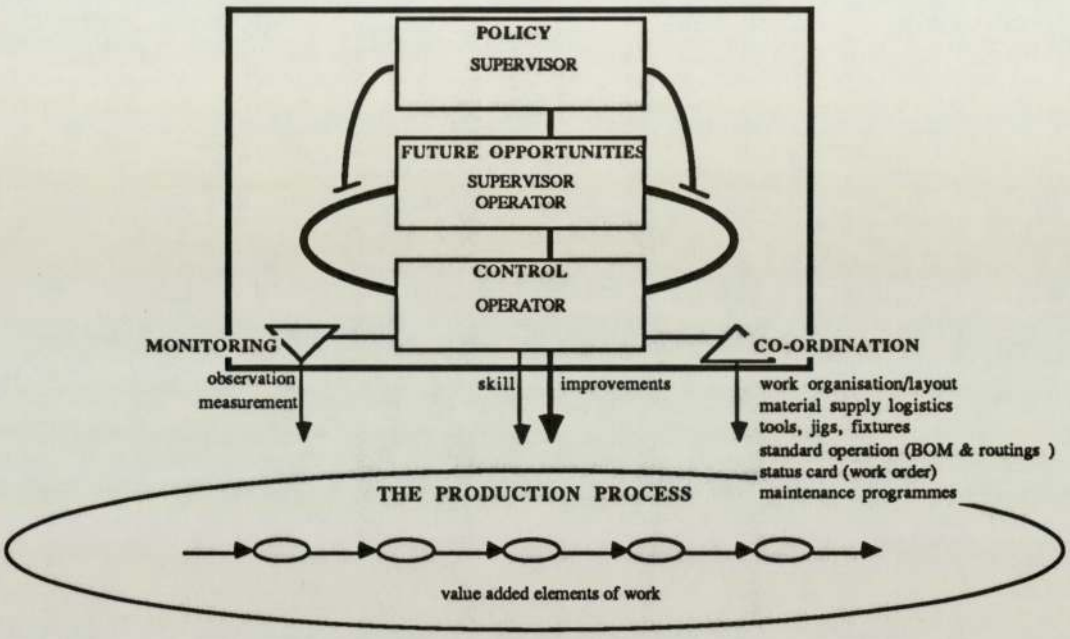


figure 5.4 Autonomy on the production line

Once the conditions were judged to be suitable, the production director consented to the formation of a problem solving group to address the specific problem of PCB faults (section 5.3.1.3.2). Following the success of this team a second problem solving group was formed to deal with the problem of leaks.

Although the introduction of SPC was discussed, the view was held that the conditions were not right for its effective implementation. Other initiatives included the initiation of formal meetings thereby ensuring that specific interactions did occur: daily five minute meetings for all operators, fortnightly briefings by the production director to the supervisors and managers, and similar type meetings held by the supervisors and managers for operators.

5.3.1.3 The Learning Loop...

Having created the conditions whereby line problems could be identified and dealt with, it became the responsibility of the line personnel to deal with the problems. Analysis of existing data revealed that over twenty percent of all units produced required rework. This was excluding the faults that were missed, manifesting in customer complaints.

5.3.1.3.1 ...identifying and reducing defect levels

Attention focused upon reducing this level of rework by improving processes and by identifying the cause of defects and taking action against their occurrence.

The supervisors approached the line improvements by using simple work study techniques: producing and analysing models of the line in terms of individual elements of activity. The value added activities (primary activities) were distinguishable from the non-value added (regulatory activities), revealing unnecessary and problematical activities. For each element of work, a standard time could be derived based upon the actual time to carry out the activity, this taking into consideration all necessary movements and a "relaxation" factor. A potential time would represent the time to carry out solely the added value aspect of that element. Each element could be relocated about the line, enabling the line to be rebalanced, taking into consideration adjustments in the daily number of units to be produced, the number of workstations and hence the number of operators. A further advantage of this approach was the flexibility that was introduced. However, this demanded that each operator had a wide range of skills, which was easily achieved with the training programme. Progress in reducing line disturbances was monitored using simple graphical displays generated by both supervisors and operators. Three major categories were identified: leaks, PCB faults and faults associated with the finish. Limited success was achieved due to the complexity of each of the three issues. A more focused approach, using a problem solving group, was adopted (section 5.3.1.3.2) with a more successful outcome. Later developments included the introduction of aids to prevent easily made mistakes when working at speed.

The director, now being able to monitor both the problems and the improvements within production, was, after two months, able to discern a pattern of problems which were not being resolved (figure 5.5). The material related problems highlighted already recognised supplier difficulties and inadequacies of the production "information system". Another issue highlighted concerned ownership

for the production processes (e.g. Consumer line wiring section). Production expected that when a breakdown occurred an engineer would be immediately released from Engineering to address the "emergency", an issue which Engineering reluctantly put up with. The Engineering view was that Production were responsible for sorting out their own problems, contracting out if necessary, but using Engineering if they were in a position to help (section 5.4.1).

As the production management's appreciation of what was possible improved, this led to increasing demand for better operational information on what was happening. Production management increasingly made use of the quality information collected on the shop floor, monitoring the highlights and key trends. The production director monitored such issues as lost production time, the number of available operators, absenteeism and the failure to meet the production schedule, relating these to a per unit basis. However, this raised concern over the different sources of data and the lack of a single data-base. Information regarding an issue could be derived from two or more separate sources, each using different measurements and yielding different messages.

Data collected for the period 12/8 to 25/9	GENERAL ASSEMBLY							Consumer Line			Paintshop	Fabrication	Warehouse	Repairs	TOTAL	
	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Refrige	Wiring	Finish						
material shortages			1	5	12		22	3	7	6		2	4		60	***
non-conformance to specifications		3	7	7	2	11	7	20	17	27	5	4	2		108	*
component failure	INFORMATION NOT AVAILABLE				1	2	4		6	4				INFORMATION NOT AVAILABLE	17	
storage fault									2						2	
equipment shortage		1	1			2	9	1	1	1					16	
equipment failure		1			2	1	5	5	15	4		9			33	
spares shortage								2	3			1			5	
design fault							1	6	2	1		7			10	
process failure			3				4	6	40	9		2			62	**
poor housekeeping								1	3	2					6	
documentation error		2	3			2	1	1	1			13			10	
paperwork unavailable			1		2	1	3	4	1	1					13	
organisational failure						1	2		3						6	
TOTAL		7	16	12	19	20	58	49	101	55	5	38	6			
							**		*	***						

data available for period 12/8 to 29/8

figure 5.5 Production problems

5.3.1.3.2 ...process improvement - the case of the PCB area

Using the help of the analyst, a problem solving group attempted to reduce the occurrence of on-line PCB faults - a major issue. Consisting of two operators from the PCB area and a supervisor, the team started their investigation in September. Over the following month, they distinguished the different types of faults, devised and implemented a daily log quantifying the occurrence of faults (figure 5.6) and analysed the logs, identifying how the occurrence of faults could be reduced. This analysis was presented to management, revealing "causes" (normal text - figure 5.7) and proposing possible solutions (underlined bold text - figure 5.7). They highlighted the limitations of what the team could achieve. Many faults arose due to disturbances which were outwith their control, but within the control of the managers. Action was agreed and carried out over the following three months. The team monitored the improvements, noting the reduction in on-line faults at workstations 18 ("D") and 30 ("F") (figure 5.8). In addition to the limitation of how far the team could progress, difficulties experienced by the team included the inconsistent self-discipline to record the details and the fact that faults were not always identified (cf. customer complaints). Although the level of faults was reduced, the incidence of faults stabilised at a new level, reflecting the dependence of the team upon the actions of others.

figure 5.6 Recognising the variety of PCB fault types

PCB FAULT ANALYSIS

DATE:
UNIT / BOARD TYPE

Solder defects			TOTAL
Bridges			
Dry joints			
Damaged tracks			
Shorts missing			
Other solder defects			
Process defects			**TOTAL**
Wrong value components	R		
	TR		
Missing components			
Reversed components	Diodes		
	Transistors		
	IC		
	Capacitors		
	LEDs		
Damaged components			
Badly fitted components			

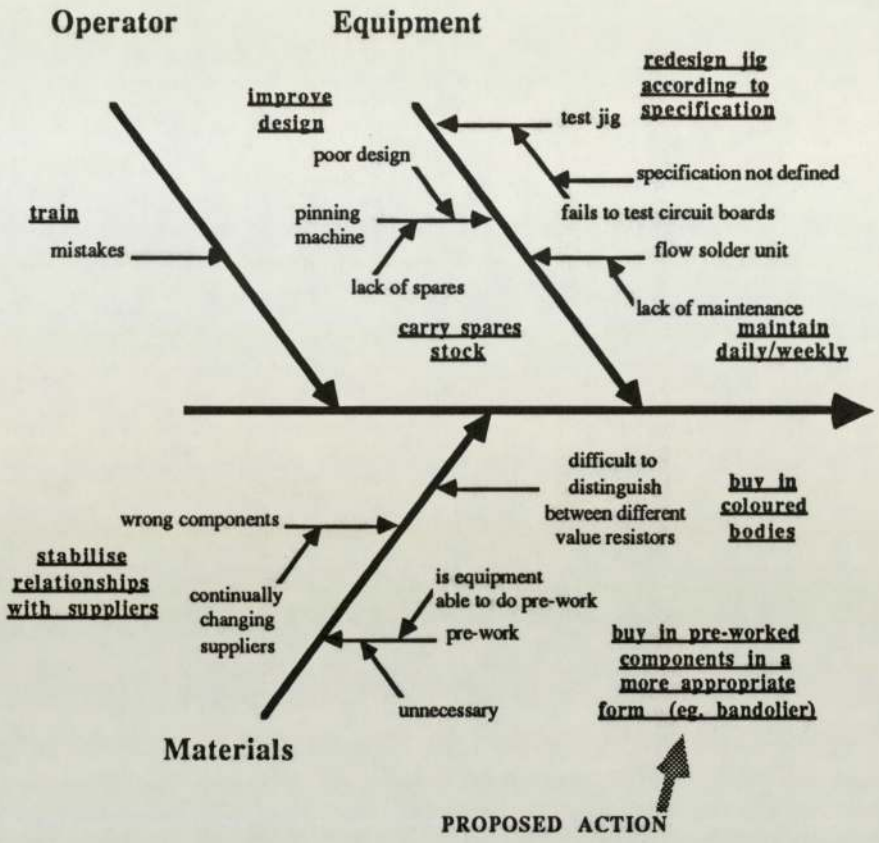


figure 5.7 Eliminating the PCB faults

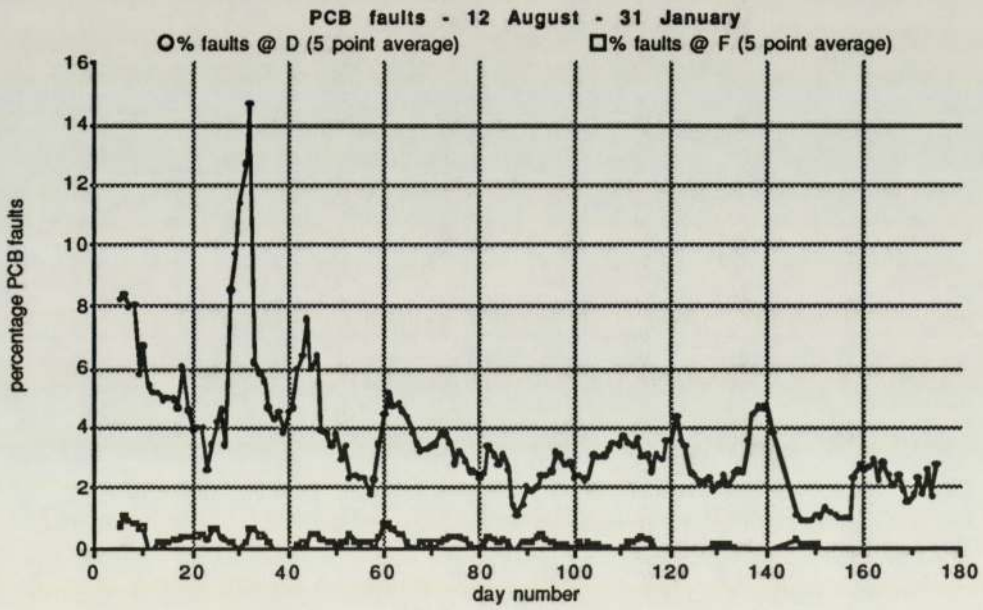


figure 5.8 Measuring PCB improvements

5.3.1.4 Discussion

Success in creating the conditions so that change could be effected, was marked by the regularity and richness of interactions, though was marred by some resistance by the production manager in pursuing possibilities. Success in achieving improvements was marked by the reduction in fault levels to under five percent. Although progress was slow, it was achieved and by those who managed and operated the production line. As a group, they developed the ability to both generate responses to deal with disturbances and communicate the need for a response to the appropriate variety generator. Attention focused not only upon the elimination of disturbances. It also focused upon the release of the latent properties of the process, achieved by improving the capability emerging from the co-ordinated functioning of the resources. This was achieved by developing these resources, paying particular attention to individuals. They tended to lack an appreciation of how to collect and use information. One key feature of the learning by both the analyst and production personnel was the creation and use of models to understand and analyse the situation: e.g. the modelling of the production line by the analyst (figure 5.3) and the modelling of the problem issues by the project team (figures 5.6, 5.7 and 5.8).

The question arises of how effective this process would have been without the assistance of the analyst. It is proposed that the analyst's contribution was the acceleration of the learning process. This was achieved by facilitating the occurrence of the right interactions, by steering conversations about possibilities and by supporting the development of appreciations.

Whilst the ethos within production was shifting under the leadership of the production director, it was hindered by two prominent issues. The first concerned the individual, who retained the option of whether to act as desired and use the new skills and practices. This was in part influenced by the second issue, concerning the management style prevailing within the company. Management action, perceived by the individual to deny him the option of choosing to contribute, may receive a less than willing response to "requests". A vicious circle may arise whereby the deteriorating willingness of personnel is complemented by increasingly autocratic management. Within the company, management by edict and the symbolism of the "clocking-in system" contrasted with the espousal of a "fair" environment and empowerment. Despite the removal of the "clocking-in system" in May the following year, management tended to operate by edict. Although increased responsibility and variety had been promoted at lower levels, this conflicted with a widespread reward / punish attitude to control, where warnings were regularly

given out. Eighteen months after the start of this exercise, although absenteeism (3-5%) and lateness was low, employee turnover, particularly on the consumer line, was high (~15%).

5.3.2 Approach 2 - MRPII: a solution... but to what problem?

The essence of an MRPII "system" is that it supports the on-going and timely interaction among all activities within a manufacturing organisation (figure 5.9) by providing accurate and detailed information. It translates a vision of the company into long-term and short-term plans these then manifesting in recorded activity and historical data. It can be viewed as a distributed information "system, supporting and prompting decision-making at all levels of the organisation. The availability of the required information enhances the quality of decision making, supports the reduction in operational costs and provides a stimulus for improvements. For the "MRPII system" to be fully functional, this requires disciplined practices, implying the co-operation of the workforce. Further, this also requires the ability to recognise and deal with problems. This requires a suitable culture for the "system" to be implementable.

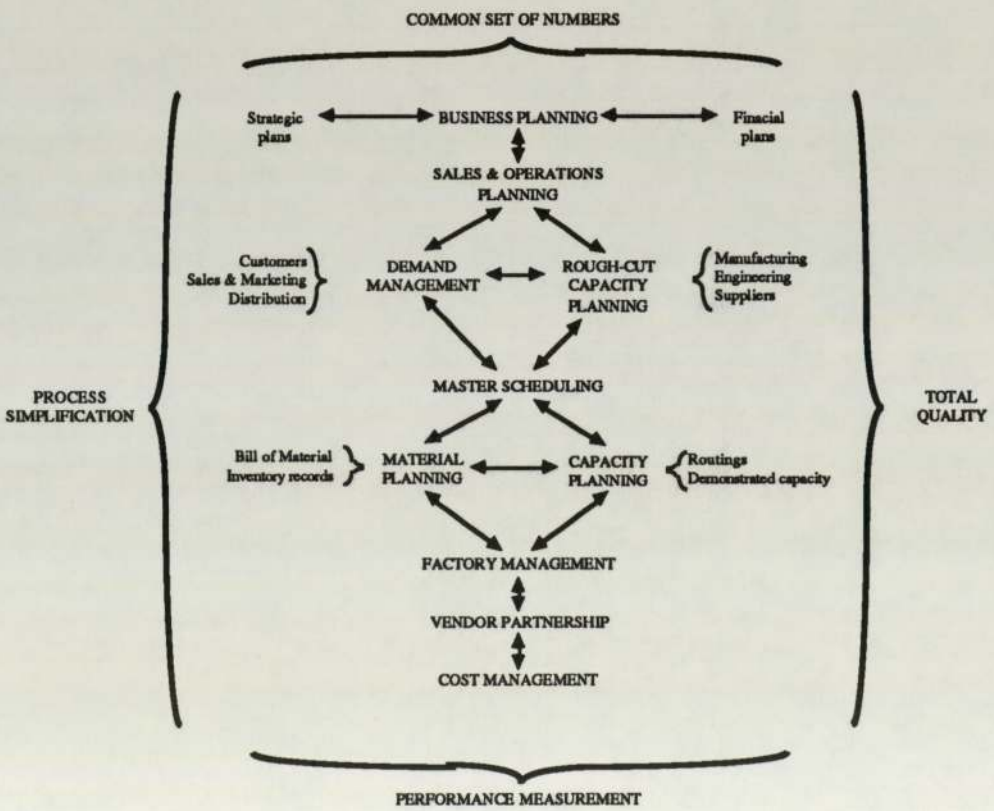


figure 5.9 An MRPII template

5.3.2.1 A problematical situation

Discussions among several directors led to the decision to pursue the MRPII route. The inadequacies of the existing "information system" (as revealed in section 5.3.1.3) led them to believe that a new "system" was required. End of year stock audits indicated significant discrepancies between actual stock and records. Bills of Material were inconsistent in both content and composition. The consequence was the tie-up of a large amount of capital in component stock and finished goods. Also appreciated was that this decision implied changing the company's culture, in particular the practices of the work-force, a process already initiated (section 5.3.1), but requiring a more formal programme.

In response to this, a project team was formed and a programme developed. The "Company II" vision emerged. Despite the team's failure to fully understand what they were doing and the ensuing difficulties they experienced, the programme was pursued. Unfortunately, by the time it was realised what should have been done, it was too late. The programme was abandoned after five months. A summary of the approach adopted by the project team is presented in table 5.2.

5.3.2.2 The Cybernetic Loop...

The situation can be viewed in terms of the conditions that supported the functioning of the project team and the conditions that supported the introduction of MRPII. The former defined the initial context in which the project team operated. The latter, whilst being the initial content of their activities, was to establish the later context in which they would function.

5.3.2.2.1 ...creating the conditions for the project team to function

The decision to embark upon this programme arose out of discussions among directors, in particular, the managing director, the director who was to lead the project team and the financial director. Also involved in these conversations were consultants.

table 5.2 The MRPII route - approach 2

Transformation	To effect the improvement of the information "systems" supporting the production activities
Actors	Project team (3 people (facilitators), including two Directors)
Suppliers	External consultant (part-time)
Customers	The whole company excluding the Sales Divisions (they were viewed as independent units dealing with different issues which would be addressed by another means. However, their interface with the rest of the company would receive attention through the programme)
Owners	The Managing Director?
Duration	December to April
Regulatory mechanisms	Project plan (figure 5.10)
Process	Through education of the workforce, by initially targeting a core of key people, then cascading this throughout the company Specific issues were addressed by "task forces", these being composed of key "users" (approx. 6 to a team, which includes a team leader and facilitator)
Accomplishments	A high profile was achieved for the company vision People were prepared to expect change The benefits of making improvements was quantified The value of the plan was appreciated by Directors
Difficulties	The vision was perceived as the panacea for current day-to-day difficulties, with an attitude emerging that the project team will sort them out. The project plan was unrealistic in timescale, with too much being expected too soon The consultant "pushed" education, emphasising the importance of attending externally held courses The project team did not fully understand the specific tasks needed to be carried out.

The project team was formed composed of the project director, another director and the analyst. The project team attended courses providing them with a basic understanding of MRPII and the process of introducing MRPII. On-going discussions ensued between the project director and the managing director. A consultant was contracted to provide assistance in the creation of a programme for change, this being achieved by periodical visits, supported by continued interaction using postal and telecommunication facilities.

Justification of the exercise was carried out, both to provide assurance that the programme was worthwhile and as a means to sell the programme to the company's directors, investors and site personnel. The financial model developed, compared one-off and on-going costs with anticipated quantifiable benefits, both for the current and future financial periods.

Following the initiation of the project, as part of the organisation created to support the introduction of MRPII (section 5.3.2.2.2), the decision was taken to form a

steering committee. This comprised all the company's directors, chaired by the managing director. The committee would provide direction and control the progress of the programme, functioning in parallel to the company's "normal" events. The project team, reporting to this committee, would develop and carry out the programme. The project team had the managing director's authority to effect events as required.

5.3.2.2.2 ...creating the conditions to support the introduction of MRPII

The anticipated process involved the unfolding of the vision (Company II), first into a "skeleton system", then into the full-fledge "system". To achieve this, people were to be organised so that the vision of Company II would cascade throughout the company (figure 5.10). The project team was expected to manage the change process, define the vision, design the "skeleton system" and develop the people so that they could handle change. A Steering Committee was formed with their task to approve, authorise, resolve and monitor the proceedings. Task Forces, composed of a core group of employees, were expected to translate the "skeleton system" into a fully-operational "system", co-opting assistance as required. This core group, who would have operational ownership for the functioning of the "system" were to "sell" the emerging "system" to the remaining employees. Each transition stage was marked by a "pilot", at the end of which, each person involved would fully understand both the "system" and their role in it. The end of the final pilot marked the transfer from the "old system" to the "new system".

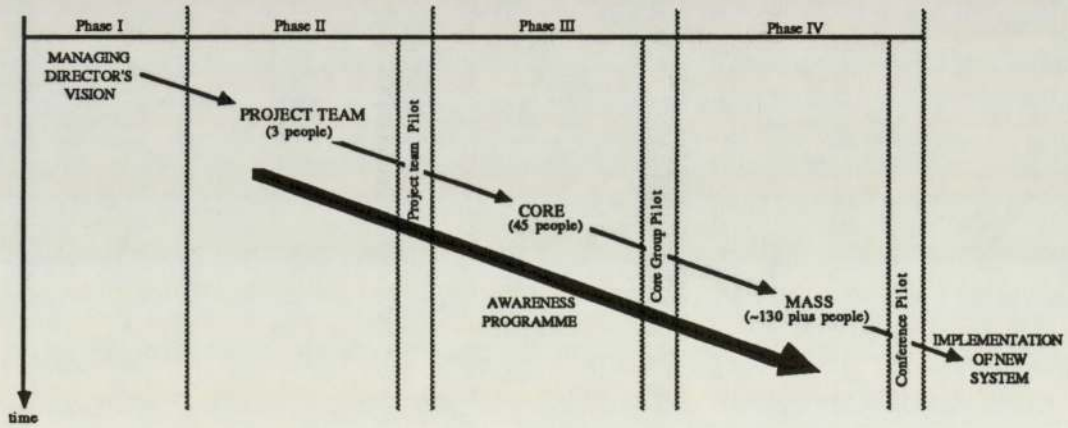


figure 5.10 Cascading the vision into reality

A programme was devised to support this process (figure 5.11). It distinguished between changing the culture and changing the information system. The former was to be achieved by developing the people through education: the latter by introducing better practices by means of task forces.

IMPLEMENTATION PROGRAMME

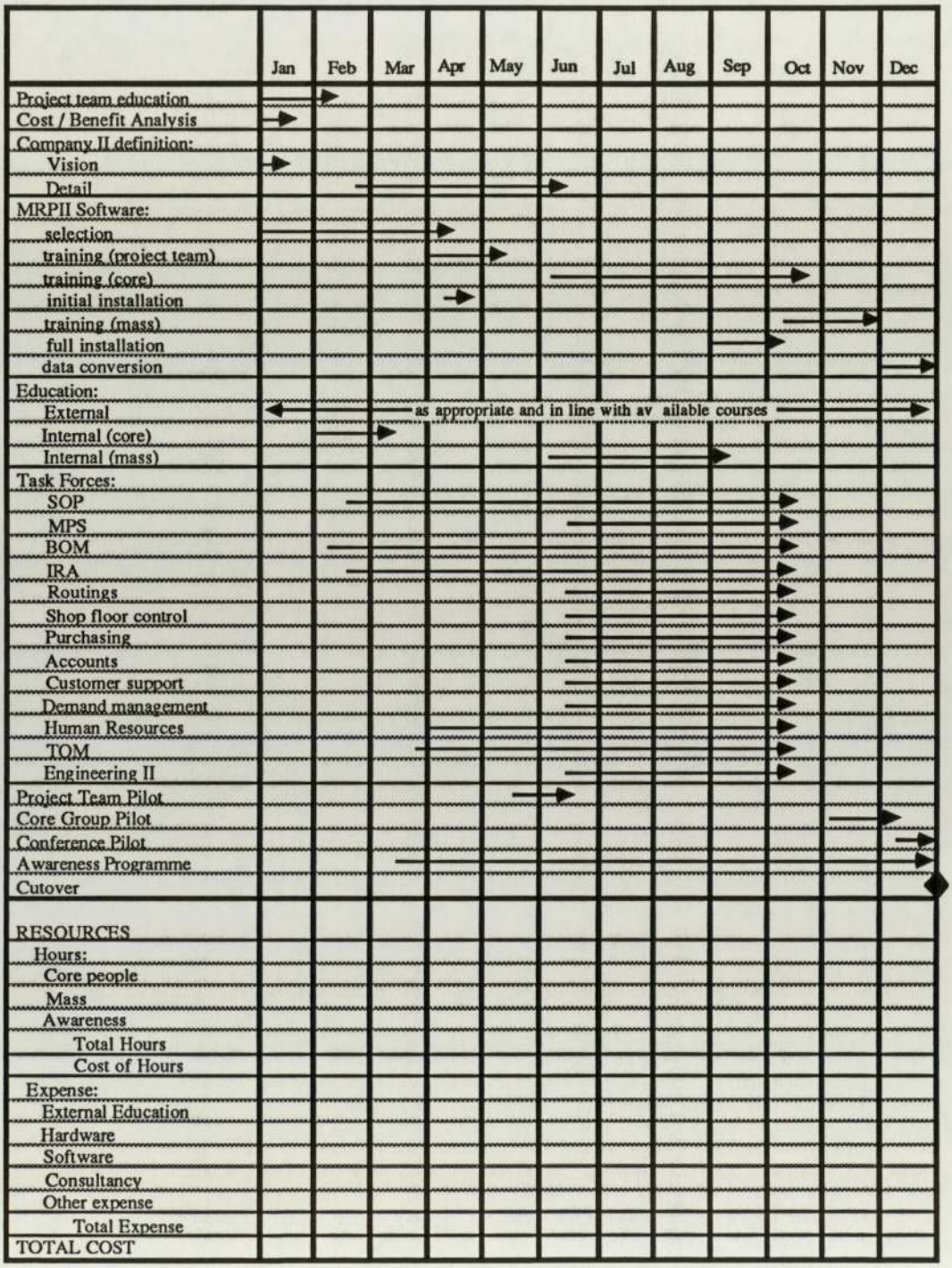


figure 5.11 A programme for introducing an MRPII system

Two resource plans were generated. The first identified the internal / external courses people would be expected to attend and provided an analysis of the time and cost demands. The criteria for establishing who to include in a task force was the subject of debate. Concern was expressed about the exclusion of people from events and their reactions, despite the reasons of logistics. A similar plan was generated for the task forces, where the emphasis was not to overload people with task force responsibilities. These "models" were made available to management for them to anticipate and address the requirements of their business and highlight potential conflicts. Further, an awareness programme was planned both to promote the project and to permit expression of senior management commitment. A growing appreciation of the importance of planning emerged with each project programme revision (every few weeks): the failure to generate a realistic programme gave rise to the situation where people's expectations were raised, but the project team were not ready to meet these expectations.

5.3.2.3 The Learning Loop...

The distinction can be made between the learning by the project team and the learning by site personnel. In both cases, the question arises as to what was learnt and what the impact of this was.

5.3.2.3.1 ...the failure to effect change

The project team were faced with a variety of issues, these including:

- understanding what it is that is to be changed: What is MRPII? What are the current "systems"?
- establishing the process by which this change was to occur. Who is to be involved? What is to be done? What is the programme?

Despite their efforts to develop an understanding of both MRPII and the in-place "systems", there was pressure to establish and progress a programme to bring about the desired changes. Consequently the team learnt much about how to facilitate change. They managed to create the conditions and establish an organisation that had the potential to effect the desired change. However the team failed to develop an adequate appreciation of that which was to be changed. They lacked an understanding of the existing "systems", the problems being experienced and what was required. They did not appreciate how the proposed "system" would satisfy requirements and overcome problems. Although each team member developed their own view of how things worked, no group view emerged of actual practices or what should be happening.

Consequently, difficulties were experienced, this leading to lack of progress, which in turn resulted in programme revisions. Although the conditions were created which permitted conversations about possibilities, these conversations lacked content and led to indecision and inaction. Similarly, in the internal classes, the content of the classes failed to make the transition between the theory underpinning MRPII, experiences which the class attendees could relate to and proposed practices. This inhibited both their learning and the performance of the task forces.

Questions arose regarding the value and purpose of education. Should there be a heavy reliance upon external education as recommended by the consultant? The value of external education was espoused to be the transfer of the wealth of experience to different people, thereby enriching the available perspectives of those bringing about the change - an expensive process. But it could also encourage more on-going debate. Would internal education be as effective? People did become more aware of their work environment following the internal classes. However, discipline in the use of systems was not developed, raising the question of how this was to be achieved? The teaching of new skills and practices was viewed as the domain of training.

Difficulty was also experienced in the selection of a software package. Short-listing was based upon the reputation of the software packages and selection upon the comparison of software houses and the features of the packages. The fields of the database were not considered within the context of the application. The software screens lacked meaning. Further, when the question arose regarding the merits of the existing "information system" which was accepted as being inadequately used, there was embarrassment. It emerged that an upgrade to the existing "information system" was available offering many of the facilities of the MRPII packages, for a fraction of the cost.

Promotion of both the vision and the programme did not occur, failing to support the hidden commitment of senior management. This later led to such questions as "what's happening with Company II?"

As the team developed a better appreciation of the existing "systems", the needs of the business, proprietary software “systems” and the change process itself, they started to question the initial assumption of the need for an MRPII “system”. One unanticipated difficulty that surfaced was the growing attitude that operational problems would be sorted out by the new "system" and so were left unattended.

This was exacerbated by the managing director's prompting for something to happen, this based upon his observation of a lack of visible progress and of the on-going discussions which appeared to lead to nowhere.

5.3.2.3.2 ...the inability to change

Although the roles, responsibilities and the anticipated mechanics of the task forces was clearly defined, they did not fully understand what was required of them. The difficulty lay in establishing the content of their enquiry, which was exacerbated by the absence of the skeleton "system" for them to reference. They could not appreciate the context in which the issues they were attempting to deal with had meaning. No-one knew what changes were to be made. Consequently, despite initial enthusiasm, the task forces soon got bogged down in on-going discussion about details.

This lack of understanding also reflected the failure of the education. The theory was viewed as difficult to grasp. There was insignificant reference to practices. There was no indication of the tools and techniques which the task forces would use to achieve their aims. To summarise, the content of the classes was too removed from the reality of the work-place, both actual and desired. The task forces did not understand what they were doing.

The Steering Committee also did not make much progress, again because of lack of understanding of the issues being discussed. On-going conversations repeatedly threw up the same issues. There were no mechanisms to orientate the content of the conversations towards clear policy statements and actions.

5.3.2.4 Discussion

The preceding review of approach 2 illustrates the interplay of several iterations of the Cybernetic Methodology (figure 5.12). Section 5.3.2.2.1 examines the cybernetics of the situation from the perspective of the project team. Section 5.3.2.2.2 examines the content (learning loop) of the project team's attentions, this being the cybernetics of the situation from the viewpoint of the company personnel. This led to the creation of conditions which supported the intended activities of the company personnel. However, it also identified the project team as participants within this context. The content of the activities was the subject of section 5.3.2.3.2, which revealed that these activities failed to produce the anticipated outcomes. Section 5.3.2.3.1 presents a second iteration of the learning loop from

the perspective of the project team. Whereas the first iteration (section 5.3.2.2.2) was concerned with the learning that created the conditions, the second iteration concerns the learning that arose from the difficulties experienced.

		VIEWPOINT	
		PROJECT TEAM	COMPANY PERSONNEL
ISSUES	Cybernetic Loop	section 5.3.2.2.1	section 5.3.2.2.2 ...1st iteration section 5.3.2.3.1 ...2nd iteration
	Learning Loop	section 5.3.2.2.2 ...1st iteration section 5.3.2.3.1 ...2nd iteration	section 5.3.2.3.2

figure 5.12 Unfolding approach 2

The question arises as to where the weakness in the process lay. It is proposed that this concerned the learning loop of the company personnel, which included the project team. The project team, as participants facilitating this learning loop, did not appreciate the issues underpinning this learning loop and thereby were unable to provide help to these personnel. Few relevant models about the issues were produced and of sufficient detail to orientate conversations about both possibilities and action.

However, as was being appreciated by the project team, perhaps MRPII was not the appropriate solution. This suggests that not enough time had been spent at the outset understanding the existing situation and establishing precisely what the issues were.

5.3.3 Approach 3 - "putting management in control"

5.3.3.1 A problem situation

The weakness of the second approach, the failure to understand the situation and identify the appropriate issues, could be viewed as the strength and attraction of the third approach. It appeared to the managing director that people were not sure what they were doing and what they were trying to achieve. Although this was reflected in the project's lack of visible progress over the preceding months, this was applicable to all company activities and was symptomatic of the deeper rooted problem which was viewed to pervade the company: "Management were not in control".

The managing director instigated the following approach, which occurred in two phases. The first phase (approach 3a) was managed by full-time consultants who controlled the project on a daily objectives basis. When the consultants departed, "for cost considerations", their approach was adopted by the two project team directors who took over the subsequent running of the project (approach 3b).

5.3.3.2 Approach 3a - creating relevant models

The third approach revealed the expertise of a consultancy to produce models to orient discussions on the merits of the "systems" in use, directing these discussions towards improving operational practices.

The team of consultants gained entry to the company by providing two weeks of work free, then charging a high fee for all subsequent work. By gaining entrance to the company, they managed to both understand the situation of the company and develop models to support their case for further work. They offered an attractive high visibility methodology which appeared to place as much emphasis upon verifying progress and justifying the programme as it did on achieving results. Their espoused "co-venturing" in their working relations. Co-operation appeared to be enhanced by the need of the company to perceive "value-for-money".

5.3.3.2.1 The approach

An outline of the features of this approach is presented in table 5.3. The approach facilitated the systematic and intensive examination of the selected "area", the design of the new "system" and its introduction and implementation within the area. A follow-up to this implementation enabled the fine-tuning of the "systems" and an assurance of their continued use. Table 5.4, though incomplete due to lack of information, indicates how this was achieved.

The approach was developed over a number of years and placed emphasis upon the practice of "co-venturing", developing an understanding of how the "system" works, then implementing solutions. No reports were produced, instead, the consultants insisted upon a weekly meeting with the managing director. Daily briefings were held at the start and finish of each day, chaired by the project manager and attended by the project team. During these, progress was reported, problems discussed and the following day's activities allocated.

table 5.3 The "hard" approach - approach 3a

Transformation	To give managers control
Actors	Project team (2 full-time consultants (project manager and colleague) and 5 employees, including two Directors). External project administrator.
Suppliers	External consultancy (full-time)
Customers	The whole company excluding the Sales Divisions
Owners	The Managing Director
Duration	April to May (5 weeks)
Regulatory mechanisms	Project manager; twice daily project team briefings; daily activity sheets
Process	Detailed and systematic programme of activities which was directed towards quickly introducing new systems
Accomplishments	Provided the project team with a "procedure" for introducing change Highlighted the importance of project management
Difficulties	Expensive Alienated members of the project team Limited training of project team members and little transfer of skills Intrusive

table 5.4 The consultants' approach to analysis (not complete due to unavailability of information)

A	Area profile	Structured format questionnaire to capture basic information from the manager of that area, indicating how well he is in control. Identifies people, roles and their interchangeability and the physical resources. Establishes how time is distributed and forecasting, planning, monitoring/controlling, reporting and scheduling practices. Identifies operational problems and how disturbances to the routine are handled. Identifies developments initiated or proposed and the reason why.
B	Brown paper	Maps the documentation/information/material flow, using actual documentation.
C	Activity lists / standard data	List of all distinguishable activities occurring within the area.
D	System critique	Critique of the models carried out by the manager of the area, project manager and "consultant".
E	System write-up / problem definition	Summary description of the area, indicating key issues.
F	Volume information	Presents a measure of the amount of work being carried out.
G	Quick / early results / benefits	To take advantage of "quick and easy" improvements and provide a feeling of accomplishment.
H	Flexibility charts	Establishes who in the area can carry out the activities listed.

5.3.3.2.2 Discussion

The approach can be viewed from two perspectives: the cybernetics underpinning this approach and the learning process.

From the cybernetics perspective, the consultancy team were effective in creating the necessary interactions which permitted them to develop sufficient understanding of the company that they could both negotiate further work and maintain the company's commitment to what they were doing. Consequently, they developed a project managed programme which systematically worked through the "systems" of the company, evaluating them then upgrading / replacing them. Further, by supplementing their numbers with the former project team and additional company personnel ("internal consultants"), they were able to organise a project team to carry out the programme. However, whilst they appeared effective in their organisation, several issues were raised.

The ability of the "internal consultants" constrained their effectiveness, since they received no training for the tasks they were asked to do. Thus, problems were addressed by the project manager as they arose. Further, the authoritarian style used to manage the team did not reflect the espoused spirit of "co-venturing", creating in some a feeling of "us and them". This extended into a feeling of intrusion by the managers of the areas "investigated".

This was complemented by an effective learning process, involving both project team members and the managers of the areas. A good understanding was achieved of the existing "systems" and the problems experienced. This was achieved primarily through the production of rich models. Large "brown paper" visual displays mapped "systems", created using actual documentation and other relevant materials. These models supported both individual analysis and group discussion. They supported conversations about possibilities, orientating debates and facilitating the development of mutual appreciations. They supported the transition to conversations for action.

However, the consultants invited only managers into these discussions and preferred to carry out the analysis themselves. Instead, these large displays offered greater potential for co-ordinating conversations than was happening. Although one person may be involved in creating the initial model, the analysis and development of the model need not be the prerogative of this single person, but a group effort arising through the discussions amongst all participants. The opportunity is a better

shared appreciation of the situation and the increased likelihood of acceptable outcomes.

However, one incident questioned the dynamics of the whole process, hinting that it was being mechanically applied without thought to the effectiveness of existing "systems". A new "system (Management Action Plan) was devised by the project manager, whereby problems experienced would be allocated, via a co-ordinator, to the "problem solver". Concern was raised that the proposed "system" was bureaucratic and inferior to the "system" already in operation in production. This was dismissed by the project manager, but the new "system" was not implemented.. This raises the distinction between indiscriminately applying a well used formula and thinking about the uniqueness of the situation.

5.3.3.3 Approach 3b - making change happen

The project continued without the consultants. The project directors were instructed by the managing director to develop the consultants' method, using what they knew about it, and to use it to continue with the process of improving operational practices. A major feature of this approach was the changing view as to what was required. The initial intent was to put in-place MRPII over the following year to be followed with on-going improvements under the umbrella of the vision of Company II. Instead, the decision was made not to proceed with the purchase of a new software package, instead to upgrade the existing "system". This was viewed as part of an envisaged on-going programme of improvement, organised into a series of stages, named Company II, III, IV.... , each with a set of clear objectives. The approach that was developed pertained to the first stage - Company II - "to give managers control". The Company II vision was corrupted.

5.3.3.3.1 The approach

The aim was "to give managers control" through the provision of better "systems", underpinned by the software upgrade. Attention focused upon the "systems" being used. It was viewed that the new upgrade would satisfy the needs of the business, this requiring that people make better use of available facilities. The key issues were: "management in control"," operating systems", roles and responsibilities, key measurements and policies and procedures.

The company, excluding the Sales Divisions, was split into eleven distinct areas, these being: Production Control, Material Control, Purchasing, Buying,

Engineering, Product Support, Quality Assurance (QA), Telesales, Sales Order Processing, Financial & Secretarial Services and Production. From these, seven were selected and each assigned a "consultant". The remaining areas were to be addressed at a later date. QA was viewed in a slightly different light. Although this department was viewed as problematical and required a major shake-up, it was maintaining adherence to BS5750. Further, it was unclear as to what the role of QA should be within the company. Thus, QA was not viewed as a priority. Similarly, the Sales Divisions were viewed as separate issues, these to receive attention at some later stage.

An approach emerged (outlined in table 5.5) adapted from that used by the consultants. It was managed on a daily objectives basis. The method that was developed (table 5.6) could be interpreted in terms of five activities: understand the situation and design a solution, present the design to users and managers for critique, revise design taking account of critique, represent to users and managers, implement. It was applied in each selected area.

table 5.5 Approach 3b - developing "systems"

Transformation	To give managers control
Actors	Project team (9 internal "consultants", including two Directors). NB. one Director left the project to move into an appointment created as a result of the activities using approach 5 (section 5.4.2)
Suppliers	The Directors' contacts
Customers	The whole company excluding the Sales Divisions
Owners	The Managing Director, the project manager
Duration	May to December
Regulatory mechanisms	Project manager; daily project team meetings, these shifting to every second day, then once weekly
Process	Detailed and systematic programme of activities which was directed towards quickly introducing new systems
Accomplishments	Introduced better practices into the selected areas
Difficulties	Oversimplified understanding of the change process End-users did not fully understand or own "the new system" Redesigned systems highlighted: confusion between primary and regulatory activities inappropriate and meaningless measures of performance lack of attention to detail New systems were "imposed" upon end users Corruption of the Company II vision

table 5.6 A systematic approach for designing and introducing a new "system"

A	**Department Analysis (3 weeks)**	**Provides understanding of the area**
i	area profile	Structured format questionnaire to capture basic information from the manager of that area, indicating how well he is in control.
ii	brown paper	Maps the documentation/information/material flow, using actual documentation.
iii	area write-up	Summary description of the area, indicating key issues.
iv	problem identification	Identifies disturbances outwith the managers control.
v	brown paper critique	Critique of the models carried out by the manager of the area and the "consultant".
vi	quick results / early benefits	Identify and take advantage of "quick and easy" improvements and provide a feeling of accomplishment.
B	**Standard data (1 week)**	**Indicates capacity and training requirements**
i	skills chart	List of all distinguishable activities occurring within the area, including quantitative measures.
ii	flexibility chart	Establishes who in the area can carry out the activities listed.
C	**Implementation of early benefits (1 week)**	**Early action**
i	list of early benefits	Identify early benefits and design new practices, documentation, etc.
ii	dates of implementation	Agree with manager when quick results are to be implemented and measure impact (e.g. hours saved).
D	**New system concept (3 weeks)**	**System design**
i	flow diagram	
ii	new documentation	
iii	key measurements	Two measures to be used to indicate the level of improvement.
iv	staffing requirements	Establish new staffing requirements.
E	**New system implementation plan (3 weeks)**	**System introduction - planning**
i	key dates	Agree with manager date for new system introduction. Prepare a presentation of new system to 1. project team 2. area personnel 3. all departmental heads
ii	staff training plan	Plan of how new system is to be introduced and training is to be carried out. Target is to have at least two people able to carry out each operational activity.
F	**Monitoring implementation (6 weeks)**	**System introduction - reviewing**
i	observations	Full-time "observer" of the implementation, identifying problems and handling queries. Daily report to the project manager of difficulties encountered.
ii	standard data / conversion rates	Quantitative measures of all distinguishable activities, indicating measurable improvement of new system over old system.
iii	volume forecasts	Generate equation to permit the calculation of staffing requirements for different volumes of work.
iv	savings evaluation	Evaluate cost of implementation against benefits.
v	verbal proofs	Listen for acknowledgements of a better system by users.

5.3.3.3.2 The Cybernetic Loop: did conditions support change?

Interactions were occurring at three levels. The first concerned the interactions between the project directors, the managing director and other company directors. These interactions appeared to be frequent, permitting events to be modified as appropriate. However, the question arises as to the content of these interactions. Although an insight into expectations emerged from their conversations, it lacked clarity and coherence when communicated to the team members. Further, the attitude was communicated that most activities could be reduced to mechanical "systems", with clear objectives and clearly definable parameters. This raises the questions of what they were expecting from people and what they appreciated about what they were trying to do.

The second level of interactions concerned those within the project team. The way the team was managed was maintained as introduced by the consultants, though modified over time. Meetings, espoused to provide a forum for communication and enhance a team spirit, instead provided the project directors with a monitor-control mechanism. The twice daily team meetings reduced to daily meetings, then thrice weekly meetings then weekly, before being abandoned for a more personalised style of interaction. Though experiences were described during these meetings, the opportunity was lost for the team members to appreciate the significance of events, to learn and to transfer this learning into their own activities. Instead difficulties were handled by the more senior team members on an individual basis. As difficulties mounted the enforcing of the rigour of the method was loosened.

The third concerned the interactions between the "consultants" and the personnel within each area. Many of the team members did not appreciate what they were doing, lacking both expertise in handling people and understanding of the technical issues. However, they were authorised to do whatever was necessary, often imposing "systems", antagonising the people in their area and creating further difficulties. Consequently interactions often failed to develop the understanding, participation and commitment of the area personnel, instead tending to focus purely upon the exchange of information.

Further, the general lack of promotional activity created the situation whereby people increasingly asked what had happened to Company II. People were observing a group of individuals carrying out tasks which often interfered with what they were doing. They had no means for appreciating what they were

observing. There was no visible leadership to establish the credibility of what was happening. The anticipation created during approach 2 failed to be maintained during approach 3. This led to cynicism and reluctance to co-operate, not only with the end customers - the company employees - but also within the project team.

5.3.3.3.3 The Learning Loop: were outcomes acceptable?

During the ensuing seven months the project met with varying levels of success. Acceptance of the "new systems" varied, particularly the greater the change. In each area, the day of changeover to the "new systems" was marked to signify the adoption of the new way of doing things. However, this symbolism unduly raised expectations.

The Repairs area (Product Support) experienced the biggest change and was initially the least successful. The Repairs manager was unhappy about many of the proposals, feeling excluded from the design of the new "system", in particular, the design of the database. This effected his closer involvement, attention to his requirements and a "system" which he accepted.

The changes to the other areas were not significant. They achieved clarification of previously grey areas, particularly in terms of roles, responsibilities and correct practices. Each area was documented, describing all these essential features as well as indicating how performance should be measured. The question arises of whether these changes were successful. Each area experienced its own difficulties.

In the Fabrication, Paintshop and General Assembly area, the main issue was the definition of the role of production manager (section 5.3.1.2.2). This highlighted the question of whether the production manager had the ability to meet the expectations required of their roles. Further, the attempts to develop the supervisors was viewed with mixed feelings. The transferability of the supervisor training into the work-place was questioned, with comments being expressed about the lack of visible improvement. However, supervisors claimed they had little time to make improvements commenting that they were to busy with other things. Further, not all supervisors chose to adopt the desired attitude, this manifesting in poor housekeeping and records within their area.

Difficulties experienced in the Material Control and Production Control functions arose due to inadequate attention to the detail of how the "system" should operate. Newly delegated responsibilities were not fully accepted by the material controller,

this requiring manager intervention to deal with the arising problems. Discouraged by the multitude of problems that were arising and the pressure of meeting deadlines, particularly those concerning material shortages, the Production Control staff reverted back to former practices. The "system" did become operational through continued efforts to sort out the difficulties as they arose. This included the use of task forces to clarify and resolve specific issues, e.g. supplier relationship improvements (focusing upon the worst performing suppliers) and stock record accuracy. Difficulties experienced with the task forces included lack of progress, lack of available time and lack of direction.

The distinction was made between the purchasing and buying activity, both located within Production. The distinction was recognised between the activity of identifying suppliers (where focus was upon the selection of components, taking account of reliability and cost, and was carried out during product design) and the development and maintenance of supplier relationships (where focus was upon price and delivery and related to the manufacturing activities). An attempt to transfer responsibility for the "identifying suppliers" activity to Engineering was resisted by the production director, though desired by the technical director. The resolution of this issue was postponed to a later date.

The Engineering Department was handled as one area and presented a different package of problems to those encountered in the Production Division. Engineering was characterised by its projects, for which requirements tended not to be clearly defined, had less predictable outcomes and required competencies which took years to develop. Consequently, when the method outlined in table 5.6 was used, it revealed the weaknesses, not of the "systems" but of the personnel. This led to an alternative approach being adopted, this being described in section 5.4.

The Accounts function was considered to require a major overhaul. A modified approach was adopted, based upon establishing who the customers of this function were and what they required. This enabled the necessary activities to be identified that would permit these requirements to be satisfied and, hence, the requirements of these activities to be established. This work was carried out by those within Accounts themselves. This enhanced the likelihood of their accepting the new "system" and that the detail would be adequately addressed.

One issue which created difficulties was the selection of suitable "Key Performance Indicators" (KPIs). The policy was to have two KPIs for each area, providing an indication of that area's performance. Questions arose regarding who was to use

these measures, were these measures a good reflection of what was going on in the area, what were the consequences of failing to perform... The prevailing view was that if an activity was measured its improved performance would follow.

Despite the difficulties encountered, the vision did re-emerge, but only in conversations, and improvements did result. Many mistakes were made, but a lot was learnt about how to proceed. The position by the middle of November was a significant step towards developing a strategically thinking organisation with its parts taking a more pro-active attitude towards taking ownership for their self-development.

5.3.3.3.4 Discussion

A variety of issues are raised. Two that appear prominent are the interlinked issues of control and "systems".

The view that "things are out of control", may be met with the response to tighten the controls. What does this mean? The manager may view this in terms of the in-place "systems". Everything must be done according to the "system". But this raises the question of what is a "system".

A "system" has been defined as "a formally defined process" (section 3.1.1). However, this raises the question of the role of the individual. The distinction can be made between a "system" and an "activity". We tend to associate activities with what people do, for which they may develop habits, conventions and "systems" to enable these things to be repeated. We can view a "system" as being devoid of people. To accommodate people is to expect them to behave totally in a formally defined manner. But people are not automatons. When we expect people to mechanically carry out routine activities, we encounter "undefined" behaviour, both positive and negative. But can you suppress the negative whilst enhance the positive? When we introduce technology into a process, we may improve the effectiveness of the "formally defined process". The technology can be viewed as a "system". Whether, electrical, mechanical or hydraulic mechanisms, they can be interpreted as rule-bound procedures. Every aspect is "formally defined" in terms of what should be accomplished and how. "Systems" may be fine for routine activities, but should any disturbances arise, what happens then? Can the "system" handle the disturbance?

What is formally defined as the "system" appears to be inadequate to handle the potential complexity of situations. We define "systems" to deal with anticipated disturbances. We can define "intelligent systems" which themselves can define "systems". However, not all disturbances can be anticipated. We cannot anticipate that which we cannot formally define (e.g. the behaviour of people). Our attention focuses upon that which lies beyond the "system" (e.g. "informal system" - Hofstadter, 1979; "non-algorithmic ingredient" - Penrose, 1990). We use our mental constructs (systems - section 3.1.1) of what is out there to derive our "systems". However, there still there is a gap between our mental construct and the totality of what is out there. Our information tends to be imperfect. Nevertheless, whatever the situation, a person can consider possibilities and make decisions, aspects of which we tend to be unable to formally define. Whilst our understanding of this process is unclear, it accommodates what we describe as our reasoning, intuition and emotions. Thus, for the disturbances that the "system" is unequipped to handle, someone, at some point will decide that a person's intervention is required. However, the presence of the gap reveals that even the human element is not infallible. This suggests that whilst we can implement "systems" to absorb planned for disturbances, thereby freeing up time for us to deal with the more problematical issues, we should also focus upon how to close this gap.

Thus, the view that "to give managers control" required the development of "systems" ignores that which cannot be defined in the situation but which can give rise to disturbances. Further, it suggests that "systems" can generate responses which can adequately handle these disturbances. Activities (an activity being defined as something done by a person) can be handled by "systems". The person becomes subordinate to the "system". The person's task is to "stick to the "system"", because the "system" will get it right, not the person. This "system" viewpoint is upon the design of the "system" then the fit of people into the "system".

However, disturbances arise which the "systems" designers and managers cannot appreciate: people are unable to perform, people choose not to conform, giving reasons which are not necessarily consistent and may appear to be downright "silly". Further, "systems" will generate responses which are inappropriate to the situation. It is suggested that a "systems" approach to Total Quality Management (e.g. BS5750) and information systems face a realistic prospect of "failure". It overlooks people, both as the source of disturbance and as response generators. Alternatively, those who take an "activity" viewpoint place emphasis upon the actions of people and the interactions between people to achieve a given purpose. It

recognises that people can choose not to conform. Further, it recognises the opportunity arising from developing people. The issue then becomes one of how the "system" can aid people.

It can be appreciated that the "systems" approach appeared attractive in the context of the production environment. The emphasis tends to be placed upon routine and the predictability of the "process". It underplays and encourages us to assume that there is no need for individual creativity, that the ability of the person is to act mechanically. However, problems do arise and can proliferate. The response is a growing awareness of the contribution of the individual in dealing with the unpredictability of the production work-place, this being reflected in the "quality movement". However, the attempt to harness the creativity of the individual requires an management attitude that focuses upon people and not the "process". This manifests in the trust that is placed upon the individual and the commitment that is expected from the individual. It requires ability in the individual and the desire to contribute. For this to happen the incentive must lie with management.

In contrast, an environment, where the ability and creativity of the individual is assumed as a prerequisite, is that of Engineering. The transformation of ideas into products highlights the technical bias within Engineering. However, not to be under-emphasised is the issue of how people are managed.

5.4 Bringing about change within Engineering

5.4.1 A problematical situation

The Engineering Department tended to be viewed as an autonomous unit synonymous with the Technical Division and was monitored from a Profit & Loss perspective. However, it had a poor reputation with the other Divisions. The complaints levelled against the Engineering Division concerned the poor quality and lateness of work, the non-closure of projects and the high cost of additional engineering after the hand-over to either production or the customer. Further, they were expected to accommodate the "urgent" jobs that Sales had already agreed with customers and that Production required for their production lines.

The culture of Engineering was accepted to be different from Production, reflecting the different nature of its work. Work was identified in terms of projects, for which requirements tended to not be clearly defined, had less predictable outcomes and

required competencies which took a long time to develop. The issue which arose concerned what could be done to improve their performance, recognising that among Engineering's strengths was the commitment of its personnel.

It was assumed at the outset that Engineering could be handled in the same way as the other areas in the company. By improving the "systems" and ensuring that people adhered to these "systems", management would be able to regain control. Consequently, the method used in approach three (table 5.6) was rigorously applied. Stages A and B provided insights into how Engineering functioned, permitting detailed models ("brown papers") to be created which highlighted several redundant practices. These practices were stopped (stage C) and an attempt was made at designing the new "system" (stage D). However, it became apparent that the method was inappropriate. Although the "systems" were inefficient and difficult to use, they had developed so as to accommodate past disturbances, many of which had been forgotten. Further, the development of new "systems" were of major project magnitude, requiring the technical expertise of the engineers and investment in technologies. Indeed, several projects had already been initiated to address specific "systems". More importantly the existing "systems", although tending to be inefficient, were effective. Hindrances to the improved performance of the department could not be attributed solely to the "systems". The problem was deeper rooted. The design of "new systems" was a distraction and became a secondary issue (section 5.4.2.3.1)

5.4.2 Approach 4 - The Cybernetic Methodology as an aid for change

5.4.2.1 Creating a rich picture

The value of the method used was the insight gained by the analyst into the existing situation. It provided a quick and effective mechanism to produce a set of models which could be used as devices to orientate conversations about issues which were perceived to be problematical.

The method was also complemented with an off-site week-end workshop in June involving everyone within Engineering and facilitated by the analyst. Instigated by the technical director, its purpose was to develop the department's identity and examine how the department could develop. During this workshop, a detailed self-analysis of the department was carried out. From this many "names" were brought forth, these attempting to capture the ethos of the department, from which one was

agreed upon - "to supply a first class design and engineering service". The department was starting to accept ownership for its own development.

At the beginning of July, the analyst gave a presentation to the managing director, the technical director, one project director and the engineering manager. The situation of Engineering was unfolded using a model (figure 5.13) around which discussion followed. Focusing upon the accepted name, the primary activities of Engineering were defined as "the design of products - so that Nano has a product family that..." It was agreed that this was to be achieved by good fundamental management principles, paying attention to specifications, added value, deadlines and budget. It was emphasised that product design was not an activity that could be allocated to anyone, instead it being a professionally recognised skill, requiring technical ability and the self-discipline to develop this ability. Innovation was not to be neglected, particularly in view of competition. Thus, a competent person could be expected to be able to do a good job. Consequently, the question was raised why the design process was not functioning.

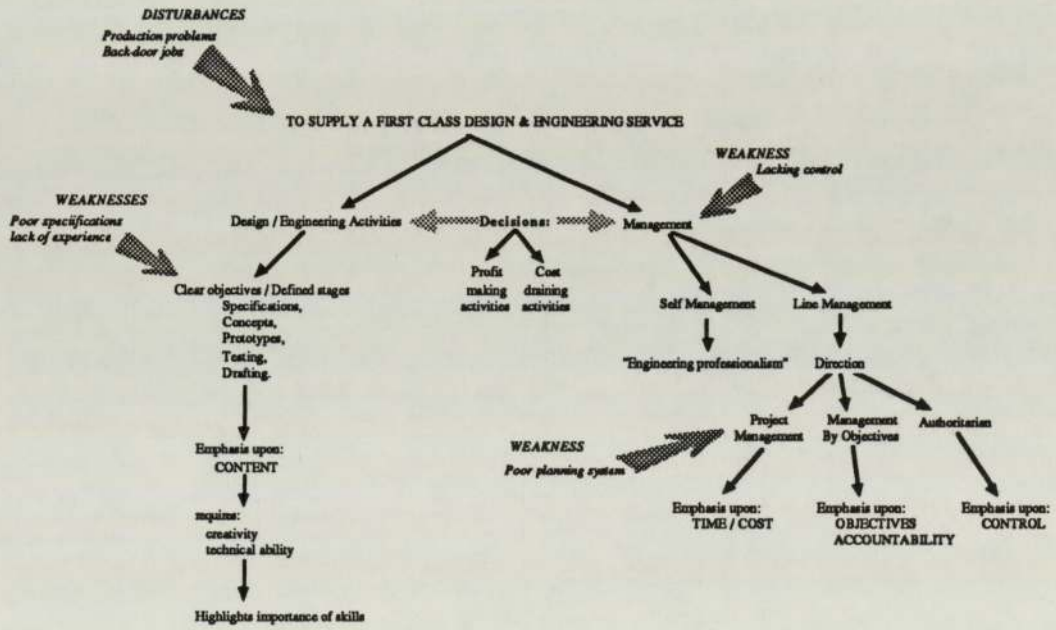


figure 5.13 Modelling the situation of Engineering

Emphasis was placed upon two issues: the competence of people to do assigned tasks and the development of these people. The existing state was that people were doing tasks they were not capable of doing. Work was allocated on a random

basis. Skills were being misused. There was little learning. The distinction was made between the self-management of the engineering professional and the different approaches open to line management. The prevailing company management style was authoritarian, with "flavour of the month" being management by objectives. However, the engineering manager was introducing project management, this directed towards supporting self-management. However, little attention was being paid to the development of the professional engineer. Instead, Engineering management were busy fire-fighting, sorting out problems. Engineering personnel were left to fend for themselves, creating more problems. One unappreciated consequence of this was the dissipation and loss of the company's technical knowledge about its products. The cybernetics of the Engineering department was not supportive of good engineering practice. It was this that the analyst identified as being the major issue, which was accepted by those at the meeting.

5.4.2.2 Naming systems

To address this issue, the analyst adopted the framework of the Cybernetic Methodology. This approach is outlined in table 5.7. The analyst viewed his role as a "change agent", "facilitator" or "catalyst", but from two perspectives. The first was concerned with improving the cybernetics of the Engineering department, so that it was able to learn about its products, develop its resources and improve its "systems". An "adaptation mechanism" was being designed for Engineering (section 3.1.1). The second concerned making actual improvements to "systems" and practices. By addressing the former, the conditions would be established to pursue the latter. However, the analyst would not be making any of the changes himself. These would all be done by those within Engineering.

The analyst's Cybernetic Loop was concerned with creating the conditions to support conversations for possibilities and for action. The analyst's Learning Loop was concerned with developing the appreciations of those attending the meeting about the organisation of the company, so that they would effect improvements to the existing cybernetics of Engineering, thereby providing a suitable context for learning. Engineering's Learning Loop was concerned with appreciating the situation and making actual improvements. In this way the analyst's Learning Loop was directed towards developing the Engineering Learning Loop, which in turn was initially directed towards its own Cybernetic Loop, before returning to focus upon more specific issues. Not only would Engineering undergo change driven from within itself, but it would develop both the understanding and ability to

maintain its self-development. This approach also tacitly underpinned the first approach (section 5.3.1).

table 5.7 Approach 4 - the Cybernetic Methodology

Transformation	To effect the conditions which support the professionalism and creativity of the individual and the effectiveness of the Engineering department
Actors	Internal facilitator ("catalyst" or "change agent"), Engineering management
Suppliers	
Customers	The Engineering department
Owners	The Technical Director
Duration	July to December
Regulatory mechanisms	A meeting is held with the Business Development Director each week to discuss project progress, difficulties and potential actions. A briefing is given to the project group at three week intervals to inform them of events within the area.
Process	The activities indicated in the Cybernetic Methodology both to create the conditions for effective problem solving and to manage the process of problem solving
Accomplishments	Focused discussions amongst directors, which placed issues into perspective, giving rise to decisions which could be acted upon Engineering management re-structuring creating organisational learning for product families and engineering resource development Development of a strategic view of the Engineering department resulting in a five year development document.
Difficulties	Non-conformance to the accepted approach Lack of clarity regarding what would be achieved Difficulty in establishing clear objectives and timescale

5.4.2.3 The Cybernetic Loop...

5.4.2.3.1 ...creating the conditions to support conversations

To create the conditions to support conversations it is desirable to establish what we intend to achieve during the interaction. Consequently, in creating the conditions, we are ensuring that the necessary people are brought together and that the necessary facilities are at hand. We are creating the conditions to optimise the likelihood that our intend is achieved. The intent may be the bringing forth and appreciation of different views so that a shared viewpoint may develop. Alternatively it may be to ensure that ownership is established. In both cases we can enhance this process by using models (e.g. computer-based models and "brown paper" models), developing appreciations by using these devices to orientate conversations. In the case of Engineering the right people were those identified at the analyst's meeting: the managing director, the technical director, one project director and the engineering manager. The device used by the analyst were models.

5.4.2.3.2 ...creating an Engineering "adaptation mechanism"

What emerged from the analyst's meeting and subsequent conversations was the concept of a matrix organisation (figure 5.14) which focused attention in two directions. The first concerned the consolidation of knowledge regarding a product family, this being achieved through a new role of product development manager. A product development manager would be appointed for each of the five product families. The second was concerned with the development of Engineering's most precious resource - its people - this being achieved through the existing role of engineering manager. One issue recognised was the need to clarify all roles within Engineering and define the nature of their responsibilities, particularly that of the new role of product development manager.

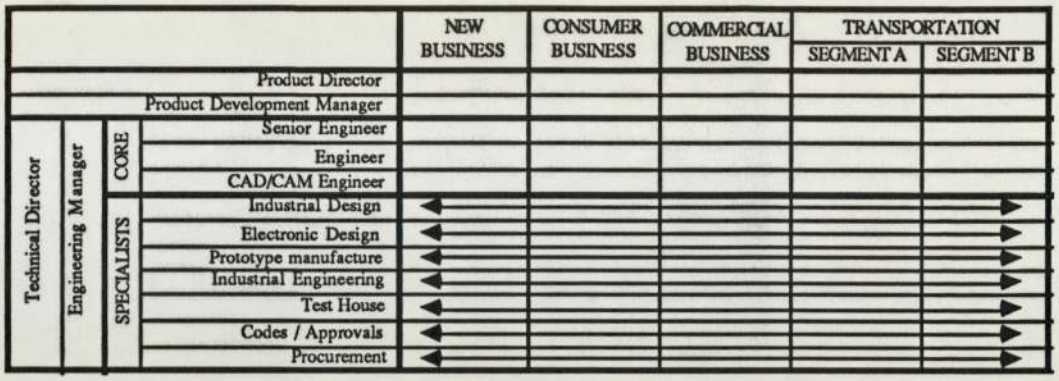


figure 5.14 The Engineering matrix

Different views emerged regarding the scope of the role of product development manager. One view held the role to equate to that of product general manager, responsible for all issues pertaining to the product family. Another view held that this role was concerned solely with the technical issues pertaining to the product family. Further, the question arose as to whom this role reported: to a new role of product business director or to the technical director. In early August, without waiting for this to be resolved, the managing director decided to appoint, for two key product families, two people to this role, one of whom was one of the project directors. They were nominally to report to the technical director. However, it was recognised that this role needed to be clarified since there was potential conflict with the role of sales director and likely confusion over what should be expected.

A model was produced (figure 5.15) to clarify how the product development manager would fit into the company. This model was used to orient discussion. It raised the issue of Marketing, a function which was not recognised within the company, but which had been discussed on a number of previous occasions. This led to consideration of the relationship between Sales and Marketing, which in turn raised the issues of the company's structure and the possibility of a re-organisation. The outcome was general agreement about this role, until the Sales / Marketing issue was resolved, placing the emphasis upon the technical bias. What was still unclear were the boundaries of this role. Nevertheless, there was now an organisationally recognised mechanism which was explicitly committed to the development of each product family.

The other main concern was the engineering manager's role. Reporting to the technical director, the engineering manager was expected to ensure that engineering

resources were both able and available to do the required task. It was viewed as a resource development role, both providing personnel with the time, tools and training / education to improve their effectiveness and also seeking improvements to the facilities. It was also viewed, though questioned, as a resource monitoring and co-ordinating role. Supported with the newly introduced "planning system", it was expected that the engineering manager would maintain daily contact with his personnel. Although the engineering manager explicitly accepted these roles, based upon observations of his behaviour it was questioned whether he fully appreciated this.

Other recognised roles were differentiated into those providing core engineering skills and specialist skills. A group, providing the core skills required for that product family, was assigned to each product family. Less utilised specialist skills, for which it was not feasible to have a single person in each group, provided a service to all the groups. Identified in this latter class was the procurement function, an issue which had not been resolved (section 5.3.3.3.3).

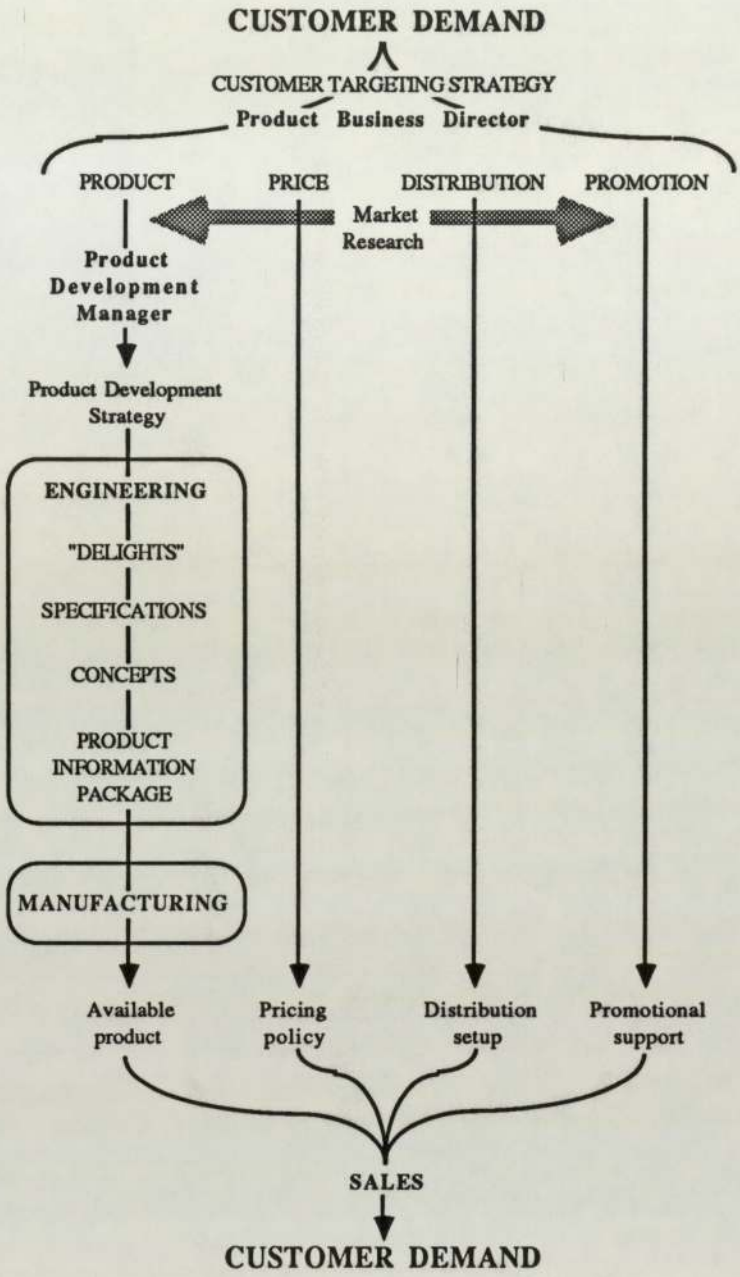


figure 5.15 Modelling a customer driven organisation

In response to the question about how these roles would function together within the engineering department, a model was produced and presented to the technical director (figure 5.16). This model took the VSM format and was used to orient discussions about the necessary issues.

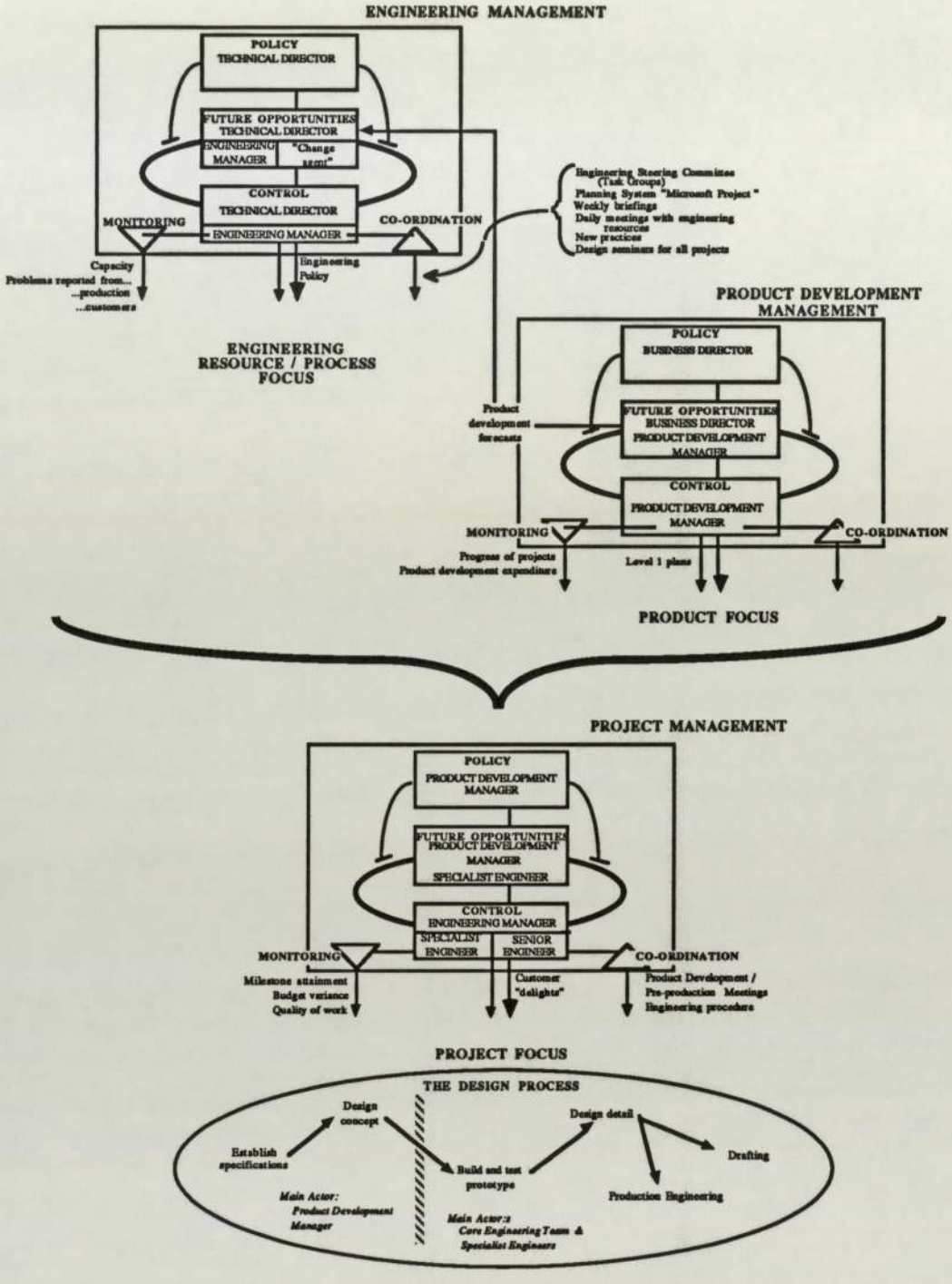


figure 5.16 Modelling the management of a design project

The design project was identified as the core primary activity unit, this being managed using project management techniques. A project team would be assembled for each project under the leadership of a project owner. The team would consist of representatives from all functions for the duration of the project. The project owner would tend to be either the product development manager or for internal projects, the engineering manager. The project owner would be responsible for establishing the initial programme and identifying relevant innovatory issues, supported in this latter activity by the specialist engineers. Projects would be controlled by a manager through the senior engineer, with the expectation that each team member took responsibility for the control of their own work. Views differed as to who this manager should be, though the dominant view was that this was the role of the engineering manager (figure 5.16).

The project would be influenced from two directions: from an engineering resource perspective and from a product perspective. The first, the domain of engineering, would be under the leadership of the technical director, who, with the aid of the engineering manager and the change agent (analyst), would establish a long term plan for the department based upon forecasted work (e.g. five year horizon) for each product family. This would be implemented by the engineering manager. The second, within the domain of a hypothetical product development function, would be under the leadership of hypothetical product business director. With the product development manager, they would develop their long-term plan for the product family, which the product development manager would implement.

In this manner, Engineering would retain its autonomy, thereby providing a service in which its resources would be contracted out to each of the product development managers. However, the exact nature of this interface required clarification, in particular, identification of who would have project control.

Although the technical director did not understand the logic of the model format (figure 5.16), he appreciated the logic of the argument presented to explain the functioning of engineering.

A model (figure 5.17) was produced which was directed towards clarifying the nature of the interface between the engineering manager and the product development manager. The intention was to create the option for the "project control" activities to be allocated to either of the roles, depending upon the nature of the project.

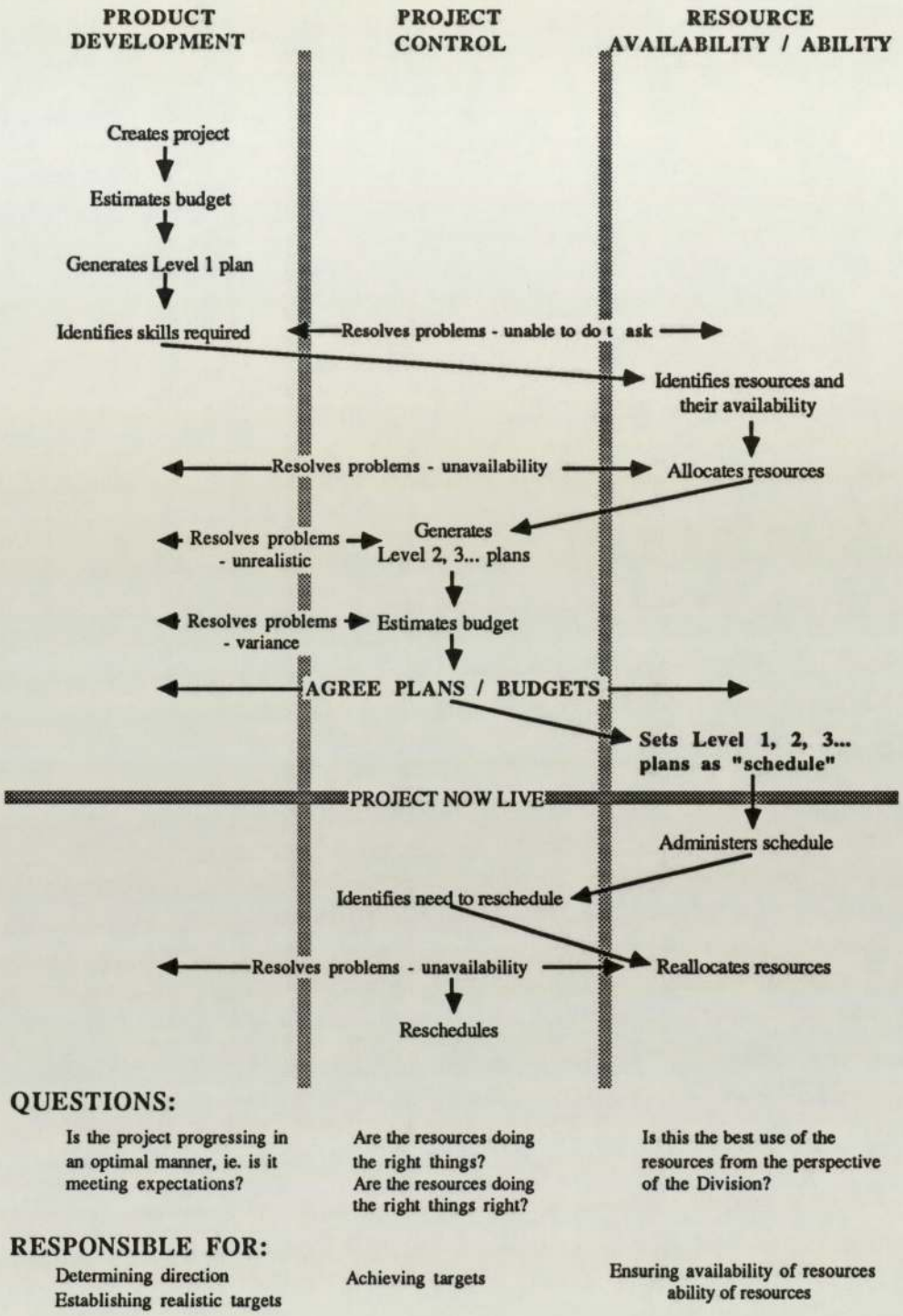


figure 5.17 Distinguishing between roles

Whichever manager took responsibility for controlling the project, then he would also take responsibility for the performance measures attached to this activity. The engineering manager would be responsible for ensuring the effective utilisation of the engineering resources and the efficient use of their time. The concern of the

managing director, that people were attending to the wrong objectives, was being addressed by the engineering manager, who met his personnel daily, agreeing objectives for that day and reviewing whether the previous day's objectives had been achieved. The prevailing opinion was that this was necessary if bad design practices were to be overcome. This activity would be carried out by whomever was controlling the project.

By the end of November, the proposals had been extensively discussed and generally accepted as the way forward. They had been partly implemented as they were unfolded, with the outcome that people were generally functioning as expected, with perhaps the exception of the engineering manager. As mentioned, his actions appeared to differ from what he explicitly accepted to be his role, raising concern about the attention being given to the development of the resources.

5.4.2.4 Learning Loop...

Engineering was learning about itself in terms of its overall organisation, with the outcome that it was adapting itself (creating the conditions) so that it was more supportive of what it was about - the design activity. However, other issues had been raised which had been receiving varying levels of attention: these included the development of a long-term plan, improving the existing "systems", replacing them if necessary, and improving the capability of the design process. The first two could also be viewed as providing the conditions to support the latter, since both pertained to the regulation of the design process, the former concerning possibilities in the future, whilst the latter enhanced the effectiveness of the design process. Since the intent was for developments and change to manifest from within rather than be introduced from without, the changes that had been made to the organisation of Engineering could now enable this to happen.

5.4.2.4.1 ...long-term direction

In response to the recognition of the need to take prior action in anticipation of future events and manage the process of change and improvement, a five year Engineering development programme was outlined by the analyst.

It proposed individual development plans for each member of Engineering so that career aspirations could be aligned with engineering requirements, thereby assuring the availability of the specialist skills required. An apprenticeship style development programme was in operation, providing a base. Further, desired and actual skills

had been crudely identified using matrices, providing an insight into the strengths and weaknesses of the existing skills. Also proposed was the on-going use of task forces as a mechanism for achieving change, these managed by both the technical director and engineering manager. This process had been initiated in May to improve "systems" though had met limited success (section 5.3.3.3.3).

The proposals in the development programme provided the focus for continuing discussions between the analyst and the technical director. Over time the technical director became increasingly involved in the development of this programme, taking it over from the analyst, extending it to include outline proposals for the development of each of the product families and assuming ownership over it.

5.4.2.4.2 ..."systems" to support good engineering practices...

5.4.2.4.2.1 ...problematical situation

During the period in which the analyst developed an appreciation of how Engineering functioned (section 5.4.2.1), he distinguished a number of mainly manual-based "systems" being used within Engineering.

The "system" to review project progress ("system 1") had been revised earlier in the year and appeared to be conceptually sound, though was to be augmented by the introduction of a project planning "system". The departmental management information "system" ("system 2") also appeared to be conceptually sound but upon deeper investigation was found to be time-consuming, limited in scope and was based upon both inaccurate and missing data. A "system" to deal with changes to either documentation or products ("system 3") was cumbersome and gave rise to a continual backlog of work. Often the implications of a requested change were not realised at the time when authorisation was given to initiate the change process. The "system" used for issuing new documentation ("system 4") was complex, hindered by an awkward indexing "system". No-one understood the "system" for raising a part number and creating of a Bill of Material (BOM) ("system 5"). Other "systems" could be distinguished (e.g. CAD/CAM, test-house, modelling, drawing formats, technical library), but could be viewed as subordinate to the five listed.

By distinguishing individual "systems", it was possible to address individually the complexity pertaining to each one within the context of the Engineering system, without becoming overwhelmed by the complexity of the whole Engineering "system".

Three developments influenced the direction of progress. The first was the engineering manager's introduction of a PC based project planning system (Appendix C), which had major implications for both the management of projects ("system 1") and the running of the department ("system 2"). The second was one project director's efforts to introduce a computerised document storage system, linking up to display screens on the Production shop-floor, this expected to effect the document issuing system ("system 4"). Third was the need for accurate BOMs by Production to enable accurate stock information to be derived ("system 5"). The BOM can be likened to the DNA molecule; it contains all the information regarding a product from which all other information is either derived or attached.

5.4.2.4.2.2 ...achieving change

Initial progress had already been made with a revision of the change procedure ("system 3") and the commissioning of the project planning software ("systems 1 & 2)". With regard to the commissioning of the planning "system", difficulty was experienced in establishing meaningful performance indicators. Earlier in May, two monthly meetings had been initiated for each Division, chaired by the finance director. Their purpose was to review performance, this based upon cost variance and schedule attainment. The difficulty arose in the derivation of suitable schedule attainment measures for Engineering. This was due to the unpredictable way that engineering plans changed. It took till October, before suitable measures were identified, these based upon around seven visible milestones for each project. The intention underlying these measures was to improve the accuracy of forecasts.

The development of the other "systems" was being achieved by the tasks forces. Five task forces were set up. Membership was compulsory and involved all Engineering personnel. The underlying philosophy was that Engineering assume responsibility for putting their own house in order. The expectation was that once a task force had completed its objective, it would disband and another task force would form to address another issue. The primary role of the analyst was to help the task forces get started so that they could function on their own and to affect the conditions so that they could continue to function effectively. However, progress was severely restricted by the availability of time from the task force members, despite time being allocated for meetings and for getting things done. Time was a problematical issue. Further, both the technical director and particularly the engineering manager had little involvement. Questions were asked typified by: "Is management interested? "and "why should I spend time doing this when I've more

pressing work?". Further, the task forces recognised that they were identifying issues which required policy decisions by management, but which management would not appreciate unless they involved themselves more with the task forces.

After a month, the analyst formed an Engineering Steering Committee, whose membership included both the technical director and the engineering manager with task force leaders attending as required. It role was to provide direction for the task forces and introduced a more formal mechanism to link long-term plans and actual improvements. One of the first issues addressed was BOM ("system 5"), this becoming a priority issue. During the ensuing meetings, responsibility for the progress of BOM was explicitly handed over to the engineering manager. At these meetings, the analyst steered the conversation to clearly establish what was to be expected from the engineering manager. Following this, aided by the analyst, the engineering manager set about establishing the issues which required his decision so that the BOM task force could proceed.

5.4.2.4.3 ...the design of products

The attention of the analyst had been focused upon creating the conditions whereby Engineering had the capability to develop themselves, using the analyst as a change agent. This was a slow process, since they first had to understand themselves in order to make the necessary changes that would permit them to be adaptive. However, central to all this was the improved capability of the design process. The general format of the design process had been clearly defined by the technical director and the engineering manager earlier in the year ("system 1").

Subsequent analysis of the design activity revealed fifty-eight distinct activities, calling upon differing levels of creativity. It was argued that there were aspects of the design activity which were routine and could be handled in a mechanical manner. However, the skill of the engineer lay in his/her ability to intuitively select appropriate responses to the succession of queries that arose when carrying out a specific task. This brought into question the nature of work within Engineering. Did the tasks contain a level of uncertainty and require a level of skill to generate adequate responses? What were the creative requirements for each task? These questions were not resolved. Instead, the style of the design process and the creativity of the individual was approached by the analyst as being something that should not be mechanised. Control of the design activity was intrinsic to the individual. What was important was the quality of the results, with time and cost being important commercial considerations. This implied that the individual be

developed with self-control as the aim. This returned attention back to how and how long it would take (section 5.4.2.4.2.1).

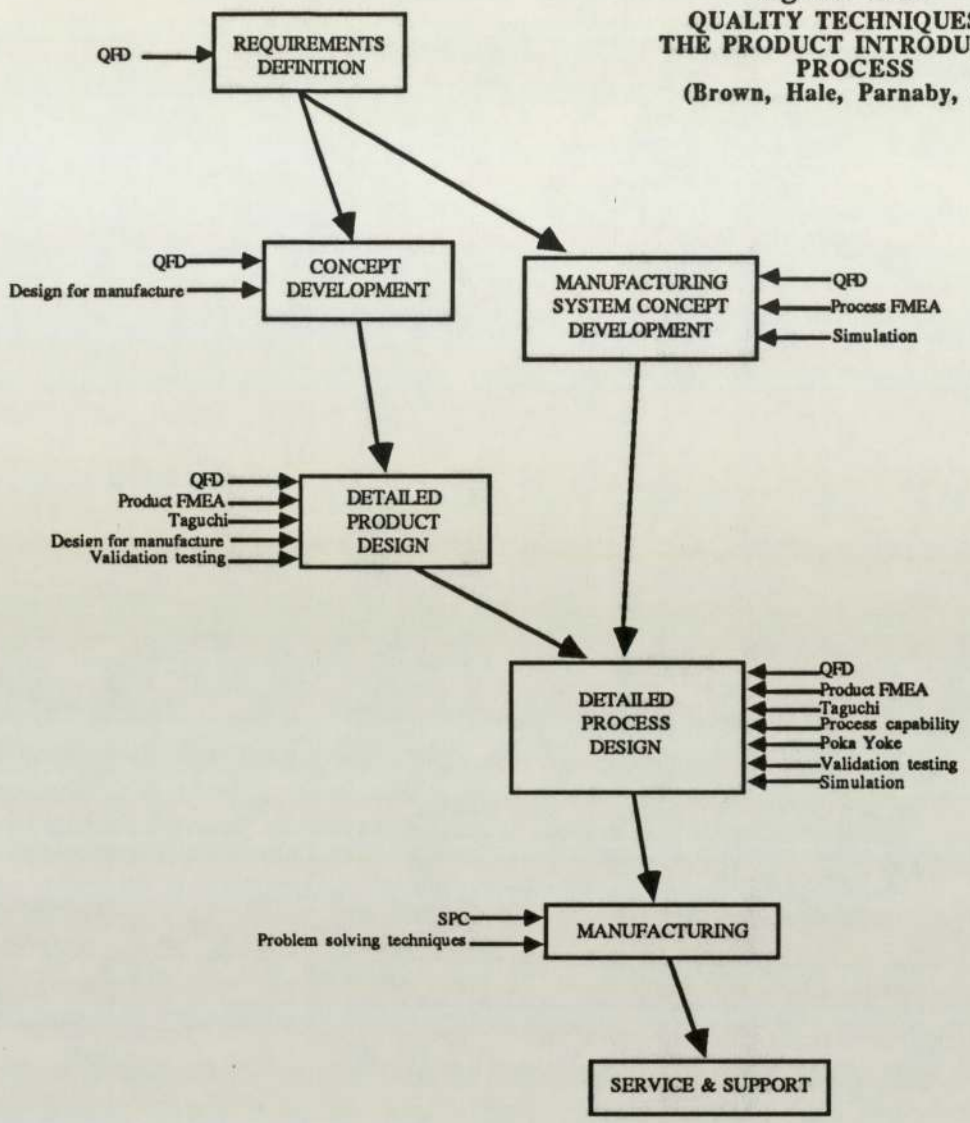
Although expectations of significant immediate improvements varied, it was perhaps more realistic to envisage that improvements would initially be slow in appearing, but would accelerate with the development of the understanding, self-discipline, skills and professionalism of the personnel. However, in the short-term, the emphasis was upon supervising the less experienced personnel and improving the "systems". Further, an unquantifiable opportunity existed in the adoption of appropriate tools (figure 5.18: e.g. QFD was being examined as an aid to clarify specification definition), but these also would require time to introduce. Nevertheless, debate ensued about the pace of visible improvement.

5.4.2.5 Discussion

Although a variety of issues are raised, one which is prominent is the analyst's approach to the problematical situation of Engineering. In response to his task of improving existing "systems", he questioning what was being asked of him. Further, he challenged the view that change was driven from outwith the system as was being practised within the company. Instead of change within Engineering deriving externally from the analyst, the analyst attempted to create the conditions whereby change derived from within Engineering. (This point was later appreciated by the Accounts department during its review (section 5.3.3.3.3), though it failed to appreciate the value of a facilitator.) In doing so, he made tacit use of the Cybernetic Methodology to guide his thinking and actions.

No initial assumptions were made about the nature of the problem, instead attention focused upon bringing forth and developing appreciations of different views about the situation. Tasks identified by the analyst included creating the conditions so that good conversations could ensue. Also was the task of producing relevant models which the analyst could use as devices to orient conversations both about possibilities and action. However, to produce adequate models, the analyst found that this required sufficient appreciation about the situation for challenging insights to emerge, this demanding that the analyst spent time getting to "know" Engineering.

figure 5.18
QUALITY TECHNIQUES IN THE PRODUCT INTRODUCTION PROCESS
(Brown, Hale, Parnaby, 1989)



One of the produced models used the format of the VSM (figure 5.16). The VSM was used by the analyst to develop a coherent argument about a possible Engineering organisation. Whilst those participating in this conversation did not appreciate the logic underpinning the VSM, they appreciated the logic of the argument. Consequently, whilst the VSM provided the analyst with an analytical device, it also provided the analyst with a linguistic device to orientate discussions (section 3.2.3.1).

Once the conditions were created to support change, individual issues were addressed which involved the analyst, who again drew upon the Cybernetic Methodology. What became apparent with the activities of the task forces, in particular, the BOM task force, was the ease in which the cybernetics of the

situation could be inadequately addressed: was the context consistent with the content and vice versa? i.e. were the right people being involved and was their involvement adequate? Other questions raised included: was there leadership and direction? how did the problematical issue fit into the general situation of Engineering and was mechanism making this link adequate?

5.5 Discussion

An insight has been presented into one company's experience with the process of organisational change. Over an eighteen month period, four different approaches to organisational change were attempted. These have been examined using the framework of the Cybernetic Methodology. The methodology's explanatory value has been illustrated, this enabling penetrating insights into the process of organisational change. Further, these insights permit an insight into how the methodology can contribute to the handling of the process of organisational change. What emerges is the opportunity to learn from each of the approaches. We can learn about how we can be more specific about what it is that we desire to change. Further, we can learn about the how we go about effecting change. Thus, it becomes possible to design an approach to organisational change which improves the likelihood of the desired changes occurring. It is anticipated that this approach will use the framework of the Cybernetic Methodology.

5.5.1 A review of the five approaches to change

Although the pressure for visible results underpinned much of the effort, other issues arose which prompted changes in direction.

The first approach, successful in terms of what it sought to achieve, was targeted at a limited application. It was characterised by the semi-structured on-going interactions of the analyst with production personnel. It reveals the choice of the individual in accepting change and the influence of management style in hindering the effort. This approach was inappropriate as an organisation-wide approach to improvement, it requiring a more planned format to handle the complexity of the organisation.

The second approach, using a team of "change agents", addressed the company as a whole. Significant effort was placed upon planning the process of change, this leading to the creation of conditions adequate to support the anticipated change. The

process of change initially functioned as anticipated but became severely constrained. Inadequate attention been spent at the outset in understanding what was to be changed: how the company functioned and what was desired. This failing permeated all subsequent activities. However, it is likely that, if this had been adequate addressed, the programme could have been very successful.

The third approach corrected the weakness highlighted in the second approach, by providing a method for understanding what was happening.

In two phases, the first phase utilised the experience of consultants. Rich ("brown paper") models were produced which were use to orient debate and bringing forth views. However, despite an espoused regard for the individual, the antithesis was experienced with attention focusing upon "systems". The high cost of consultants brought this phase to a close.

The second phase was derived from the first and was developed over time. It recognised the need for both attending to detail and improving the participation of the "system" users in both the "system" design and implementation. However, this approach again focused upon "systems", viewing the organisation in terms of "systems" and assuming that by addressing ""systems" the other issues would sort themselves out. People were a secondary feature. Failure to make significant progress may be attributed to inattention to the needs of the individual, both as a user of the "system" and as a person. This was demonstrated by the reluctance of users to accept new practices. It also highlighted the inability to distinguish between symptoms and causes, this reflecting a lack of appreciation (poor models) of the context in which the symptoms arose.

The fourth approach emerged with the recognition that the organisation was about people and that "systems" are a manifestation of the formalised interactions between people. Effective change was viewed as deriving from within the system (i.e. organisation or individual) rather from without, raising the question of how this was to be achieved. Emphasis was placed upon understanding the situation, in terms of the people, their interactions and the issues they brought forth. By understanding a situation, it was possible to produce models about the situation. The distinction was made between models about the interactions which permitted issues to be brought forth and models about the issues. These models provided a focus for debate, orienting different viewpoints towards a common viewpoint. By improving interactions, better models could be produced and vice versa. The outcome was a re-organisation of Engineering, thereby permitting the necessary

interactions to occur (an internal adaptation mechanism) so that better models about the issues (e.g. product designs, improved "systems") could arise and thereby lead to more effective action. This was anticipated to also support the development of the individual. However, this approach was marred by the lack of short-term visible progress.

5.5.2 What is it that we desire to change?

The experience of attempting to effect change highlighted the need to be clear about what it was that was being achieved. "To give managers control" is too fuzzy. We need to be more specific about the issues. However, the question arises as to how. Insights have already been presented into possible issues, but these can overwhelm. Consequently it becomes desirable to organise these issues in some way that permits them to be handled.

Leavitt's model (1965), introduced in section 2.3, provides a starting point. We can revise this model of the four organisational dimensions to accommodate the preceding insights. People (actors) can be renamed *Individual* to accommodate those qualities that are distinctly human. The structure of the organisation can be recognised in terms of the *Interactions* among the organisational individuals. Task is renamed *Process* to focus attention upon the transformation, whether formally defined or otherwise. *Technology* provides the means to enhance the individual's activity and interactions and thereby enhance the performance of the process. The emerging model of an organisation is presented in figure 5.19.

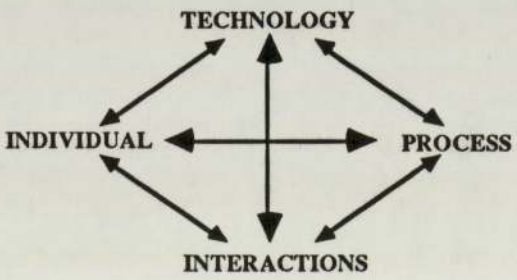


figure 5.19 The dimensions of an organisation

This model makes explicit both the core issues underpinning change and their interplay in the context of the organisation. Thus, whilst we can examine the adequacy of this context using the Viable System Model, we can study the specific issues which are our concern.

The economics of quality reveals the need to develop the capability of existing processes, highlighting the growing importance of the individual. We can focus upon the ability of the individual to perform given activities and handle the necessary interactions. We can establish their limitations and inhibitions and question the scope they have for further development. Similarly we can evaluate the process, e.g. in terms of outcomes, required resources and regulation, and determine how much improvement can be anticipated by introducing technology, more experienced individuals or better quality materials. Further, we can examine interactions (e.g. using the Variety Engineering Template or Viable System Model). We can examine the manager-subordinate relationship, clarify responsibilities, reveal the dependency upon the command channel and expose how measurements are used and their meaning. We can evaluate the interactions within teams, highlighting weaknesses. We can assess the reliance upon "systems" and establish whether their use permits individuals to abdicate responsibility for good practices.

What emerges is the opportunity to be more specific when it comes to defining what is to be changed and thereby be more focused and explicit in effecting change.

5.5.3 How do we go about effecting change?

In effecting change, two significant distinctions emerge. The first concerns the attitude towards what is to be changed, this being reflected in the two statements:

- the organisation is about "systems", though people are a necessary feature
- the organisation is about people and that "systems" are a manifestation of the formalised interactions between people

Whilst the first presents a mechanistic "sausage-machine" view of activity (the viewpoint interpreted to be underpinning approaches two and three), the second re-emphasises the "humanness" of activity (the viewpoint underpinning approaches one and four). The analyst took the view that an approach based upon the second viewpoint would lead to fewer disturbances to the change process arising from people. This leads to the second distinction of how to achieve change.

In effecting change, the question arise as to how it is driven, distinguishing between the imposition of change from outside and self-development, which can

draw upon external assistance. Notwithstanding, the expectation is for internal change to occur, this raising the question of what essential internal conditions are required to give rise to desired change and how these arise.

In imposing change, the need arises to manage both the relationship between the external manager and that being changed and also that which is being changed. In managing that which is being changed, this raises the question of how the external manager creates the necessary internal conditions for the change to happen. However, it is questioned whether the external manager can actually create these conditions.

It is proposed that if a self-development approach is adopted, then the external manager needs only to manage the relationship between the external manager and that being changed. The necessary internal conditions which would support self-development are created from within. Insights into the possible nature of these internal conditions are drawn from the Viable System Model. Three mechanisms are suggested: the first being one to provide direction, the second being an adaptation mechanism and the third, a monitoring-control mechanism. Often the monitoring-control mechanism tends to be well developed whilst the adaptation mechanism tends to be weak, with direction being variable. For these to improve, an adaptation mechanism is required, which, if weak, suggests that another mechanism is required to develop this mechanism. Thus attention focuses upon the relationship between the external manager and that being changed. This approach tacitly underpinned approach one, whilst was explicitly used in approach four. The creation of the essential internal conditions was aided with the use of the Cybernetic Methodology.

Thus in reviewing approaches two and three, it appears that they incorrectly placed emphasis upon managing that which was being changed. By placing emphasis upon the wrong issues, these approaches introduced more complexity into the situation than was necessary. Further, these approaches were inadequate to handle this complexity. The lack of attention upon the relationships between the external manager and that being changed suggests that there was insufficient appreciation of what could be changed and by whom. Further, the attention given did not lead to the creation of the necessary internal conditions for the change to happen, since this was not a recognised objective. Instead, it is suggested that whilst internal conditions did change, these conditions were not necessarily aligned to what was required, since they arose from the internal need to provide some response.

Consequently, changes that did arise were less than optimal, with "people problems" arising.

5.5.4 Designing an approach to organisational change

In designing an approach to handle organisational change, we can distinguish between creating the conditions to support change and the actual change itself. In both cases a sequence of events can be identified which entails the transition from appreciating the situation, to establishing what is to be changed, then to producing relevant models to enrich appreciations about what is to be changed, concluding with effecting the change. This sequence of events is described by the Cybernetic Methodology.

This process may arise through self-development or be facilitated by a "change agent". In the case of the latter, several iterations of the methodology may be identified: one pertaining to the "change agent" with the Cybernetic Loop focusing upon the conditions required for the "change agent" to be effective, whilst the Learning Loop addresses the conditions required to support change; the second iteration pertains to the organisation experiencing the change, with the Cybernetic Loop focusing upon the conditions required to support change (i.e. the Learning Loop of the "change agent"), whilst the Learning Loop attending to the change. The option exists for the "change agent" to design himself into the organisation (conditions) to support change (e.g. the second approach), in which case, the Learning Loop of the organisation also becomes that of the "change agent": the "change agent" becomes involved in effecting the change itself.

In a situation involving a lot of people, the conditions to support change may require much planning. In addition to the design of adequate regulatory mechanisms (using the Viable System Model) to support the change process, more conventional project management techniques may be used to determine the logistics of the process, taking into consideration time, cost and resource availability. Both require attention to the participants in the process, establishing their roles and responsibilities.

5.5.5 The emerging insights into the role of the participants...

The mnemonic TASCOI (Espejo, 1989) provides a template for establishing the roles of people in the change process. The distinction is highlighted between the actors who effect change and the owners who have managerial responsibility for change. It supports the handling of the issue of ownership for proposed change. It permits those who define the context within which the change is to occur to be identified (Intervenors), thereby enhancing the likelihood that conditions to support change can be created.

A simple analysis (Appendix D) of the parts played by each of the participants in the development of the Engineering Department (ref. section 5.4.2), identified six stages in its Learning Loop (figure 5.20). It assumed that conditions were adequate to support this learning (section 5.4.2.3.1). The distinction between what was espoused to occur and what the analyst observed revealed a gap. The existence of this gap raises the question of whether the initial purpose could actually be achieved. This suggests the need for someone to close the gap, highlighting the two roles of owner and "change agent".

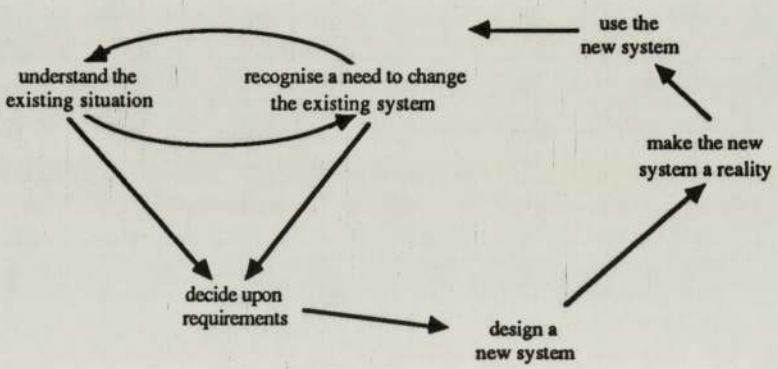


figure 5.20 A model of a change process

5.5.5.1 ...."ownership" and the role of "owner"

The distinction can be made between a person being observed to behave as if he has ownership for an object and a person having ownership for an object yet being observed to behave otherwise. This issue appears to be of general importance (e.g. in law), but its relevance to organisational change is of interest here. It appears to be an accepted view that the owner of an object is likely to be more caring towards that object. Thus, the actor in the work-place, if he has ownership for his work-place, is

anticipated to be more caring about this work-place. Similarly, it is anticipated that the work-place is more likely to be improved through the involvement of an owner / actor than would be the case for an external agent handing over an improvement with the expectation that the actor uses it. Consequently, the question arises regarding how we define an owner and establish when ownership occurs.

Checkland (p224, 1981) defined an owner as "some agency having a prime concern for the system and the ultimate power to cause the system to cease to exist". This, rephrased, defines the owner as the person who has the power to make the transformation happen or prevent from happening. However, Espejo defines the owner as he "who controls or would control the transformation" (1989) which he later revises to he "who has the managerial overview or would have the managerial overview of the transformation" (1991). An insight into the usefulness of these definitions can be considered by examining the issue of ownership with regard to an analyst's view of bringing about change within Engineering.

The analyst's intent was to effect an improvement in Engineering practices. This involved the analyst producing a long-term plan outlining how Engineering was to develop. Although there were on-going conversations with the technical director, the plan and its production remained under the ownership of the analyst. However, the only person who could enable the implementation of the plan was the technical director, indicating his role as owner. The technical director was also in a position to define the context within which the plan had meaning, indicating his role as an intervenor in the planning process. However, although he appreciated the value of the plan, he was not generating the responses which suggested to the analyst that he was taking over ownership for either its implementation or production. The question arises as to what actions would suggest that this was occurring.

The technical director started to develop parts of the plan himself, determining its direction, directing the analyst and initiating, through the engineering manager, its implementation. He was not merely enabling these processes. He was increasingly managing and being seen to be managing these processes until a point was reached where he took it over. The analyst's role switched from owner / actor to actor / facilitator.

The managing director's role in this process is revealed in his power to stop the analyst from working upon the plan: if this happened at an early stage in its development, then the plan would possibly have been abandoned. Otherwise, it may be assumed that the technical director would have continued with the plan. The

managing director defined the context within which Engineering functioned, having the power to disband Engineering. He also had the power to define Engineering. However, he did not manage Engineering. His role was solely that of intervenor.

This insight suggests that to describe ownership either in terms of power is misleading or in terms of control is inadequate. Ownership, manifesting as an observed behaviour, can be equated to the activity of management, which in turn can be described with reference to the Viable System Model. The emerging role of owner is a managerial role of which control is only one facet. To ascribe ownership is to pass comment about observed behaviour. This is distinct from being an actual owner, for whom "living up" to the role through the activity of management is an option.

It appears that ownership for what was happening within Engineering was weak (table 5.8). This was suggested by personnel within Engineering perceiving a lack of both leadership and control, reinforced by the other Divisions perceiving the need for improvement not only in the primary activities but also in the way these were regulated. Although people were "empowered" to take action (e.g. the task forces - section 5.4.2.4.2.2), initial enthusiasm quickly waned. The lack of management involvement was translated into the perception that management were not interested. It appeared that both the technical director and the engineering manager failed to effectively take responsibility for driving these improvements and become figure-heads for change. Although the prevailing Engineering management style tended to be introverted, personnel failed to perceive visible signals of management commitment and progress, instead translating their actions negatively.

The efforts of the analyst to transfer ownership for developments within Engineering was by means of developing appreciations of possibilities and guiding conversations for action. This was enhanced by explicitly establishing ownership responsibilities thereby identifying who was going to be responsible for what. This approach was adopted during a meeting to ensure the engineering manager's ownership for the development of a new Bill of Material (BOM) "system" (cf. section 5.4.2.4.2.2). During this meeting, directors established what was expected. Significant progress followed from this meeting due to the involvement of the engineering manager.

table 5.8 Establishing ownership for the development of Engineering (derived from Appendix D)

Technical Director		
Understand the existing system	espoused	recognised the need "to provide direction regarding how Engineering should function on a long-term basis": expectation that Engineering personnel understood the Engineering systems and practices
	acted	too many meetings and not enough time: relied upon day-to-day contact with Engineers for understanding of how Engineering functioned: no formal approach for ensuring that Engineering personnel understood how Engineering should function
Recognise a need for a new system	espoused	view that "things were not as bad as people made out"
	acted	on-going discussions with the Engineering Manager and Facilitator, though did not necessarily see the need for change as a major issue
Decide upon requirements	acted	quietly expressed his own views regarding how and what should be done
Design a new system	acted	makes decisions regarding the acceptability of models
Make the new system a reality	acted	authorised that things were to be done in this way
Use the new system	acted	expectation of improved performance, but questionable whether had fully accepted some of the proposals, e.g. failed to call the meeting of the Engineering Steering Committee on several occasions due to involvement in other matters, much deliberation over the development of individual career plans
Engineering Manager		
Understand the existing system	espoused	as manager of the Engineering function is "expected to understand how Engineering functions in order to control it" and "ensure that the Engineering personnel had this understanding so that they followed the system"
	acted	few initiatives: poor communication: his understanding was an outcome of day-to-day activities: no formal approach to establish what actually was happening: Engineering personnel did not understand the Engineering systems - widely held perception that Engineering was out of control
Recognise a need for a new system	espoused	"the systems need improving"
	acted	few initiatives appeared to be forthcoming with regard to getting others to recognise the need for change
Decide upon requirements	espoused	"this is what I would like"
	acted	general view as to what would like but has not established whether it is feasible nor examined the details
Design a new system	espoused	"this is what we've been thinking all along"
	acted	was involved in discussions with technical director and facilitator regarding possibilities
Make the new system a reality	acted	hesitantly accepted the various proposals from the Facilitator and introduced them after much deliberation
Use the new system	acted	"this is mine" (but only with regard to the project planning software)
Engineer		
Understand the existing system	acted	users of the systems on a day-to-day basis; individual practices reflect hear-say communication regarding how things should be done
Recognise a need for a new system	espoused	"lack of control, too much fire-fighting, too many interruptions"

Decide upon requirements	acted	has views but not necessarily in line with what the Engineering Manager desires: not consulted
Design a new system	acted	expressed their views regarding what they expected from the new system
Make the new system a reality	acted	involvement in Task Groups to address specific issues arising from the overall plan though eventually start questioning why they are doing this
Use the new system	espoused	"little has changed, still fire-fighting"

5.5.5.2 ....the role of "change agent"

The role of "change agent" or facilitator is one which is becoming increasingly recognised within the executive recruitment sector (figure 5.21). Insights have been provided into this role both from the perspective of using the Cybernetic Methodology (section 3.2.4) and from the role of the analyst in the four aforementioned approaches to change. This role can be more clearly defined by examining the activities of the analyst (facilitator) during the development of Engineering (table 5.9).

figure 5.21 An advertisement for a "Change Manager" (April 1992)

CHANGE MANAGEMENT
PROJECT ROLE

A renown market leader and major UK company is embarking upon a co-ordinated programme of cultural change. This is a key role in the project team which will lead the design and implementation of the change process. You will currently be recognised as fast track within a blue chip PLC, regarded as an implementor and influencer. Career enhancement opportunities are superb and you will be given every opportunity to achieve full potential. The benefits package and working environment are first class.

THE POSITION

To work with the senior team to plan and drive strategic & cultural change.
To ensure effectiveness and co-ordination of change programme through facilitation, coaching and consulting.
The strategic input to design of management processes to ensure quality objectives.

QUALIFICATIONS

Hands-on experience of managing the change process, ideally in a manufacturing or service environment.
An entrepreneurial approach and highly motivated team player.
A multi discipline background including exposure to quality management initiatives.
An analytical approach combined with the ability to drive projects.
A graduate with post graduate business degree, minimum 10 years experience.

table 5.9 The emerging role of the Facilitator or "Change Agent" (derived from Appendix D)

Understand the existing system
- acted: understands what is happening at a level which enables him to create the conditions whereby all participants can understand the situation in a manner which permits further discourse and action

Recognise a need for a new system
- acted: created the conditions where the strengths and weaknesses of the Engineering could be discussed by the Intervenors, placing emphasis upon the weakness that concerned how people were handled: identified issues which management did not recognise

Decide upon requirements
- acted: interpreted differing requirements and established a portfolio of potential scenarios

Design a new system
- acted: translates different perceptions of what is required into models for discussion: creates environment whereby models can be discussed

Make the new system a reality
- acted: communicated the value of the new system to the intended users and customers

Use the new system
- espoused: "do not expect instant results: will one day realise that Engineering has significantly improved: current emphasis is upon creating the conditions to support effective design engineering"
- acted: observed that there was an increase in the time spent upon added value engineering by the existing resources with a corresponding decline in emphasis upon low added value work and re-engineering work: certain projects were observed to be better managed with higher moral (reflecting the personal qualities of the new project manager)

Three key activities are identified. The first is the creation of conditions so that meaningful conversations are held. In addition to ensuring the right people are interacting, this may require that conversations are managed, calling upon diplomacy skills. The second activity is the production of models. Whilst this may be carried out independently by the "change agent", this may also occur in a group environment, where the analyst imposes structure upon issues as they are brought forth, thereby permitting models to unfold during conversations. The better the "change agent's" appreciation of the issues, the more insightful the models that may emerge and the greater the likelihood that pitfalls can be steered around. Third is the activity of promoting the "cause", reinforcing the message from senior management.

Whilst the "change agent" can help to effect the change, it is those who are affected by the change who will determine whether the change will take place. It is they who will accept the change and behave in a manner appropriate to the change. The "change agent" is merely a catalyst. By being sensitive to the needs of those affected, he will accelerate the pace of the transformation. To do this he will be authorised to enquire into any perceived relevant issues and also have open access to people as required. The "change agent" may need to challenge assumptions, this

suggesting that he holds a senior position within the company and reports directly to the most senior person in the organisation. Good communications should exist between the facilitator and senior management, thereby maintaining consistency in the transition from vision to action. Similarly, the "change agent" needs to be managed in a manner which does not incapacitate him.

The skill of the "change agent" includes ensuring that the right people develop ownership for the change and that they understand what is required from them as owners. This may require explicitly establishing responsibilities, thereby reducing the opportunity for passing the buck when things go wrong and thus minimising unnecessary delay and frustration. The failure to accept ownership may give rise to the abandoning of the effort at the earliest incident. The intrusion by intervenors can reduce an owner's sense of ownership, giving the owner the option to abdicate responsibility. The facilitator can be viewed as a coach, both to the owners and the actors.

Within companies, the emerging role of "change agent" (facilitator" or "manager of change"), as illustrated in an advertisement (figure 5.21), appears to support the picture presented above. Further, this advertisement identifies expertise across a wide range of functions and influential interpersonal skills as desirable qualities. The employer of this "change agent" appears to value people, since it is concerned with "quality objectives" and "quality management initiatives". However, it appears unconcerned or unaware with a view expressed by a consultant that the "change agent" should be an internal appointment. This view is not necessarily valid if the appointee has both the skills and the support to enable him to learn about the organisation. Such a package of skills may be found associated with a skilled user of the Cybernetic Methodology and the Viable System Model. What is clear is that the "change agent's" role has far deeper considerations than suggested in the advertisement.

CHAPTER 6
MANAGEMENT - A WAY FORWARD
the practice of cybernetics

Cybernetics has been defined as "the science of communication and control in animal and machine" (Weiner, 1948). An alternative view is to regard the phenomenon of communication and control as taking place within a domain, which we can think about from the perspective of Cybernetics. Although we can think about this domain in other ways, the theory, language and framework offered by Cybernetics provide a coherent and consistent means for handling problematical situations. It supports us in making adequate distinctions, developing rich appreciations and establishing effective actions. It permits us both to develop an appreciation of why different outcomes are possible and to suggest why one outcome arises instead of others.

The strength of Cybernetics perhaps lies in the way it handles the distinctions that can be made in a situation. These distinctions (e.g. context - content, observer - observed, thinking - interaction) are directed towards questioning the often taken for granted assumptions we make about a situation. Attention is not confined to the issues that are presented, but to the underlying issues which permit these issues to be brought forth. One prominent distinction, this underpinning the Cybernetic Methodology, can be described as the physiological - psychological distinction. In observing phenomena we can determine physical relationships, ascribe mental properties and examine the interplay between the two. In taking this perspective, it provides an integrative framework to link all the disparate theories that are amassed under the headings of physics, biology, zoology, sociology, psychology, politics, management theory.... .

Consequently, just as Cybernetics can provide insights into or explanations for the behaviour of "animal and machine", it is not unreasonable to expect that it can advise about the behaviour of "animal and machine". In chapter three, it was concluded that cybernetics was the science of management. It can be argued that the phenomenon of management takes place within a domain which we can effectively think about using the theory of Cybernetics. We can use the language of Cybernetics to express our thoughts about management. The framework can guide how we affect management behaviour.

However, a major weakness concerning Cybernetics is the widespread failure to appreciate both the theory and the language. Further, and consequently, there has been little experience of using the theory and language. Thus, the framework offered by the Cybernetic Methodology has lacked the development that results from its use. This has led to a poor appreciation of the difficulties associated with Cybernetics. Further, criticism has arisen, this appearing to be based upon a poor appreciation of the assumptions underpinning Cybernetics, in particular, the Viable System Model.

6.1 The practice of Cybernetics

Cybernetics provides a logic for thinking about the situation. It provides a language to support conversations. It provides a framework to guide the handling of situations (section 3.4). In the two case-studies presented (chapters four and five) the framework of the Cybernetic Methodology assisted the analyst to question the assumptions underpinning the two situations, and in the latter situation effect an outcome which permitted the situational participants to become more effective in their on-going handling of the situation (section 5.4).

6.1.1 Insights from the case-studies

The case-studies present an insight into the use of Cybernetic Methodology and the Viable System Model.

The value of the Cybernetic Methodology has been revealed in a review of a research project. Insights were generated into the complexity of a situation confronting a researcher during a two year research project. Issues which were not initially readily apparent were clarified when using framework of the Cybernetic Methodology (e.g. the espoused project name versus the project name-in-use, the role of the researcher). Further, by using this framework to retrospectively examine this situation, insights were suggested as to why one particular outcome occurred as opposed to others, this highlighting its explanatory value.

This explanatory value has also been revealed in the study of attempts to effect organisational change. Weaknesses in various approaches were revealed, these tending to emphasise attention upon some aspects of the change process, whilst underplaying other aspects. The Cybernetic Methodology, when used to effect change, provided the analyst with a balanced framework with which to ask

questions about the situation. It was not used in a rigorous manner moving sequentially from one activity to the next. Instead, the methodology guided movement within the situation. Indeed it would be difficult to establish whether adequate attention had been given to any particular activity in the methodology. The attention that was given was the best that could be given at that time, returning at a later date if necessary. However, one weakness in the analyst's use of the methodology was that the other participants were unaware that the analyst was using any structured approach. The analyst was concerned that they would fail to appreciate the methodology. Instead, a more conventional argument was presented, focusing upon relevant issues and their treatment. Consequently, the issues of how the other participants would respond to the methodology and whether there would be any improvement in dealing with the situation were untested.

The experience of the Cybernetic Methodology highlighted a variety of issues, in particular, the distinction between thinking about the situation (pertaining to the informational domain) and taking action in the situation (pertaining to an operational domain). Whilst a theory has been presented which both describes the workings of the methodology and formalises its use (section 3.2), actual use takes place in a context characterised by "normal" language and "normal" interactions. We do not move into a world of virtual reality in which all that exists is "systems thinking, systems practice". In using the Cybernetic Methodology, the emphasis is upon how we structure our thoughts and how these guide our movements within the situation. Cybernetics provides us with a new perspective with which to make and handle distinctions; a perspective which we would "normally" not consider. By doing so, it permits us to develop fresh and penetrating insights into a situation and lead us to more effective action.

Another issue raised concerns the role of models in this process, which we can view from two perspectives: what we view models to be and how we use models (section 3.2.3.1). We can view models either as "representations" or "interpretations" of reality. The view we adopt may affect how we use models, which we can do in two ways. We can use models as devices (analytical devices) to support thinking about and analysing situations (analytical mode). This contrasts with the use of models to support our interactions with others, i.e. as a "linguistic device to support communications" (linguistic mode). We often use both modes together: when we "think on our feet". If we adopt a "representational" view of models, the emphasis will be upon the rules underpinning the model and the rigour of their use. Debate may ensue about differences in the use of the rules. Alternatively, an "interpretational" view emphasis is upon the insights gained from

the models (e.g. metaphors), with debate focusing upon differences in the insights and their implications.

The value of rules or conventions for the production of models manifests in the consistency in the models produced. By attributing "meaning" to particular symbols or constructions, people can communicate through models, transferring ideas via the models without any other interaction. These conventions also support consistency of analysis, so that people can draw similar conclusions independently. This is the basis of the scientific method and is illustrated in the engineering sector with the use of drawing standards (e.g. BS308; BS5070).

The meanings derived from the model reflects both the outlook of the user of the model and the purpose of its use - at the time of using the model. The models used are not confined to a particular class or type, but are any that can enhance an appreciation of the situation. The emphasis is upon the use of the model.

When we use the Viable System Model the question arises of how rigorous must we be in adhering to the theory. The presentation of the model in figure 4.2 is less rigorous than that of figure 3.1. Does this matter? The question must considered within the context of its use and the user. Its loose use permits a cursory insight to be gained by the user and highlights the more apparent issues. Further it can be used loosely as a linguistic device by the experienced user to convey views to others, without dragging these users into the complexity of the model itself. Experience suggests that people can appreciate the essence of the model and hence the logic of an viewpoint without recourse to penetrating the model's detail (section 5.4.2.3.2, figure 5.16). One key issue is the experience of the user. The more familiar the user is with the logic of the model, the greater the analytical potential, in other words, the greater the likelihood that the user will be able to recognise the more subtle issues which the model can reveal. The less familiar the user is the greater the likelihood that the user will fail to appreciate the issues, quickly jumping to conclusions and thereby mis-interpreting the situation. Similarly, the user needs to appreciate the situation which he is modelling, otherwise the outcome will be an inadequate analysis, this leading to inadequate conversations and inappropriate action.

It can be concluded that the Cybernetic Methodology and the Viable System Model are not "painting-by-numbers" approaches for handling the complexity of problematical situations. To be so would be to deny the user the challenge of penetrating the complexity of Cybernetics and developing an appreciation of how

both the methodology and the VSM can be skilfully handled to provide informed responses to match the demands of each new situation. Whilst in the short-term this may be costly and time-consuming, in the longer-term the outcome is likely to be more effective responses from the perspective of cost, time and quality.

6.1.2 Debates directed against Cybernetics

An insight allowing the debate to be opened about the merits of Cybernetics and the framework presented is provided with the encompassing review by Flood and Jackson (1988). They identify eight issues which critics have raised against Cybernetics and the Viable System Model in particular (figure 2.5).

figure 6.1 Criticisms levelled at Cybernetics
(Flood and Jackson, 1988)

Methodological

1. The cybernetic model is often accused of adherence to misplaced mechanical and biological analogy (Checkland, 1980; Rivett, 1977; Ulrich, 1983).
2. The concept "variety" has been criticized as:
   a. a poor measure inappropriate for scientific work (Rivett, 1977), and
   b. "unexceptional" when applied to the management of social organisations (Checkland, 1980).

Epistemological

3. The cybernetic model is held to give an impoverished, or subset, picture of organisations (Checkland, 1980; Thomas, 1980).
4. The cybernetic model emphasises stability at the expense of change (Ulrich, 1983).
5. Cybernetics encourages organisations to function on a set of a priori identified goals without regard to the field of relationships in which they find themselves. This can be dangerous (Morgan, 1982).
6. The cybernetic model underplays the purposeful role of individuals in an organisation (Adams, 1973; Ulrich, 1983).

Utility

7. Following no. 6, there are clear autocratic implications when the cybernetic model is used in practice (Adams, 1973; Checkland, 1980; Lilienfield, 1978; Rivett, 1977; Thomas, 1980; Ulrich, 1983).
8. The cybernetic model is difficult to apply in practice (Rivett, 1977; Thomas, 1980).

A response to these criticisms here, in part, iterates their response. However, in the light of the insights presented in this dissertation, an updated response is required.

1. An insight into the nature of complexity is logically unravelled to derive a view from the viewpoint of an observer of how people interact, both individually and collectively, in such a manner as to permit this behaviour to be modelled, discussed and modified. The observer may identify a group of people - an organisation - and recognise a pattern in their interactions -

structure. Beer (1984) describes the process of how the logic was derived and its scientific basis, explaining how he derived the VSM. The concepts of cybernetics can support a better understanding of mechanical and biological systems or, vice versa, these analogies can be used to help clarify some of the concepts presented. However, to claim an analogy as the basis of the theory is erroneous.

2. The value of "variety" as a concept is perhaps illustrated with the example of the design of a set of screens for a database. The task involves establishing the user's data requirements; how does the user identify disturbances and determine suitable responses; distinguish different categories of data, perhaps establish different acceptable states within each category. The data, perhaps collected from its supplier(s) by a clerk, may be recorded on several specifically designed forms. The database containing the required input data will be constructed from "fields", definable in terms of id, length, type and acceptable states. An input screen will be designed identifying the "fields" and arranged in a manner that facilitates data entry. Several of these input screens may be required for different input situations. The output screen will reflect desired data requirements, again composed of fields, but this time with the option that these fields can be constructed from a computation of the input fields. Further, this output screen may distinguish a number of user responses, printing reports or transmitting reports to other users. This situation is characterised by the distinctions made. However, although the focus here is a database, we can apply a similar approach to any situation we experience. We make distinctions. Variety, as a concept, is inherent to how we observe a situation and how we handle situations. That variety is unexceptional is that it provides an effective measure of situational complexity irrespective (without exception) of the situation. As Zeleny (1986) points out, the issue which is of concern is that pertaining to how we handle variety. Options include the development the individual as a variety generator and the development of technology to reduce the variety the individual has to handle.

3. To iterate Flood & Jackson, this is" difficult to sustain". When using the logic of the VSM, the user is systemically unfolding the complexity of the organisation. In doing so, the user must continuously ask the question "do I make a distinction here or not", this reflecting the perspective taken. The outcome of this is a rich view of the organisation. The question that does arise concerns the issues which the VSM cannot cope with. It may be

suggested that the politics of the organisation is one. However, although the issues clarifying the fit of politics into this logic have yet to be established, politics is a way of describing the interactions among a group of people and hence it is anticipated that it can be accommodated.

4. Stability and change are mutual partners in a process of ongoing interactions among people. It is due to the impossibility of getting a complete view of the situation constituted by the world's population that there will be people who will do things that will have a destabilising effect upon others, consciously or not. The Variety Engineering Template (figure 3.2) is one tool for studying the stability of an interaction, whether between individuals or groups, and identifying possible desirable and feasible changes.

5. To iterate Flood & Jackson and to refer to previous comments, this criticism is not sustainable. Goals are subservient to stable interactions (section 3.2.4).

6. This comment reflects a failure to appreciate that organisations are constituted by people with particular qualities (properties (Maturana & Varela, 1975)), who are there to carry out some meaningful activity in the context of the organisation and as such have definable roles. This is distinct from any purpose that a person wishes to ascribe to themselves or others in the context of living. However, it is the recognition that organisational activities are carried out by people, that offers management significant opportunity for developing these people so that they choose to make a contribution to the organisational activity. Individuals have a choice in what they do, irrespective of how repressive the system. It is how we can affect this that is of concern; particularly when the person chooses to participate, but the manager intrudes and stifles the person's "freedom" of choice - demotivates (cf. Ulrich 1981). Our attention now focuses upon management style, which the VSM can so adequately address, this placing as much emphasis upon communication as upon control (section 3.1.1). The VSM is not so much about structural design, instead being concerned with modes of interaction, both formal and informal - if this latter distinction is useful.

7. The failure to understand the nature of control gives rise to the illusion that control is about autocracy. As presented in section 3.1.1, control need not be so naively viewed and if this view persists possibly reflects the desire to maintain this view - a quality inherent in man's nature? However, Flood &

Jackson observe that "the VSM specifies no mechanism for the democratic derivation of purposes and suggests no procedures for facilitating debate about the nature of the goals pursued". Does this statement have validity? For many companies, purpose is not a negotiable issue. A company tends to be formed to accomplish a purpose, this being decided by the owner. When the company has grown to a size and the original owners are replaced by shareholders, purpose is still not necessarily negotiable, this being a matter for the professional managers who have responsibility for the company's viability. Purpose can then be ascribed as much from what actually occurs (what it does) as from what is espoused to occur (what it ought to be doing) (Espejo, 1991). In an organisation such as a school, purpose may be loosely defined with regard to a class identity (Espejo, 1991). However, its specific purpose, manifesting in how it is distinguished from other schools - its identity - is an issue for those running the school, the governors and perhaps the parents; there may be more need here for the appearance and practice of "democracy". Flood & Jackson's observation has relevance. But since we are concerned with the "engineering "of mechanisms to facilitate interaction and hence debate, their comment is incorrect. The VSM does help us with the interaction issues raised in all three scenarios, that is if we understand what it is that the VSM models (section 3.1.2).

8. Difficulty arises because of a widespread lack of understanding of both the logic of the model and what it means to apply the model. Recognition of this has led to publications by both Beer (1985) and Espejo & Harnden (1989), though it is valid to question how successful these have been. Difficulty can be attributed in part to the view that the VSM is a representation of reality. Chapters 14 and 16 in Espejo & Harnden (1989) clarify this issue, introducing the view that the VSM is a linguistic device (section 3.1.2). With this new view of the model, the question arises regarding how rigorously the logic of the model should be adhered to. Whatever the response, the use of the model is now enhanced with the availability of the Cybernetic Methodology and clarification of the epistemological underpinnings.

Flood & Jackson's concluding comments place cybernetics and the VSM within the "functionalist paradigm" (Burrell & Morgan, 1979), casting doubts about its fit within the "interpretive and radical paradigms". Two issues arise. The first concerns how cybernetics is to be categorised, if it must be. It is apparent from the foregoing that there are aspects of cybernetics which can be comfortably placed

within each of the paradigms identified by Burrell & Morgan, though the "interpretive paradigm" is perhaps highlighted. The body of theory that comprises cybernetics takes as basic, the distinction between what is there and what is perceived to be there, developing both avenues. This leads to the second issue; what outlook on the world should a user of cybernetics have? It is by viewing reality from the position of an observer observing the observed and interacting with other observers that many of the difficulties, when attempting to apply cybernetic concepts, can be overcome. Thus, an analyst who creates a model of a situation, can ask himself how the model will a help in the situation. Is the model a representation of reality or an interpretation of reality? The analyst (or "group viewpoint" - section 3.2.2) who adopts a representational stance will likely be interested in the detail of the model and the insights that this can provide to himself. The analyst who views the model as an interpretation of reality will be more interested in the conversations that ensue among different viewpoints; the development of each person's model of the situation and their possible convergence. Both outlooks have their use and complement each other.

Jackson (1989) adds to the foregoing issues in a subsequent review of the VSM. The view that the VSM "provides no mechanisms..." appears to conflate the distinction between the model and the use of the model. The VSM is a device for examining the interactions among entities, identifying the essential functions for an entity or body of entities to be viable. In using the model, the user will identify the entity and ascribe properties to the entity. Thus, when the entity is the individual, the user can ascribe the properties of purpose, learning, self-discipline and choice. Attention focuses upon those interactions that we deem will favour the occurrence of desired states. However, the model will not tell us what interactions we should select over others. Instead, it guides us in determining possibilities, drawing upon our appreciations of the suitability of specific interactions. This raises the question of how we develop these appreciations and what we do with the insights gained. This we can do using the Cybernetic Methodology, which in turn may lead us to use the VSM. The modelling activity is only one of a set of activities involving interaction among people. It is through these interactions that any mechanism emerges.

Jackson discusses Ulrich's (1981) debate upon the distinction between purposiveness and purposefulness and the relationship of these concepts to cybernetics. However, how relevant is this debate if we consider the concept of purpose as pertaining to an observer, whether observing self or something else? The distinction can be made between an organic system, whose purpose can only

be assumed by an observer who feels that purpose must be attributed, and a "man-made" machine or organisation which is ascribed the purpose for which it was created (Espejo, 1991). A further distinction can be made between the purpose that has been ascribed ("ought to do") and what an observer observes it doing (point 7 above). Thus, different purposes can be ascribed to the observed.

Jackson's recognition of the use of the VSM to further self-interest, indicates a property attributable to man. Thus, when we examine interactions and the manifestation of those properties which are viewed with disdain, our concern is raised to the level of ethics and morals. We can ask such questions as, "Is this right?" and "Who should be the judge of this?". However, if we wish to affect a particular situation, then we have the choice to enter into debate regarding this situation. These debates arise through interactions and since cybernetics is concerned with these interactions, we have a means to "engineer" these interactions so that we can appreciate each others views, if we so choose. Self-interest is not an outcome of cybernetics, but perhaps the opposite. As Jackson observes, "there are no *explicit* statements outlining the circumstances in which the VSM can be 'properly' employed." Instead we are left to our own judgement, can choose what we do and be observed by others in what we do.

So where does this leave us? It appears that there is a lot of misunderstanding about cybernetics, which the work of Espejo is slowly correcting, this work forming the core of this dissertation. However, this dissertation is not concerned with the debates regarding epistemology although it may have inadvertently involved itself in such. Instead, it is concerned with how these concepts can be used in dealing with problematic situations constituted from the interactions of self-reflecting people, i.e. the methodological issues. However, before moving on, the question arises concerning alternative approaches to dealing with complex situations.

6.1.3 Competing against alternatives

In trying to identify alternative approaches to dealing with complex situations, the difficulty arises where to begin. Two issues must be considered. The first concerns the different theories of organisation and where cybernetics and the VSM stand with regard to these alternatives? The second issue is concerned with alternative approaches to problem-solving and the fit of cybernetics and the Cybernetic Methodology.

It is beyond the scope of this thesis to review the variety of ideas that constitute the differing organisational theories. Instead, the reader is referred to other reviews, in particular to the work of Khandwalla (1977), who provides an overview of organisational theory, the methods of analysis, the schools of thought and their development, Burrell & Morgan (1979), who present an analytical scheme which they use to explore the ideas of social theory and organisational analysis, Morgan (1986), who examines the different ways (metaphors) that we can view organisations, e.g. as machines, organisms or political systems, and Handy (1985) who examines the issues underpinning organisational phenomena, e.g.. motivation, leadership, team-work and culture. However, the reader must beware that Burrell and Morgan's interpretation of cybernetics (Burrell and Morgan, 1979; Morgan, 1986) reflects the misunderstandings identified within the previous section. Similarly with Flood & Jackson's paper (1988), which verifies the compatibility of cybernetics with organisational theory. If the issues which they raise are re-interpreted in the light of the aforementioned insights, then it is anticipated that this will reinforce the case for cybernetics. This has been attempted, albeit in a concise manner, by Waelchli (1989), who demonstrates the presence of Ashby's Law of Requisite Variety across the spectrum of organisational theory. It can be concluded that cybernetics does have a valid and relevant role within organisational theory, though its significance within this body of theory may need to be more clearly and rigorously presented for it to be accepted by more main-stream organisational theorists.

The second concern is the role of Cybernetics within the body of knowledge that constitutes the ill-defined area of problem solving methodology. It is ill-defined in the sense that any mode of action-orientated enquiry has relevance here. Indeed a brief examination of several different approaches was presented in chapter 2. However, there are two allied areas which are of particular interest: "systems analysis / systems development methodologies" and "information systems development", both having their application within the context of the organisation and society. Further, the analytical scheme presented by Burrell & Morgan (1979) can be applied to these two areas, thereby maintaining consistency with the aforementioned study of social theory. This precludes the need to invent a new framework to support this discussion, apart from which it would be outside the scope of this dissertation to ensure that this framework would be firmly grounded.

Burrell & Morgan (1979) identify two key dimensions for the analysis of different approaches to social theory: the subjective / objective dimension, reflecting how one should view human affairs, and the regulation / radical change dimension, reflecting

the nature of human affairs as viewed, identifying the dichotomy between "unity and cohesiveness" on the one hand and "deep seated structural conflict, modes of domination and structural contradiction" on the other. This analytical scheme is of interest since it is compatible with the notion of an observer observing an observed. Is the observer of an objective or subjective disposition? Is the nature of the observed orientated towards cohesion or conflict?

This analytical scheme supports us in tracing the development and emergence of the "interpretivist" soft approaches (e.g. SSM, Multiview) for dealing with complex situations, from the "objectivist" hard approaches to problem solving, characterised by the tools and techniques of operational research. The value of this analytical scheme has been recognised by Hirschheim & Klein (1989) who use it to examine the different approaches to "information systems development". Further, they recognise the value of extending this work to "systems development methodologies". However, to provide a comprehensive review of the different approaches based upon this analytical scheme is a major work in itself. It must suffice to merely recognise that there are many prominent researchers in these areas, including C Eden and RL Ackoff. Nevertheless, we can gain an insight into what is happening in the development of "systems analysis / systems development methodologies", specifically the Soft Systems Methodology, and "information systems development", by focusing upon the current debates about the issues which are of concern.

One insightful debate is that concerning, not the issues within either of these two areas, but the "link" between these two areas. This debate can be followed in the "Systemist" over the period 1990 to 1992, this culminating in a seminar at Warwick University in March 1992, supported by a special edition of the "Systemist" in August 1992. It appears that a key issue concerns the distinction between the apparent objectivity inherent in "information systems development" and the subjectivity of the emerging "systems analysis / systems development methodologies" (Lewis, 1992). Debates are presented upon such issues as the compatibility of Data Flow Diagrams with conceptual models (Prior, 1990; Doyle & Wood, 1991; Sawyer, 1991), this suggesting that the issue of models presents a problematical issue for both camps (cf. section 2.2.3.1). By virtue of the existence of this debate upon such distinction between these two separate subject areas, it is proposed that this suggests that both areas are flawed. They present different viewpoints of the same issue, which it is assumed could be accommodated within a more encompassing viewpoint.

This issue concerns the situations constituted from the interactions of people and how these are handled. An insight into the issues which give rise to this flaw has already been presented in section 2.5.4.2. Examination of the Soft Systems Methodology (section 2.5.4.2) enables us to identify some of these problematical issues: context-content blurring, systems - real world blurring, thinking - action blurring and model use - type blurring. However, these distinctions have already been clarified in the context of the Cybernetic Methodology. It appears that the sound basis upon which the methodology has been grounded reinforces the potential of the methodology as a general approach for dealing with complex situations.

6.1.4 Using the Cybernetic Methodology as an aid for organisational change...

The need for a methodology to handle the complexity of a situation has been examined, both from a theoretical perspective (chapters 2 and 3) and from experiential perspective (chapters 4 and 5). It is proposed that a shift is occurring from experientially based approaches (e.g. the SSM) to one that is grounded in fundamental principles (i.e. the Cybernetic Methodology). What emerges is an appreciation of the contribution of the Cybernetic Methodology in dealing with complex situations. However, the variety of issues raised suggests that it is not an "easy" methodology to use effectively, particularly in the context of organisational change, thus requiring some guidelines or instructions.

6.1.4.1 ...a possible scenario

A scenario is presented outlining a possible sequence of events in the design and implementation of a manual-based "system". From this sequence are derived "instructions" (table 6.1) these being of possible help to the novice user of the Cybernetic Methodology.

The starting point is the manager's recognition that it is desirable "to improve the existing "systems" within his department". Following a period during which *he develops an understanding of the issues* pertaining to his stated aim, a series of meetings are held to discuss these issues, involving more senior management, managerial colleagues and anyone else likely to be affected by the proposal. The concern at this stage is *to create the conditions* whereby the necessary conversations to discuss possibilities can take place. It may be that the issues (difficulties) which brought the existing "system" to the attention of the manager

can be ascribed to some other "cause", for example, misuse of the "system" (arising from poorly trained users) or poorly informed users (arising from inadequate interfacing with other departments). The "system" may, upon analysis, be quite suitable for the department's needs, merely requiring minor adjustments. However, unless the conversations for possibilities occurs, there is a likelihood that attention will rapidly converge upon the wrong issues. Thus, it is necessary to create the conditions whereby the conversations do happen. Questions will include "who should be present?", "how should people interact?", and "how should the process be managed?". It is desirable that these conversations happen in an open environment, otherwise they will take place, if at all, in a covert manner, contributing to the organisational politics. However, attention should also focus upon the content of the conversations, *creating the models* (or providing the facilities to permit their creation) to support conversations and *managing these conversations* to ensure their progress, thereby enhancing the likelihood that these conversations converge upon an agreed action. Although several iterations can be anticipated, closure to this stage (stage 1) arises with agreement as to the action, in this case, the decision to design and implement a new manual-based "system".

To both create suitable conditions and be in a position to manage conversations requires an appreciation of the situation. Consequently, the person carrying out these activities will either be familiar with the organisation in which the situation arises or have the skills to quickly develop this appreciation. One possible approach is the VSM method (section 3.1.3).

Once agreement has been reached regarding the course of action, the task becomes one of both creating the conditions to ensure that effective action results and managing the action process (stage 2). Another iteration of the Cybernetic Methodology is realized, with closure arising when the desired action (change) results.

table 6.1 An approach for designing and introducing a new system
(adapting Espejo's three column analysis (1991))

ANALYTICAL MODE		LINGUISTIC MODE
TECHNICAL INVESTIGATION (i.e. specific content)	**ANALYSIS OF INTERACTIONS** (i.e. context)	**ACTUAL INTERACTIONS**
1.1 Find out about the situation: to arrive at a state whereby effective conversations can be held with and among participants		
Organisational identity Organisational boundaries (produce "brown paper" models of the organisational activities, produce "internal customer / supplier" models for each role) Model structural levels Distribution of regulation Study regulatory mechanisms	{Produce models of the situation}	Interview organisational owners Interview organisational participants to establish their roles and responsibilities and organisational activities Interview organisational participants as necessary to clarify uncertainty
1.2 Name Systems:		Hold meetings with participants to establish possibilities
Name possible issues of concern	Name organisations possibly relevant for clarifying the situation	
1.4 Produce relevant models (of/about the possible issues of concern)	**1.3 Study the Cybernetics** (of the situation so that conversations for possibilities can arise)	Seek expertise re. issues
		1.5 Create the conditions Organise so that conversations for possibilities can occur, i.e. people and "linguistic devices"
		1.6 Manage the process Manage meetings with participants to establish action and responsibilities for action (including ownership)
2.1 Find out about the situation (for which action has been decided)		
2.2 Name Systems Accommodate different viewpoints with regard to named situation	Name organisation relevant to the named situation	
2.4 Produce relevant models (of/about the selected issues)	**2.3 Study the Cybernetics** (of the named situation to establish how the change is to be brought about)	Discuss models with situational participants
Produce revised documentation Devise appropriate measures of performance		Discuss with the situational participants
		2.5 Create the conditions Introduce performance measures Provide necessary training Introduce revised documentation / mechanism
		2.6 Manage the process Go about improvements
Revise models	Review adequacy of the interactions	Review

6.1.4.2 ...some notes on models

In deriving table 6.1, the distinction has been made between the use of models in an analytical mode, whereby attention is focused upon thinking about the situation, and in a linguistic mode, where the emphasis is upon the actual interactions with others (section 3.2.3). This reflects insights about models revealed throughout this dissertation and summarized in a simple model (figure 6.2). It should be noted that whilst figure 6.2 suggests how we can view and use models, it is an oversimplified interpretation which ignores the interplay between the two identified approaches.

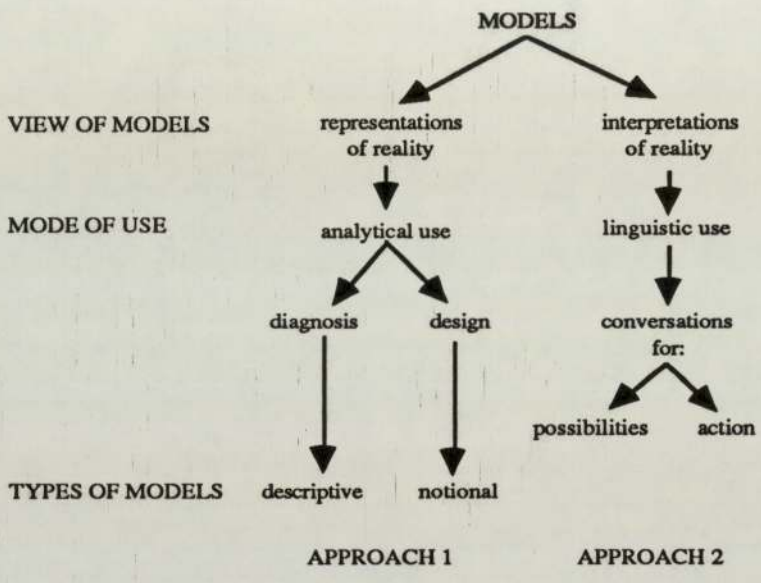


figure 6.2 An oversimplified interpretation of the use of models

However, we can make use of this interpretation in our appreciation of table 6.1. The basic distinction between an analytical and a linguistic mode can be unfolded to accommodate the distinctions underpinning Espejo's "three column analysis", upon which we can superimpose the six activities of the Cybernetic Methodology, each of which we can open up to identify specific activities. What is apparent is that the activities of the Cybernetic Methodology are not exclusive to either mode of model use. Further, two basic iterations of the Cybernetic Methodology are revealed: one iteration to determine the action to be taken from possibilities and a second iteration to carry out the action and bring closure to the situation. The set of "basic instructions" that emerge is a model which supports the use of the Cybernetic Methodology, which in turn we can use to support analysis and / or conversations.

6.1.4.3 ...how are we progressing?

One issue which has not been addressed concerns the question of how we know whether we are achieving what we set out to achieve. This becomes important the longer the time horizon, since the impact of change over the short-term may have low visibility. This raises the issue of measuring performance in some way (section 3.3) and also the issue of who should be establishing the measure. Danger arises when inappropriate measures are established and measures are inappropriately used, both having a negative effect upon efforts. The value of the measure is primarily to the actor, the person bringing about the change, by helping the actor to self-assess performance. However, the measure also has value to both the owner and the intervenor by informing them of difficulties. This raises the issue of the owner / actor relationship, and whether the owner provides support to the actor or admonishes the actor. Also raised is the issue of intervenor "interference".

6.2 Accomplishing organisational change...

The focus of the preceding section (section 6.1) has been upon the use of the Cybernetic Methodology. However, the application of this methodology is directed towards accomplishing change. Questions raised about the organisational issues which support organisational change can draw upon insights provided by both the Cybernetic Methodology and also the Viable System Model.

6.2.1 ...the conditions for organisational change

One issue which recurs throughout this dissertation and which is a key strength of the Cybernetic Methodology is the recognition of the need to create conditions which are supportive of change. This recognition may be viewed as being common sense. However, in addressing the issues of interest, the conditions that can adequately support change can be overlooked, taken for granted or oversimplified. This is illustrated with the intent to improve quality, with "systems for quality" being tagged onto the "normal activities" of the organisation, this often manifesting in ineffective quality improvement programmes (e.g. section 2.5.3). A necessary assumption is that the conditions to support change are an intrinsic feature of the organisational dynamics rather than being an addition. This implies that the mechanisms to support change are integrated into the "normal" management practices, e.g. the reporting structure. This complements the view that change is an inherent feature of organisational life.

Adequate conditions can be established using the Viable System Model. The modelling of the structural levels of the organisation enables the autonomous units that comprise the organisation to be identified and the nature of their regulation to be established so as to accommodate change. However, this raises the question of the mechanisms which support the distribution of a "policy for change" from its senior management instigators to all organisational members on an on-going basis.

One view is presented in figure 6.3. The decision to develop a "quality system" is not regarded as the establishing of a formally defined process such as BS5750: a "system" for making explicit the organisational "systems". Instead it is viewed as the development of the features intrinsic to the organisation: the organisation is to become a quality system with a quality culture. The emphasis is upon integrating quality into the fabric of the interactions that ensue within an autonomous organisation. Autonomous units function by means of cross-functional "teamwork" (e.g. Belbin, 1981). Each team manages those issues pertaining to that unit, including all those issues pertaining to quality. Policy is cascaded through the organisation, via the teams, to each organisational participant. The lowest unit of autonomy is that pertaining to the workstation of the individual, who, in the role of operator, self-manages his activities at this workstation. Exhortation is unnecessary since each person both understands and is able to act out their role(s) within the organisation. The emphasis is upon the capability of the individual to both act and interact and to be able to improve. Management's responsibility is to create the conditions so that this capability can be realised. Whilst the literature places emphasis upon the formation of groups composed of operators for dealing with quality issues (e.g. quality circles), their efforts will be limited. Although they may identify both special and common causes of faults, their efforts will be confined primarily to special causes (e.g. section 5.3.1.3.2). Identified common causes, necessarily addressed by management, can be communicated up through the teams until adequate responses can be generated which will effectively handle the disturbance, for which policy decisions may be required. Improvement also becomes an on-going managerial issue, involving all engaged in management activity (whether self-managing operators or directors). Everyone becomes involved in quality.

Any diagnosis or design of the organisation, (section 3.1.3) will reveal the pervasiveness of (both formal and informal) mechanisms which deal with quality, identifying them as intrinsic to the management activity. The desirability of formalising mechanisms reflects two considerations, the failure to create effective

interactions and the need to conform to the requirements of a Certification Body. The latter is an outward manifestation of the efforts to restore / prevent the former. Neither promotes the ethos of "effective interactions", this being interpreted as pertaining to a quality culture or more generally as pertaining to a happy and effective organisation.

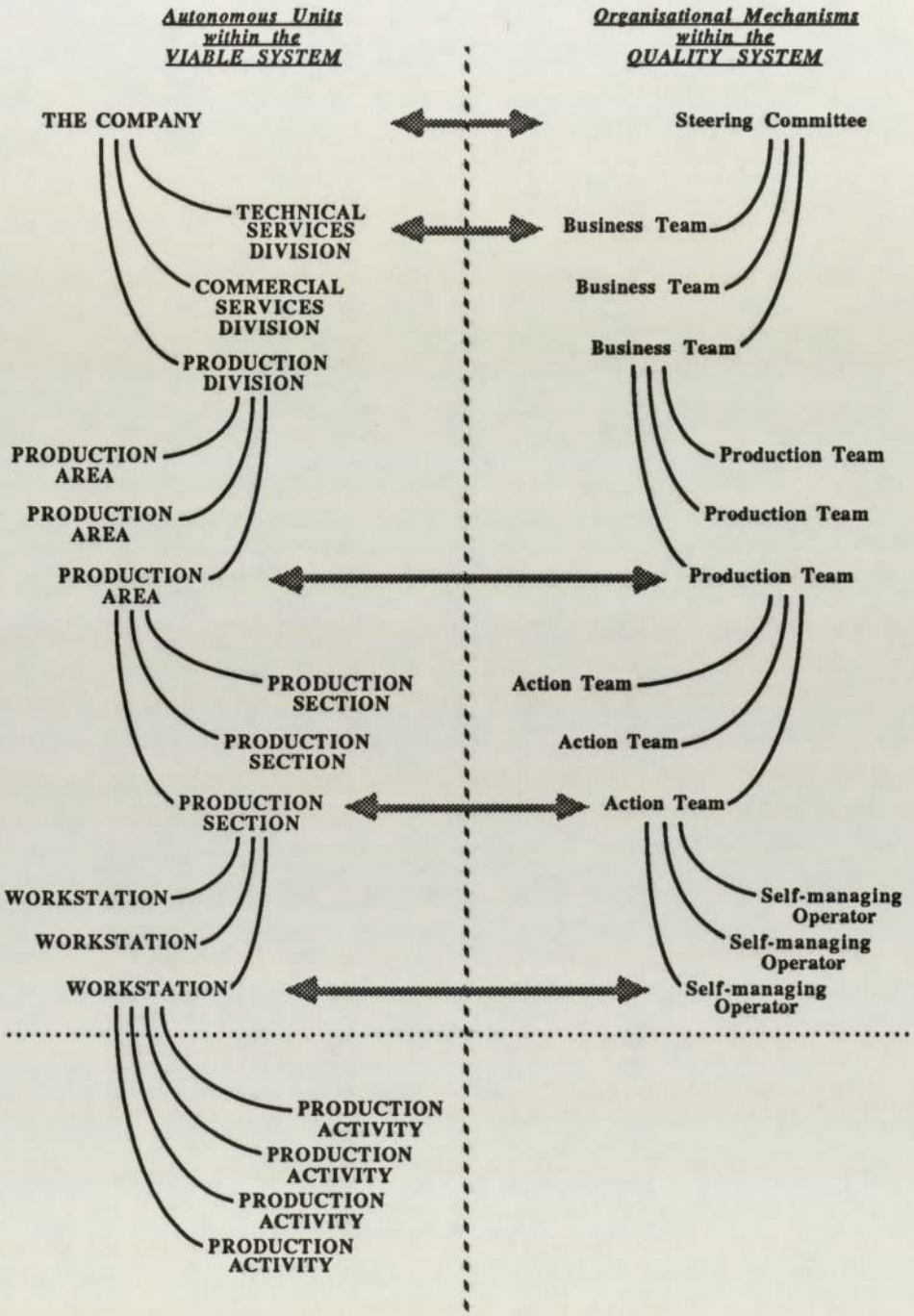


figure 6.3 **An organisational structure to support organisational change**

6.2.2 ...the re-emergence of the "Operations Room"

The Viable System Model reveals the desirability of a mechanism to support organisational change. It identifies this adaptation mechanism as the Intelligence - Control homeostat (section 3.1.1) which is found in each autonomous unit. However, the question arises how it manifests in practice.

If the organisational unit is identified as pertaining to a single person, then the adaptation mechanism must be intrinsic to the person. We assume that the person acts in a manner which takes account of past, present and anticipated future events in the world of that person. However, too often the focus is upon NOW, with most effort being directed towards sorting out the difficulties that are arising NOW - the "fire-fighting mode". The outcome is that the future can be viewed, if at all, in vague conceptual terms or in terms of pockets of planned activity. Should the need for a better calculated picture be recognised, it may be that the person simply does not have the time for this luxury - too much is happening NOW to be able to free up the necessary time. The outcome is an inconsistent and disjointed view of the future.

However, it may be that a better calculated picture is generated. This raises the question of how much attention should be given to this picture. What basis is there for this view of the future? How confidently can we determine the probability of events? How "perfect" is the information we use? We now move into the realm of decision analysis, which is left to others to elaborate upon (e.g. Goodwin & Wright, 1991).

When a number of people work together as a group, the adaptation mechanism of this organisational unit can be viewed in two ways: either as a formal mechanism or as conditions which support both formal and informal interactions. The former approach concerns the occurrence of interactions (e.g. an agenda'd meeting), though does not reveal anything about the quality of the interactions (e.g. the exchange and development of appreciations) nor the dependency upon fortuitous informal interactions (e.g. pre-meeting discussions). The latter approach recognises the richness arising from the combination of both formal and informal interactions. The emphasis is upon creating the conditions which support the ensuing conversations.

Beer describes an Operations Room (1981) or Management Centre (1979) to support the activities of the Intelligence function, by providing a "creative facility to

visualize alternative future, and to invent them.... " (1981). Beer (1981) has likened this room to a W.W.II War Room and NASA's Mission Control. He propounds that paper should be banned from this room, instead using information and communication technology (1981). Preedy and Bittlestone (1985) discuss this room in similar terms describing it as "the Boardroom for the 90s", though do not view it as paperless. The technical feasibility of such rooms is clearly achievable with satellite and digital communications making possible real time interactions between people scattered around the world. However, the question arises concerning the functioning of this room, again raising the issue of how decisions are made.

One possibility for a small to medium sized organisation is the creation of a facility which serves the Intelligence function of each of the organisational units within the organisation. In practice, it is anticipated that this facility is not dedicated solely to one unit. The emphasis appears to be upon the conversations relating to *managing the process of problem solving*, this involving sifting through possibilities and establishing action. If this is extended to include the conversations for *naming systems* and *producing relevant models*, this process will enhance the development of a shared reality. Participation can be managed in an environment which supports informal interactions. The facility's manager is concerned with two objectives: first is the effective use of the facility by different interest groups, whilst the second is the effectiveness of conversations among and within groups. What arises is a cross-functional operations facility (cf. the Business Development Unit, figure 5.1), operated by Intelligence specialists within the facility and involving organisational participants as necessary. The specialists provide a service to support the activities of line management "on their behalf". They have the skill to seek out information and transform it into formats suitable for internal use: in other words create the models of both the company and the market-place which support analysis and conversation. Further, their skill extends to the *creation of the conditions to support problem solving* thereby facilitating *managing the process of problem solving* for each problematical situation. They will promote conversations about THEN in a manner consistent with the immediacy inherent in conversations about NOW. For the function to be effective in the *creation of the conditions to support problem solving* they must have a good understanding of the *cybernetics of the situation.* The Cybernetic Methodology and the Viable System Model are Intelligence tools. Line management, who should be concerned with both INSIDE & NOW and OUTSIDE & THEN but tend to get bogged down with what is happening NOW, are responsible for ensuring that they engage in the necessary conversations. Liaison within the Intelligence function will support consistency across all

organisational units. One requirement, as for an MRPII system, is that there is one set of reliable and accurate data which is used throughout.

What is emerging is a facility which can service the organisationally distributed function of Intelligence. This facility is not viewed as a "luxury", instead being recognised as a "necessity". The vision and direction set by the CEO or Managing Director is translated into a format which everyone can identify with, contribute to and benefit from. However, it is not compatible with a closed door environment where hidden agendas are negotiated. Its corruption can give rise to a centralised Intelligence function supported by pervasive "party members" and "informants". Instead, the emphasis is upon openness and trust. It provides a domain in which models are used to orientate conversations about possibilities, enabling people to share their views of reality (Espejo, 1992). The role of this facility is similar to that of the "change agent" or facilitator (section 5.5.5.2). It provides a catalyst for supporting a number of activities which can easily not happen within a company because of the overbearing concern for what is happening NOW. It can support the process of adaptation and change: the establishing and implementation of long-term direction, the transition from an extrinsic control mode to one emphasising intrinsic control and the development and introduction of new "systems". The sad feature of Nano's Business Development Unit was that it had the potential for fulfilling this role which it had unknowingly embarked upon, but this was not appreciated by senior management and led to its disbanding by the managing director.

6.2.3 ...making change happen

Whilst attention has focused upon the conditions to support change, a variety of issues arise about the nature of the organisational changes. Central is the role of the individual (figure 5.19).

Attention focuses upon, not only the **ability** of the person to carry out an activity as part of a process, but also the person's **flex-ibility** to carry out a number of activities and the **interchange-ability** of people. Often it is assumed that the individual has this ability, failing to recognise that often this is not the case due to its inadequate or lack of development. However, it is no longer adequate to be good at what one does, the person must also fit into the **team**, otherwise be excluded in one way or another. This focuses attention upon interactions and introduces the issue of team dynamics and the difficulties associated with their functioning (Handy, 1985). The formalisation of routine interactions gives rise to the concept of the **"system"**, thereby raising the profile of their programmable properties whilst

reducing the status of their intangible properties. The concept of networking makes us aware that interactions tend not to be confined within the organisation but extend across organisational boundaries. The transparency of organisational boundaries is brought about with the growing attention upon joint ventures and the supplier-customer relationship. The aforementioned issues, combined with the rapid pace of events, highlight the potential for **disorder** and the need for **regulation.** However, regulation is not viewed as control, in the narrow sense, but as the interplay between the regulatory functions identified in the VSM, highlighting the importance of communication. Both the actions and interactions of the individual and their regulation can be enhanced through the use of technology. With the increased sophistication of the technologies available, the emphasis of the technology user tends to be upon the management of the technology to support the process, familiarisation with the technicalities of the technology being as required.

However, both technology and "systems" can distract attention from people and provide the opportunity to abdicate responsibility for good practices. This is exacerbated by personal weaknesses whereby people cannot give their "best" all the time or their "best" fails to meet the expectations of their managers. The assumption that the individual **chooses** to contribute to the activity and has the **self-discipline** to think and act can be questioned. Further, events and behaviour within the organisation may be unconducive for participation, with the effect of denying the person any choice in whether to contribute. Exhortations and punitive measures "turn the person off" and a vicious circle ensues which culminates in an "us and them" attitude. The question is raised of the value of reasoning about a situation, when behaviour appears as **irrational**. People often play games, negotiating with some and thwarting the efforts of others (internal espionage / terrorism) for whatever reason, whether selfish or otherwise.

Consequently, in the programmes that arise to effect organisational change, there has been a growing recognition of the importance of people. The emphasis is upon developing the capability and potentiality of existing resources (figure 3.6), enhancing these with new resources as the opportunity arises. Whatever the focus (e.g. reduced waste, zero defects or data accuracy) and however described (e.g. quality, JIT or MRPII) there is unlikely to be significant progress unless attention is given to people. The replacement of a team of manual labour by sophisticated technology under the control of one person still raises questions about the requirements and management of this person. From a management perspective the emphasis appears to be shifting from a Controller-Doer relationship to a Leader-Self-management partnership.

However, in view of the growing need for change, the question arises whether managers are able to cope with the aforementioned issues. No longer can they rely upon results being achieved through the "command channel". This is compounded by the recognition that ownership for the service functions (e.g. accounts, personnel, quality) should no longer be the domain of specialist departments but be restored to line management. Further, with the rapid pace of change, prior experiences become less relevant in new encounters. The emphasis is upon the manager being able to think through each new situation, this conflicting with the manager's traditional "action-man" image. Managers are being expected to deal with a complexity for which their "conventional" experience and education / training has not equipped them to competently handle, particularly if they have graduated from the "shop-floor".

What is emerging is a process which supports the realization of a vision of an "organisation" characterised by intrinsic control and on-going improvement. The phrase "situations are never as simple as the seem" is appropriate and can in part be attributed to the tendency to take for granted the cybernetics of the situation. It is suggested that to effect change in a situation involves a number of activities whose complexity increases with the number of people involved. Further, these people can behave in a manner different from what they espouse. It has been suggested that people function as self-managing teams. These teams are organised in a manner which permits the organisational vision to be translated into organisational practice. Underpinning this is the concept of a leader. The role of "change agent" is identified whose function is to act as a catalyst, to support the development of both the individual and the interactions between people. Likewise, an Intelligence facility is identified, providing a service to support the functioning of organisational entities. Conversations about the future are not left to chance. Although the words used and individual concepts presented are not new, the framework is. The Cybernetic Methodology provides assistance to deal with the complexity of organisational situations. It helps us question our assumptions.

Espejo (1990) comments

> "Yet whatever the quality of the cybernetics, the implementation process will take place (since, as an outcome of the conversations about possibilities, there is a political will to carry it out)".

However, it is questionable whether the "political will" will carry the implementation to its anticipated conclusion if the cybernetics is not supportive of

the needs of those who are participating in the implementation. Poor quality cybernetics will impede the effectiveness of the implementation. The implementation may be addressing the wrong issues. Our assumptions should not be taken for granted as being valid.

6.3 Moving on...

The foregoing account has attempted to provide a bridge between the abstraction of Cybernetics and the reality of the manager. From this has emerged a variety of issues which are worthy of further enquiry of which the following are but a few. To present these issues the distinction is made between the issues pertaining to an observer of a situation and those pertaining to a participant in a situation. Adopting the observer's perspective the issues that arise relate to the question: "How can Cybernetics help me make sense of what I observe?". The issues that pertain to the participant are indicated by the question: "How can Cybernetics help me deal with complex situations?".

6.3.1 ...to observational issues

The emergence of Cybernetics has been slow, with lack of clarity regarding its epistemological foundations contributing to this. A lot of criticism has been directed at Cybernetics, (summarised in Flood & Jackson's critique, 1988), but this has tended to be based upon a misunderstanding of Cybernetics and its epistemological foundations (section 6.1.2). In an attempt to clarify these issues, figure 6.4 was created. It presents a view of an observer observing and interpreting a situation. Although people may debate the acceptability of this view, this view prompts a variety of questions which include: "how does an observer view reality?", "what distinctions should an observer make?", "how does an observer handle distinctions?", "how does an observer interact with other observers of a situation?", "how is meaning conveyed?". It is likely that these questions have already received attention, but in a different context. Consequently, the task presented is to establish how these questions have been addressed and how they contribute to our appreciation of Cybernetics.

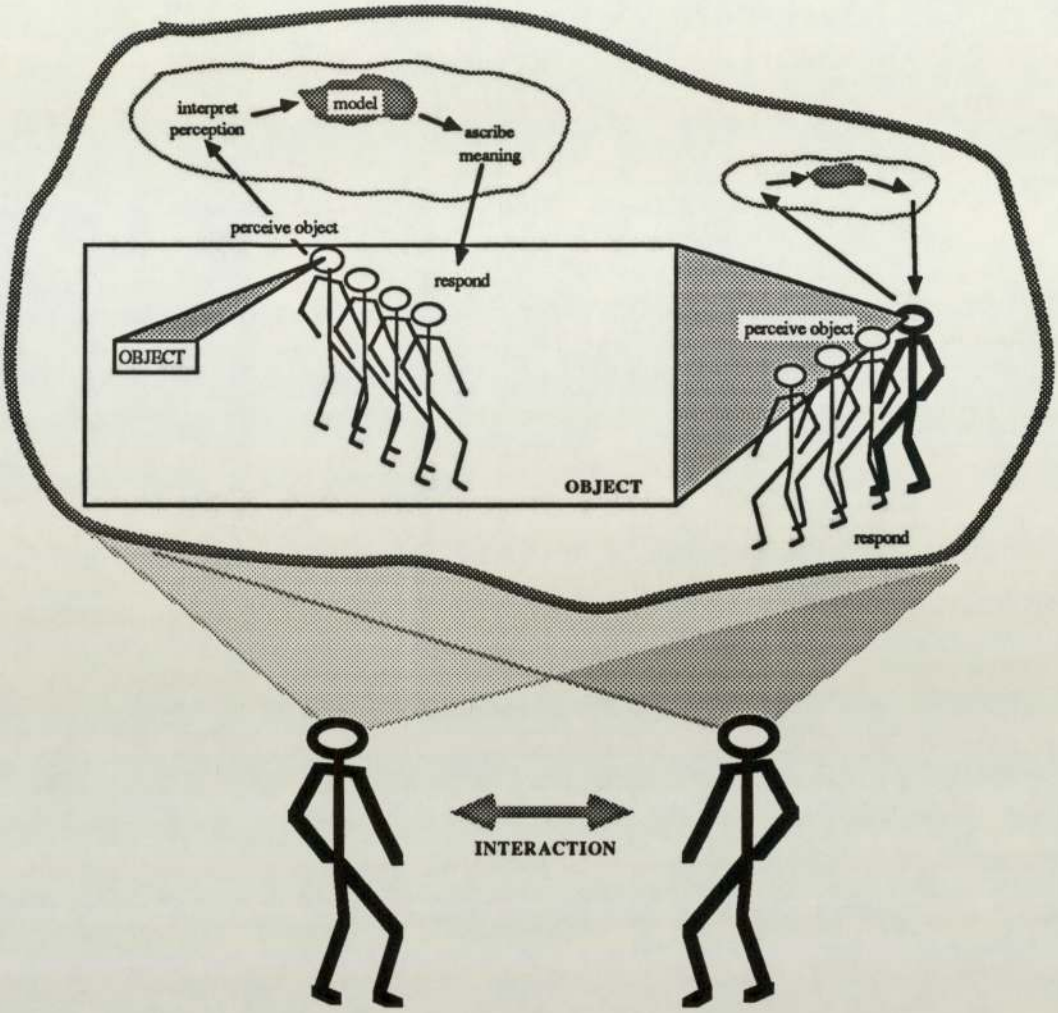


figure 6.4 **Observing an observing system observing an observed system**

Maturana & Varela provide an insight into some of these questions. Although the research underpinning this dissertation has only briefly touched upon their work, it recognises their contribution towards establishing a language which supports their description, as observers, of the (inter-)actions / behaviour of living entities. They identify the act of making distinctions and introduce the concept of "domain", which they use extensively to develop their interpretation / model of reality. However, in doing so, they overwhelm the reader with the complexity of their own distinctions.

Consequently, an attempt has been initiated to examine their model in an attempt to establish its basic form (figure 6.5), distinguishing the different modes of behaviour. This model, incomplete as it is, has provided some clarification of the distinction between the mechanics of an interaction between two living forms (the

co-ordination of actions, i.e. communicative behaviour) and an interaction which an observer "can describe in semantic terms", i.e. linguistic behaviour (Maturana & Varela, 1987). It reveals the significance of those issues underpinning an interaction which we often take for granted, though which we can recognise within the specialised areas of "advertising", "promotion" and "negotiation". It highlights the distinction between the context of a situation, recognisable as the operational domain of participants in the situation, and the content of the situation, this pertaining to the informational domain of observers of the situation. These two domains are linked through a consensual domain in which observer-participants interact linguistically using what an observer would describe as a language (i.e. an observer observes that a observed entity distinguishes an object linguistically and uses this linguistic distinction as an element in its linguistic domain: the generation and selective use of a number of elements gives rise to a language).

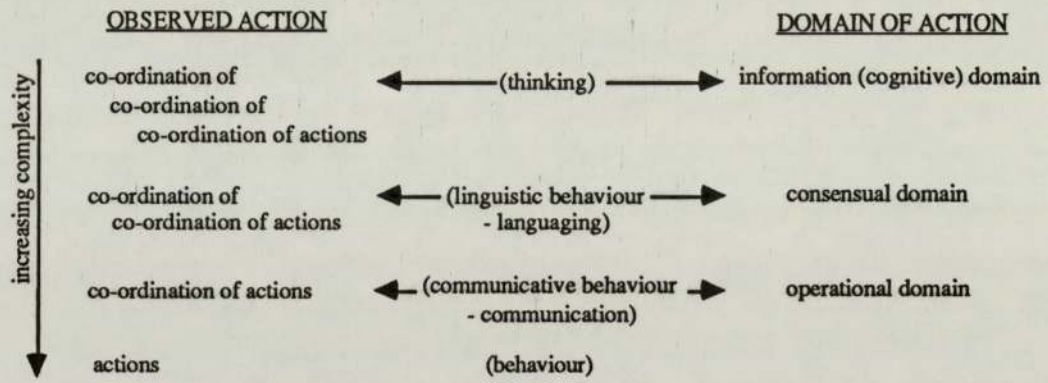


figure 6.5 The recursion of domains

One difficulty emerging with this view is that of understanding the language Maturana and Varela use. What do we mean by a domain? What are the distinctions between communication, language, linguistic domain and consensual domain. What is the interplay between symbols, "models", linguistic distinctions and our actions? In clarifying this language and our insights into how we make and use linguistic distinctions and ascribe meaning, we may also draw upon the subject areas of linguistics and discourse analysis. Despite these questions, the insights provided by both models (figures 6.4 and 6.5) enable us to start to appreciate the underlying issues pertaining to an interaction between two observers. As well as permitting insights into how the concepts of Cybernetics can be effectively used by a wide audience, we can improve our appreciation both of the organisation / management

models we create and of the interplay between organisation / management theory and practice.

Complementing Maturana & Varela's work is that of Jantsch (1980) and Prigogine & Stengers (1984). They provide an alternative insight into the behaviour of systems, introducing and developing the concept of chaotic behaviour and far-from-equilibrium conditions. This contrasts with Espejo's presentation of the logic of complexity and the notion of stability, which together present two possibly complementary views of the behaviour of systems. Hofstadter (1979) provides us with an insight into the concept of a system, distinguishing between a *formal system* and an *informal system.* Insights are offered into the distinction between a "system" and a system, revealing the significance of what can be viewed as formally undefinable processes (section 5.3.3.3.4). These tend to be associated with the social and political aspects of interactions as well as the issues of decision making, expertise and judgement (e.g. Goodwin & Wright, 1991).

The aforementioned issues have particular relevance to the appreciation and development of the Cybernetic Methodology, clarifying its use. An observer in making sense of what is being observed will attempt to understand the situation, name systems and produce models - making distinctions and interpreting these distinctions. One of these models may be the Viable System Model, a model of an operational domain, which the observer will use in the informational domain. The Cybernetic Methodology is itself presented as a model of a process. Whilst the user may use it in the informational domain to clarify his thoughts, the question arises of whether and how it should be used in the consensual domain.

If we are intent of improving our mental construct of situations (section 5.3.3.3.4), the question arises how we can enrich our appreciations of situations using the models we create and tapping existing knowledge. It raises the issue of how we combine different models or theories, raising the desirability of consistency across these different theories. This supports the suggestion of an unifying or integrative theory, which Cybernetics appears to provide. However, critics may suggest that a unified theory is contrary to how we should be interpreting human behaviour. Nevertheless, to deny the usefulness of a view because it does not meet the criteria of what is deemed acceptable is folly. If a view is found to be useful, the task is to establish why it is useful and how its useful can be developed.

6.3.2 ...to participational issues...

In attempting to establish why Cybernetics and, in particular, the Cybernetic Methodology, is useful, the preceding section has revealed issues which affect how we make sense of what is observed. However, as participants in situations our concern should be with how we affect the situation and the influence of the issues which are or could be brought forth about the situation. This raises the question of "how can cybernetics help in dealing with complex situations and bring their closure?" Insights have already been provided by Winograd & Flores (1986), who have pioneered insights into the "design of computer technology" expanding upon Maturana & Varela's work.

Alternative applications that present themselves include, "systems" design and implementation, customer - supplier relationships, teamwork, group decision-making processes, policy-making, planning, organisational learning, creativity.... The list grows, particularly if the relative merits of different perspectives are considered, of which one is the Cybernetics perspective. Then we can ask such questions as whether cybernetics can make a contribution towards the systems dynamics view of the learning organisation and strategy development processes (Senge, 1990; Morecroft & van der Heijden, 1992).

The application that has been of interest in this dissertation has concerned the issue of quality orientated organisational change within companies. In examining this application, use has been made of both the Viable System Model (VSM) and the Cybernetic Methodology. In their use, they have raised questions about this application, identifying issues requiring further clarification and thereby leading to potentially more effective interactions among the participants.

6.3.2.1 ...the Viable System Model

The VSM presents an integrative and coherent appreciation of the complexity of an organisation, focusing upon the interactions among a group of people who are carrying out activities to achieve some purpose. In using the VSM the distinction is made between primary activities and regulatory activities. This distinction can be viewed in the context of the business decisions that arise regarding whether to "make-or-buy" components and whether to perform service activities “in-house” or “contract-out”. In the former, the criteria may be based upon the value added, whilst the latter may reflect such issues as expertise, flexibility and security.

In establishing what the value added is of an activity, the question arises concerning the relationship between "activities necessary to produce the transformation" (technological activities - section 3.1.1) and activities that add value. It may be that the value added activities can only be identified by examining the detail of activities. The level of detail required is likely to be that for which we do not need to continue to make distinctions to produce the acceptable outcome, e.g. making the distinctions of *moving* a component *up-side down* from store to assembly point and *bolting* this component *face-outwards* to main assembly (cf. section 5.3.1.3.1). Indeed it is by examining the detail and how this detail is recognised, categorised and handled by the organisation that we gain an insight into the issues which are significant to the organisation. Further, it is at this detailed level that our awareness develops of the non-value adding activities which support the value adding activity, revealing redundancy and opportunities for improvement. Whilst it is suggested that value adding activities are primary activities and non-value adding activities are regulatory activities, this hypothesis has not been tested. If it is correct, then it is suggested the primary activity model can be used as the basis for a management costing "system": primary activities and their associated regulatory activities have resources allocated for which costings can be determined.

With the "in-house" or "contract-out" debate, examination of the regulatory activities may reveal the potential for significant savings by contracting out services. However, the issue is raised of how to regulate the activities of the contractor. Similarities are assumed with the relationship of component suppliers. This raises the questions of what can be learnt from studying the customer - supplier relationship and what contribution of the Variety Engineering Template (figure 3.2) in providing insights into this relationship.

When studying the regulation of a primary activity, the VSM reveals five regulatory functions. Three issues are highlighted: direction, adaptation and monitoring-control, each of which can be unfolded to raise further issues. Whilst the management literature provides insights into these issues and practising managers acknowledge them, it is questioned whether these appreciations are adequate for taking action.

This is exemplified by the current vogue for non-financial performance measures. Numerous issues can be raised concerning their determination and use (e.g. section 5.4.2.4.2.2). However, whilst the conditions to support their use has been suggested as an important issue, the question arises as to how widely this is appreciated (e.g. implementation of SPC - section 2.4.1). Indeed, it can be asked

whether we have become performance measurement psychotic with the widespread abuse of potentially useful measurements. We can ask ourselves whether we are we guilty of introducing measures because we delude ourselves into thinking that we understand their use?

Similarly, the issue of leadership is not unfamiliar. However, it still appears to be an area of contention by virtue that it does appear to automatically surface when required. Other associated issues can be raised, in particular, the issues of organisational power and politics: how do we define power and politics and how do we handle these? Further the issue of stress can be introduced: how much stress can placed upon organisational interactions before they weaken? What is the nature of this stress, e.g. fear, insecurity, ambiguity, overload, and what are the responses for coping?

These examples suggest the need to develop a better appreciation of the interplay between "systems" and systems (section 3.1.1), recognising that which lies beyond the "system" (section 5.3.3.3.4) - the *informal system* (section 6.3.1). Whilst difficulties may arise in the context of "systems", it appears that, by introducing less tangible issues into our mental constructs (systems), we are introducing major difficulties which we may not be able to address, e.g. the fit of non-rational behaviour into the model presented in figure 6.5. However we handle this problem, we cannot escape from the need to take account of the individual and the unpredictability of the individual's behaviour in our views of organisational change and our efforts to "engineer" improvements.

This becomes apparent when we consider the issue of quality: two views emerge. One concerns the process by which customer requirements are provided, the second concerns the improvement of this process. Whilst attention in this dissertation has focused upon the second, it emerges that central to both is the role of the individual. Whilst the process and its improvement may be defined in terms of "systems", those issues which pertain to the individual are neglected, since they cannot be formally defined. People's actions and interactions cannot be constrained within that which is formally defined. A customer, when reading a manufacturer's instructions for the use of its product, is assumed to "read between the lines" as necessary, that is if the customer chooses to follow the instructions. However, it is these formally undefined issues that appear to present many of the difficulties associated with the introduction and implementation of quality and information "systems". Since we cannot penetrate the complexity of the individual, we look to outward indicators, manifesting in our descriptions of behaviour, to determine

issues (section 6.2.3) which are likely to lead to the individual bringing about acceptable outcomes from the process, including the improvement of the process. Whilst the VSM enables us to name those issues which we perceive significant (e.g. commitment - figure 4.2; skills - figure 5.4) the central question arises of how we can improve the modelling of what cannot formally define.

This issue becomes increasingly important as the boundaries of the application of the VSM are extended beyond the more formal systems which we can more readily describe, e.g. the company. Harden (1991) has suggested the application of the VSM to the organisation of the local community. Whether in rural or urban areas, what constitutes community viability? What are the implications for local industry? What skills are required to generate local industry in such a way that provides a balance between primary (e.g. farming, mining), secondary (e.g. manufacturing, crafts) and tertiary (e.g. services) industry. What can be learnt from history regarding the distribution of such industry and its development? We can consider the issue of the (self-)regulation of industrial sectors, examining the balance between government intervention and self-regulation. The boundaries of application can be broadened to accommodate the running of a country (of which the Chilean experience is the most widely publicised). Can the VSM provide an insight into the management of the planet? What appears to be offered is a powerful tool for examining the viability of any situation characterised by the on-going interactions among people.

One specific application concerns the situation of the school which finds itself faced with closure. Different interest groups emerge each with the intent to save the school but under new management. Questions that arise include the viability of the school, the organisation of the different interest groups into a cohesive whole, the management of dissenters and the loyalty of parents.

Foss (1989) has made use of the VSM to describe the behaviour of a bee colony. This raises the question of what insights can the VSM provide into animal behaviour and the subsequent question of whether we can use these insights to provide insights into man's behaviour and the concepts of the family, community and society. Would this reveal the inherent self-interest of man and the futility of intervening in dysfunctional situations, e.g. civil war? Alternatively would it suggest the need for powerful deterrents or cohesive forces to overcome this inherent self-interest and prevent dysfunction?

Whilst the need for better appreciations of a variety of issues has been suggested, this in itself will not lead to more effective action both in the short-term nor in the long-term. These appreciations are only one part of the on-going process of effecting change.

6.3.2.2 ...the Cybernetic Methodology

The Cybernetic Methodology provides us with a means for handling the complexity of situations. It provides a framework which focuses our attention upon how we develop and use our appreciations (in terms of models) about a situation. When dealing with organisational dysfunction, the methodology, in making the distinction between the Cybernetic and Learning Loops, focuses our attention upon how meaning is given to our actions. Thus, when using the VSM, we can develop the context in which it is being used so as to enhance the likelihood that both conversations and change ensue about the issues that the VSM brings forth

However, a few implementation issues arise. Concern arises about the conditions which best support its use, since the methodology is itself a model of a learning process. Questions that can be asked include whether all participants should have an understanding or awareness of the methodology during its use, or whether an "expert" tacitly manoeuvres participants about within the situation. The apparent simplicity of the Cybernetic Methodology disguises the underlying complexity of its logic. How knowledgeable should a user be about the logic to be an effective user? What are the dynamics for naming systems? Is this a group activity, should it be a series of one-to-one interactions (interviews) between an analyst and participants or some combination as appropriate?

When discussing possibilities, what action can reduce the likelihood of group think (Janis, 1971)? Further, a series of decisions may be made each of which may seem to be the best decision at that time, but which collectively are destructive in their consequences (e.g. the space shuttle disaster). Can the likelihood of this occurring be reduced? These latter issues suggest that decision making theory can contribute to the discussion processes. Further the question arise of how conflicting views and political games should be handled. A pattern appears to be emerging regarding the nature of potential difficulties, returning our attention back to the issue of that which we cannot formally define (previous section).

A variety of situations have been presented which illustrate the application of the methodology. The common factor has been the need to achieve a result in a

situation which is characterised by its deceptiveness and the readiness to quickly converge upon a solution. What emerges is the pattern of naming issues, unfolding these names to reveal further relevant names, determining appropriate action for selected names, then carrying out the action, repeating this cycle if viewed necessary: in other words the *process* of translating an issue into an activity that produces an outcome for which there are expectations. This suggests that from a model of the possible issues, we can model the corresponding activities (cf. Checkland's conceptual model - section 2.5.4.1). The question arises of how we establish the "structural integrity" of the models, though Harnden (1989) suggests that these emerge "in a particular consensual domain". Whilst it may not be feasible or desirable to carry out all identified activities, it does permit us to prioritise upon activities. Further, if we intend to carry out the named activities then it will be desirable to regulate the selected activities. To provide insight into the desirable features of this regulation we can model the regulation of these activities using the VSM. The next step is to create in reality the intent created in the models.

Although the Cybernetic Methodology is presented as a problem solving methodology, it provides a framework for thinking strategically about situations. It has been demonstrated here as a means to support the handling of organisational change, where the emphasis has been upon internal improvements. The concern lies not only with immediate results but with longer-term viability. In this sense it offers potential as a useful approach for developing and implementing business strategies, distinguishing between the context of a strategy and its content. Thus, a marketing director in developing a marketing strategy can distinguish between what he wishes to accomplish (i.e. the content of his conversations with those who will help him achieve it) and how he is to accomplish it (i.e. the conditions required to permit these conversations or the context in which these conversations have meaning). The Variety Engineering Template offers a tool for examining interactions with both targeted customers and the public. The VSM can provide insights into his marketing organisation and its fit within the organisation. What emerges is a coherent marketing strategy which supports the functioning of the organisation.

In developing an appreciation of the use of the Cybernetic Methodology, the question arises of how its use can be enhanced. Does an opportunity exist in using the Cybernetic Methodology through the medium of computer-based technology? The VSM is already supported by VIPLAN and CYBERSYN (Syncho Ltd, Birmingham, UK). How can thinking about situations and the exchange of views be enhanced. Eden (1990) identifies several approaches, e.g. SODA, using COPE software, Decision conferencing, using HiView and Equity software, and

Metagame analysis, using CONAN software. Ackermann (1990) makes the point that many context specific developments have occurred though these have not entered the published domain. Winograd & Flores (1986) present THE COORDINATOR, a software package "to make the interactions transparent - to provide a ready-to-hand tool that operates in the domain of conversations for action". Although the merits of each approach are presented within the context of their domain of use and promotion, the question that arises concerns their merits within the context of Cybernetics.

Finally, the question arises concerning the implications of the insights presented in this dissertation for management development. The current vogue for complementing a manager's experience with ad hoc training sessions on specific issues appears as a half-hearted effort to address the imbalance in a manager's management education. More extensive programmes, e.g. MBA Degrees, may seek to improve this situation, but the question arises of what the participant gets out of the MBA and whether it is viewed as merely a piece of paper to trigger a promotion. The point has already been made that managers are being expected to deal with a complexity for which their "conventional" experience and education / training has not equipped them to competently handle (section 6.2.3). No longer can prior experience be assumed to be relevant to future experiences, since the growing pace of change, e.g. information and communications technology, is making prior experiences and knowledge redundant. A Cybernetic perspective highlights the issues of interpersonal interactions and the ability to think about situations and question assumptions, these being issues which appear to be neglected or trivialised. The question arises of how we learn to effectively learn about new things so that we can be effective when dealing with change. What is emerging is the need to develop the management skills of the individual as part of a strategy for the development of the person. Since, it is advocated that Cybernetics is a language for management (chapter 3), the question arises of how Cybernetics can contribute to this development strategy. Since we are dealing with a way of thinking about situations it may be appropriate to introduce Cybernetics as part of a school curriculum. Is this too far into the future?

Although many other issues could be raised, one immediate task appears to be to reinforce the foundations of Cybernetics. Whereas good organisational / management practice has tended to emerge based upon what is perceived as common sense, the opportunity exists to develop good practice upon more sound principles through the use of Cybernetics. The development of Cybernetics appears to be proceeding along a path in which the issues are being clarified as an outcome

of the struggle to apply Cybernetics to real-world situations. What appears to be emerging is the appreciation that Cybernetics need not be viewed as an alternative management theory but as a unifying theory, bringing together the pot-pourri of views that constitutes the theory of management and organisations. As such the question can be asked about what is required for Cybernetics to be adopted as a way of thinking by managers. It possibly offers the potential that may be equated with the contribution of plate tectonics to the earth sciences. Whereas plate tectonics became accepted through scientific argument within a community of participants which shared the "scientific" way of thinking, no common ground appears to exist which can progress Cybernetics. There is much to be done.

CHAPTER 7
CONCLUSION

It can be concluded that Cybernetics presents a way of thinking about situations. Both the Cybernetic Methodology and the Viable System Model (VSM) offer a powerful means for dealing with the complexity of situations. It is apparent from the situations presented in this dissertation that situations often tend to be more complex than initially perceived. Thus, it becomes desirable to effectively develop an appreciation of this complexity prior to embarking upon non-recoverable action. The more complex the situation, the more apparent are the offerings. What distinguishes these approaches / tools from others are their grounding. Both the Cybernetic Methodology and the VSM are embedded in a rigorous logic which permits their coherence and arguement to be appreciated. Further, they are presented using a language which supports their development and use. This language has emerged from the pioneering work of Ashby (1963) with its contributors including Espejo and Maturana & Varela. What emerges is a framework for dealing with complex situations.

However, this framework can be percieved as complex in itself. Difficulty with the use of the VSM has arisen due to an inability to grasp either the logic underpinning the model or the manner in which it can be used. It is with the emergence of the Cybernetic Methodology that we can more fully appreciate the use of the VSM.

The development of the Cybernetic Methodology for dealing with complex situations, having only recently been presented in publications (1990, 1992), has not received such widespread attention as the VSM. The Cybernetic Methodology in recognising the significance of the context (the Cybernetic Loop) with regard to the content of conversations (the Learning Loop) provides a means for dealing with the multiple viewpoints that surface within a situation. However, the language it uses is not readily apparent nor easily understood. Consequently, it disguises the richness of its underlying logic. This raises the task of clarifying the language as a major issue.

The development of the language so that people can appreciate the Cybernetic Methodology can be expected to enhance its application. From the perspective of its application, the issues arise regarding who should use the Cybernetic Methodology, what a person actually does when using the Cybernetic Methodology and what

conditions are required to support its use. Insights have been provided throughout this dissertation. It is suggested that since the Cybernetic Methodology demands a systemic way of thinking about a situation, it will remain in the domain of those who are able to think in such a manner and thus remain a specialist's methodology, with the specialist facilitating the progress of situations. This user is likely to experience at least two iterations of the Cybernetic Methodology, the first dealing with conversations for possibilities and the second dealing with conversations for action: the outcome being closure to the situation. In using the methodology the role of models is highlighted as part of the learning process. Models can be appreciated both as analytical devices and as linguistic devices.

In the situations examined within this thesis several issues have been highlighted. The first concerns the distinction between the observing and the observed systems. It highlights the distinction between an object or event and the name an observer gives to this object or event. In recognising the role of observer of a situation, the question is asked whether the observer is a participant within the situation and if so what this role is. This approach was found useful for clarifying the specific context within which the participant was to determine appropriate actions.

The second issue concerns quality and organisational change. The distinction can be made between the process that permits customer's requirements to be met and the improvement of the process. Whilst attention has focused upon the improvement of the process, it is apparent that the key feature of the process is the person. It is the person who is responsible for good practices and acceptable outcomes. Whilst "systems" can enhance both actions and interactions, they can also provide people with the opportunity to abdicate their responsibilities.

The issue of people's appreciations about situations is raised. Tacit is the assumption that people agree to behave in what can be described as "a rational manner". It can be argued that people, whether self-managing or managing others, tend to develop poor model's about the situations that they experience. The consequences are poor conversations about possibilities and inadequate action. Within the work-place, with increasing demands being made upon the person, it is suggested that they require better models if they are to become more effective.

This leads to the fourth issue. Since we cannot penetrate the complexity of the individual, we need to rely upon creating the conditions (e.g. interactions, "systems") whereby those aspects of the individual we desire / require are brought forth and developed. Whilst this can be associated with behaviour in a repressive

society, this is a negative view. In an open society, characterised by its good-will, the emphasis is upon helping people to improve their situations, whilst respecting each others rights.

It is in this latter context that, despite difficulties surrounding the language used to express Cybernetic concepts, the Cybernetic Methodology reveals its potential. It focuses attention upon people, their interactions, the development of their appreciations and effective action. It offers a powerful means for dealing with complex problematical situations.

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APPENDIX A

THE STORY OF ORGANISATIONAL CHANGE AS AN ONGOING FEATURE OF ORGANISATIONAL LIFE WITHIN A MANUFACTURING SITE

A.1 Organisational change - a way of life

The period of interest, July (year 1) to January (year 3) was characterised by a number of organisational changes. This was regular feature for the site, with on-going changes in personnel, primary activities and practices. A chronicle of major events (figure A.1) allowed a pattern to be discerned (figure A.2). One issue arising was the acceptability of a certain level of instability in interactions irrespective of their "cause". However, once this instability reached a unacceptable level, the situation becomes noticable, events are distinguished and "causes" are attributed. The arrival of the new site manager in September (year 1) was not viewed by personnel as significant, since it had little impact upon them; similarly with the arrival of process A_1. However, the collective effect of several events presented a perception, visible through the LTA measure, that "things we out of control" to both site management and Giga management.

figure A.1 Key events at the Bristol site for the period of observation

YEAR 1

September - new site manager takes over
- logistics co-ordinator joins

October - control of process A_1 transfered to Bristol site

November - transfer of European customer service for product Q to Bristol site

YEAR 2

January - The Bristol Way review
- new manager takes over the European Quality Assurance Group
- quality "sold" to the Giga (Products) European Business Committee

February - first meeting of the Contunuous Improvement Team

March - process A_1 transfered to Bristol site
- process D_1 merged with process A_2

April - the reporting of LTA is changed

May - contractors allowed into the morning "rack-up"

June - control and systems supervisor takes over from the "administrative services resource"

July - ATO team formed

(July / October - "Bristol Way" video produced)

September - manufacturing systems engineer joins

October - electronics engineer joins
- administration area reshuffle
- second The Bristol Way review

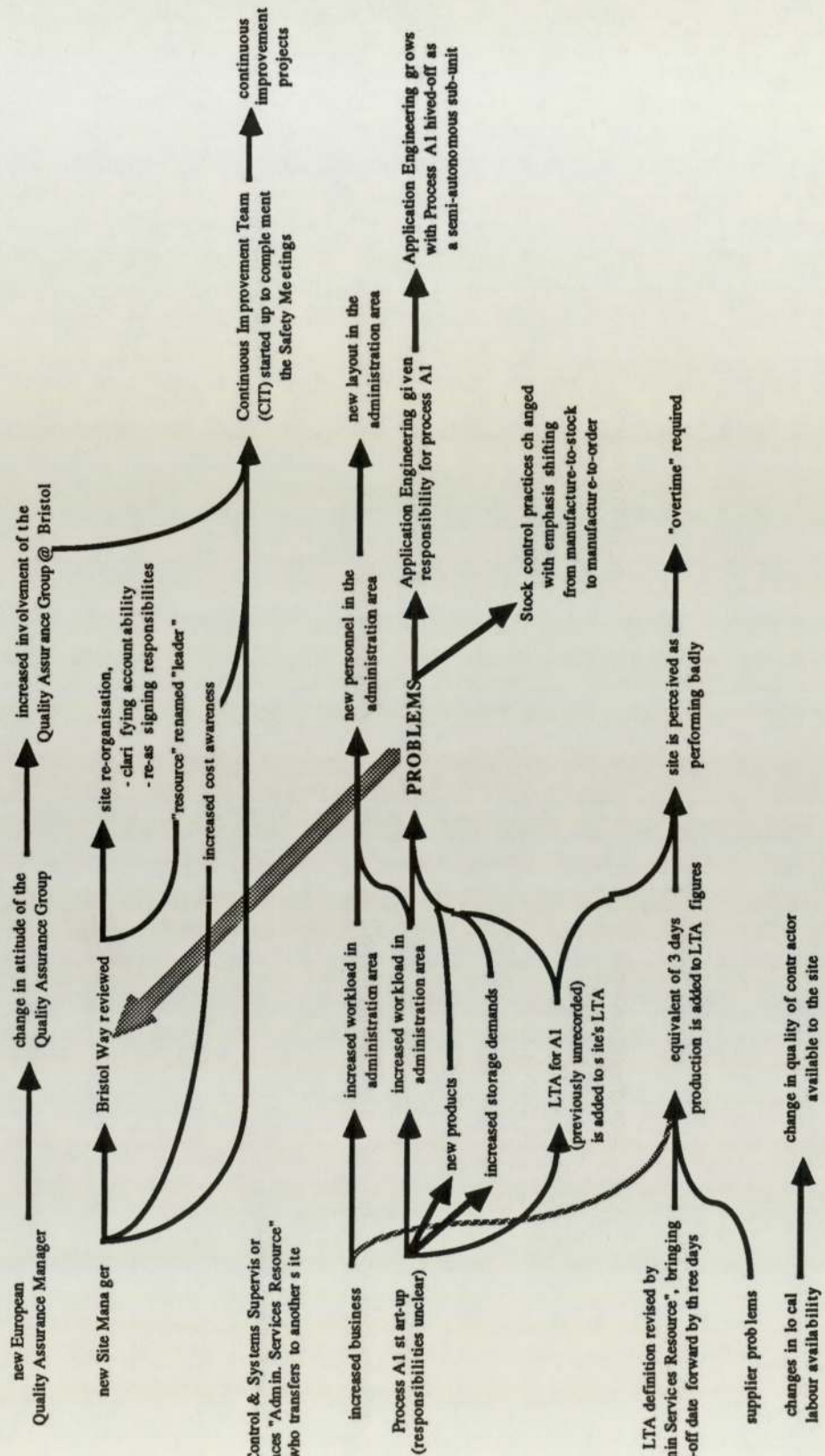
Note: During tear 2, the leaders and a number of technicians started to attend courses on quality and ISO9000

YEAR 3

January - technical manager transfers to another location: his responsibilities are divided among the remaining leaders. The site manager takes over responsibility for Quality and Safety
- Employee Education Programme commences
- new manager takes over the European Quality Assurance Group

March - new site manager takes over

figure A.2 **Perceived major events at the Bristol site spanning a year from July, year 1**



The transfer of Process A_1 to the site was intended to be accommodated within the existing organisational framework. Athough it required new working practices, it appears that the magnitude of the exercise was underestimated, with difficulties being experienced particularly with regard to its planning, scheduling and control. It could be debated that the conditions were inadequate to support the transfer and implementation of the process on-site. Nevertheless, the outcome was a two-day review by the new site manager with his Resources of what was happening on-site, including The Bristol Way and the site's organisation. A number of issues emerged giving rise to organisational changes.

Following recognition of the lack of clarity regarding responsibilities, with several functions operating without identifiable management responsibility, a re-organisation was agreed (figure A.3). Further, the view emerged that the function of a "Resource" was not fully understood on-site. The title of "Resource" was renamed "Leader" to make more apparent the nature of this role and thereby reduce misunderstanding. Another view was expressed that the site lacked a sense of purpose and that the Bristol Mission (figure 4.5), hidden from public view, was overly complex. A simplified more focused version was produced for display (figure A.4), placing more emphasis upon the values of the site. In the revision of the "Two Key Principles" (figure A.5) the word "practices" was dropped, since traditional XYZ practices, which tended to be authoritarian in nature, conflicted with the more participative practices of the site. Similarly, the specific issues of "quality and service" suggested that there could be other issues which did not require improvement. This was replaced "all our thinking and actions". The maturing of the site was being reflected in the development of its own sense of identity.

This brief insight into change does not reveal the decision-making processes underlying these events, many of which appear to be located at a more senior level to the site. What was observed were the phenomena of change and the accessible views of those affected by events. Change within the site was accepted as the norm. Improvements, whatever their nature, were expected from everyone, these manifesting as insignificant or minor events. They made life easier. Change became perceived as an issue when undesirable events occurred. These gave rise to responses whose impact was perceived as great or insignificant according to how it affected individual behaviour and the number of people affected. From the viewpoint of someone within the site, change was characterised by its reactiveness and apparent lack of direction.

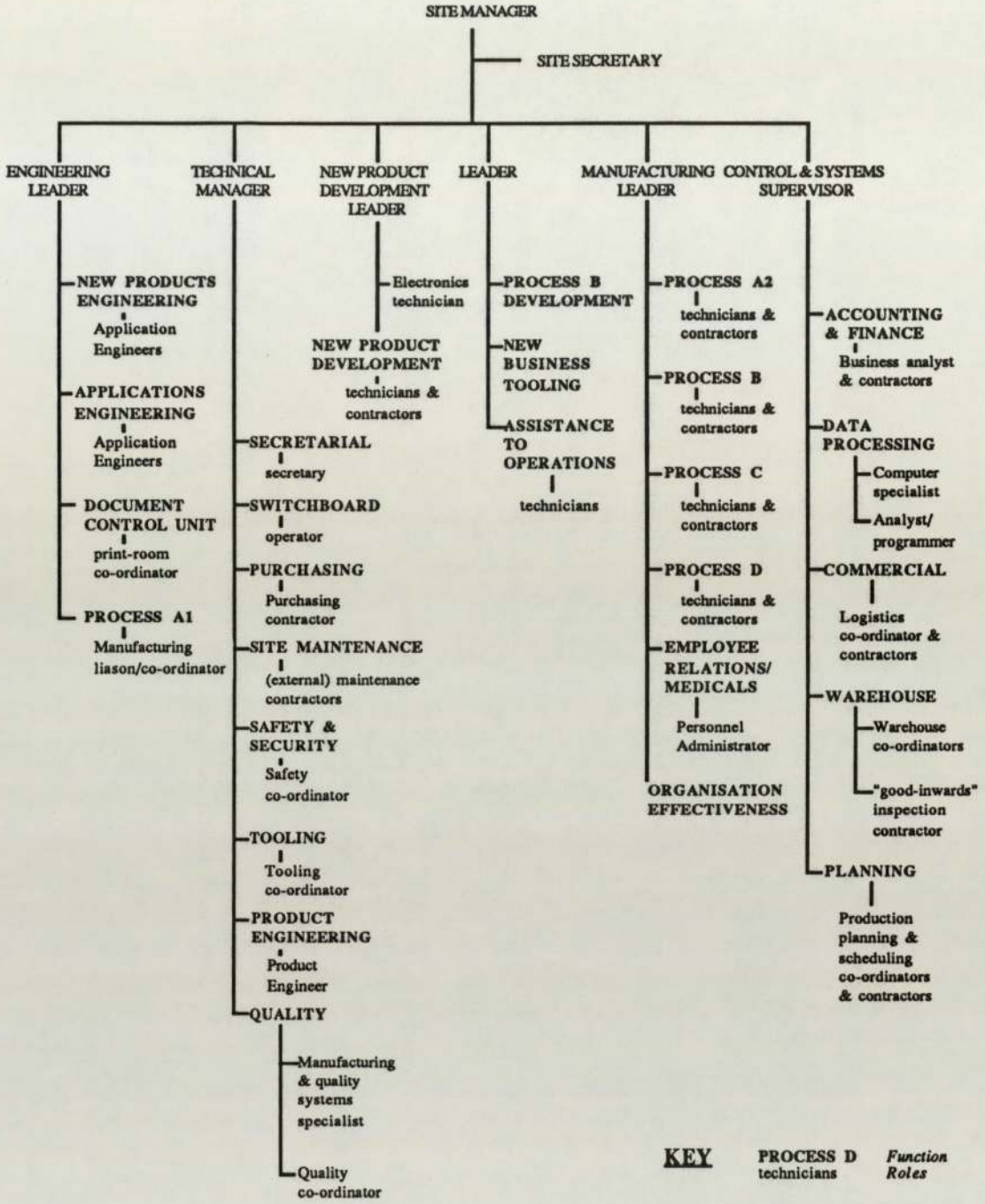


figure A.3 ORGANISATION CHART (July - August, year 2) (identifies functions and roles)

figure A.4

BRISTOL MISSION
(year 2)

Continue to develop the Bristol Way into a more profitable operation than traditional organisations.
By recognising that:

- people are capable of taking on more responsibility than in traditional organisations
- people will accept change given the right environment
- cost flexibility can be achieved
- Bristol is a model / reference for future sites / development

So that:

we meet *company* goals for profitability and maintain and continually improve our competitive position in the market environment

TWO KEY PRINCIPLES

Values the traditional *company* beliefs that have produced safety excellence both on and off the job.

Operates a profitable business with continuous improvement towards excellence in all our thinking and actions.

figure A.5

KEY PRINCIPLES

Values the traditional *company* beliefs **and practices** that have produced safety excellence both on and off the job (year 1).

Values the traditional *company* beliefs that have produced safety excellence both on and off the job (year 2).

Operates a profitable business with continuous improvement **in quality and service** (year 1).

Operates a profitable business with continuous improvement **towards excellence in all our thinking and actions** (year 2).

A.2 Organisational change - the desire for improvement...

A.2.1 ...a corporate view

Traditionally, safety has been a hallmark of the corporation. It was a reminder of this company's early activities where fatalities due to carelessness could be high. The consequent institutionalisation of the Giga safety ethos stems from those days and is reflected in its safety record.

However, quality lagged behind safety as an issue. Giga tended to view quality in a more traditional manner, with quality being the responsibility of the quality function. However, an indication that this was changing was given when the Giga's chairman announced in the early 1980's that for Giga to compete successfully on a global scale required

"nothing less than excellence ... in everything we do"

This resulted, in line with the practices of a growing number of companies, in the pursuit of some variant along the TQM theme. The result has been mixed, with one sub-organisation taking the lead in implementing a quality driven improvement programme. One of the problems recognised was a lack of understanding and commitment by upper and middle management to the programme, this being viewed as a key constraint to progress. The question that arises, for which no reply was available, concerned the attitude of Giga's upper and middle management towards the issue of quality, in particular, those who have influence over the site.

A.2.2 ...dissatisfaction (July-August, year 1)

A survey carried out over the period July-August (year 1) revealed that, despite the view espoused in the site Quality Mission (figure 4.17), this was not reflected in on-site attitudes and practices. Awareness and understanding of quality was limited. The Quality Mission was displayed at strategical locations, visible to any visitor to the site, but out of sight to the majority of the workforce. The reporting of quality related issues at the daily morning rack-up was relegated to the fourth item on the agenda (section 4.3.1.1.2).

Quality related activities on the site were performed primarily through the quality function (figure A.6), by the "quality team", composed of the manufacturing and quality systems specialist, the quality co-ordinator and a contractor performing the role of "goods-inwards" inspection. This group were resourced by the manufacturing resource, who was also resourcing the production planning and scheduling team and, both directly and indirectly, each of the separate manufacturing areas (figure 4.9). The production technicians performed product inspection. The quality team had identified the issues which they felt they should be attending to, irrespective of whether they were doing so, this comprising of a diverse range of quality related activities (figure A.7). Support to the Quality team was provided by the European Quality Assurance Team (figure A.8), based in Holland but who maintained regular and frequent contact with the site. Although quality behaviour was not very evident, the quality function presented a potentially powerful force.

figure A.6

QUALITY FUNCTION
(July - August, year 1)

Purpose: to put into place on-site, the mechanisms which will facilitate better quality control of the activities on the site.
"to control the actual manufacture of the product to the customers requirements" using specific procedures and techniques.

Actors:
- Manufacturing Resource
- Quality team:
  - Manufacturing and Quality Systems Specialist
  - Quality Co-ordinator
  - "Goods-inwards" Inspection contractor
- Production area technicians
- Material Review Board

Customers:
- Giga customers
- Site personnel
- Giga Quality Assurance Group
- Giga management

Activities of the Actors

Manufacturing Resource (with regard to Quality)
- to facilitate the performance of the Quality team, by counselling them continuously.
- to ensure problems are rectified as effectively and efficiently as possible, by direct intervention if necessary.
- to liaise with the customers and off-site Giga personnel.
- to provide information to Giga management.

Manufacturing & Quality Systems Specialist
- "still exploring what I am doing" (new to the position).
- "to implement a Statistical Process Control (SPC) system".
- "to evaluate existing systems" at all other Giga locations for on-site development".
- "to administrate the bringing on-site of a CAD system for use in Product Engineering".
- "to provide in house training" on SPC and software.
- "to look at current in-house systems, particulary ACS, for development"
  (ACS: A Computer System for planning and control).

figure A.6 (continued)

Quality Co-ordinator

- to administrate and take action with respect to site complaints, including
  - producing a monthly "Complaint Report" for the Giga Quality Assurance Group; this is used by the Manufacturing Resource in his monthly highlights and presents a breakdown of the causes of complaints, aiming to provide a historical analysis which can assist investigators.
  - receiving a "Daily Complaint Report" from the Giga Quality Assurance Group. Customer complaints are normally directed to the salesman who then:
    - contacts the Quality Co-ordinator immediately, using either the telephone or electronic mail or both, thus facilitating a fast response.
    - communicates the complaint to the Quality Assurance Group via electronic mail, who include the complaint in the next day's Daily Complaint Report, thus formaling the complaint.
- to perform day to day quality activities, including:
  - overseas "goods inwards" inspection,
  - investigating quality problems,
  - identifying and isolating all products made form any reject materials
- to write the procedures for the site Quality Manual, in conformance to ISO9001.
  NB the Giga European Quality Manual does not accommodate the Bristol Way of operating,
  the site wishes to achieve Quality Certification from various international Certification Bodies.
- to implement a Batch ID System - to support traceability of products through production and identify sourcing (includes the use of bar coding).
- to draw up a Production Inspection Listing (PIL) based upon ISO9001, using the services of a draughtsman - PIL is checked by the Technical Manager.
- to ensure inspection equipment is (according to BS standards) i) calibrated correctly by sub-contractors. ii) recalibrated annually by sub-contractors (less frequently recalibrated if rarely used).

"Goods-inwards" Inspection contractor

- to check the quality of all incoming goods from non-Giga sources:
  (it is Giga policy that no "goods inwards" inspection is performed on Giga supplied goods - which causes problems when these goods are below quality)
  " the level of inspection... depends on problems vendors have". The PIL is used to define the quality specifications.
- to maintain security of the reject warehouse and it's contents.
- to perform a random inspection of outgoing goods daily:
  a random selection is made of five work order batches, which are packed ready to leave. Inspection is carried out on a sample of each batch, the size of which is dependant on the size of the batch (approx. 1% of batch size)

Production area technicians (with regard to Quality)

- to inspect products during the production process; this usually requires the inspection of:
  i first off's - at beginning of batch run,
  ii hourly inspection thereafter,
  iii final inspection - at end of batch run.

  Recorded on an `Inspection list' which is kept in the work areas, then archived every few months (used by Quality Co-ordinator if a problem occurs). A PIL defines the quality specifications.

Material Review Board

- to decide whether reject goods manufactured in-house should be:
  i sold at lower price,
  ii reworked,
  iii scrapped.

  NB actors: "Administrative Services Resource"/Business Analyst,
  Production Planning and Scheduling Co-ordinators,
  Technical manager,
  Quality team.

figure A.7 Activities identified for the Quality function (July, year 1)

The following issues were recognised by the Quality team as requiring attention. Interviews with the Quality team suggested that they were attending to:

Manufacturing & Quality Systems Specialist:	Statistical Process Control (SPC) Quality Systems review Training/Induction
Quality Co-ordinator:	Day-to-day support of Quality functions Customer complaints Calibration Batch ID Quality documentation Product Inspection Listing (PIL) control/planning ISO
"Goods-inwards" inspection contractor:	Technical analysis Incoming goods Parts per million (PPM)
In addition three issues appeared to be addressed by the Manufacturing Resource:	Audits - site/customer Auditing Polytechnic project
The following issues had been identified but did not appear to be receiving any attention:	Quality cost analysis Computer Aided Production New processes / support Quality - Safety link / awareness Vendor partnership Production support Design review Problem solving teams

figure A.8 Activities of Giga (Products) European Quality Assurance Group (year 1)

Applicable to all Giga (Products) European sites (ensuring consistency of Quality Policy between all sites):

* TQM Programme development
  Provide links with other Giga divisions
  Communication within Products
  Quality cost/common analysis techniques
* Compilation of customer audit information
* Training/information
* Support of serious site complaint investigation
  Fact finding/evaluation of Quality systems
  Quality software/hardware evaluation
  Benchmarking
  Data source

From those activities listed above, those marked with * are of particular relevance to the Bristol site. The following activities are specific to the Bristol site

Quality project installation/support
Audits of Quality systems/processes
Supplier audits advise/assist
Training site personnel
Investigation of non-site specific complaints

The Quality Assurance Group are a highly qualified team of Quality experts, site independent, therefore in a position to provide objective criticism of a particular site's activities. They provide an internal consultancy resource.

A.2.3 ...a year of action...

Over the following year, a number of on-site developments occurred which affected both the quality function and the general awareness and understanding of quality issues by site personnel.

In September (year 1), a new site manager took over the running of the site. Although he was not obliged to continue with The Bristol Way, he was quickly converted to it following a period of observation and appreciation. His extensive experience of the quality function had helped him to develop clear views about quality, these being encapsulated in his comments:

> "I try to forget about the word "quality" because, too often we refer to quality as product and process and the fact that it has to do with what I'm doing, the way I behave, the way I think, the way I act; from everyone, from any service ...
> I'm not sure that I need a quality organisation. Its almost presenting yourself to the outside in an old fashioned way ...
> I might need people helping me to continually improve all the things we do and all our thinking. I'm not sure that I need to call that quality".
>
> (April, year 2)

> "when you start digging this and really start understanding it, it is not to do with quality. Its simply a philosophy of continuous improvement of anything you do ...
> if we talk about quality, we are having a tendency to immediately go back to the product and the end product. But there is a lot in between; the actions which are taking place, where you can improve continuously ...
> its very much dependent, all this continuous improvement, on people. That is the only true lever".
>
> (May, year 2)

Following his review of The Bristol Way in January (year 2), he decided that the manufacturing resource was overloaded with responsibilities. Responsibility for quality was transfered to the technical manager, with the expectation that the team benefit from his product and production expertise. Another change involved the transfer of the "goods-inwards" inspection contractor out of the Quality team into the Warehouse team, this marking the transfer of responsibility for the quality of in-coming materials to the warehouse team.

Coinciding with The Bristol Way review was a new appointment to the position of "European Quality Assurance Manager", responsible for the "European Quality Assurance Group". One of his first tasks he achieved was to "sell quality" to the Giga (Products) European Business Committee. Although approval had been received, the question can be asked regarding how their commitment was to be expressed. The arrival of the new European Quality Assurance Manager, when viewed in the context of the problems experienced on-site, provided the catalyst to embark upon the programme for continuous improvement. The site manager was starting to realise that:

> "there is room for improvement. Now we've started to feel that more and more".

The manufacturing resource, who held similar views to the site manager, reflected that there was

> "a feeling that quality was not being given enough attention in the Central Safety and Quality Committee. It was being tagged onto the end... "has anyone got any quality problems?"

Quality appeared not to be getting the commitment it should have, which resulted in

"a conscious decision to create a separate team, chaired and run in the same way as the Safety Committee, but called the "Continuous Improvement Team"".

There was a deliberate effort to avoid the word "quality" where possible

"to get away form the word association ... with products"

Further, it was

"intended to establish a Quality Awareness Committee to improve peoples' awareness of quality" (March, year 2)

The outcome was the initiation of a programme, involving all site personnel, aimed, not at quality, but at continuous improvement.

...a programme for continuous improvement

Although the problems experienced on-site were of a temporary nature, they highlighted the fiercely competitive nature of an aggressive market-place. Internal problems could affect the site's ability to meet customer expectations, which could only be damaging for the site and the company. Consequently it was not enough to respond to problems when they arose. It was necessary to prevent the problems from arising in the first place

In January (year 2), the "Continuous Improvement Team" (CIT) was formed with the objective

"to

encourage and develop an attitude of continuous improvement towards excellence in all our thinking and actions

in a way that:

all personnel understand and are totally involved and committed to our objectives

so that:

we strengthen our position and increase our profitability in the market-place to enable future development".

It was recognised that the success of the CIT would rely upon its careful planning, particularly at the early stages, with attention being paid to problem identification, recommendations and promptness of implementation. It was further recognised that the necessary support would need to be provided in terms of appropriate training, resources and expertise, particularly to the "task teams", who would be carrying out the "problem solving" activities.

The first meeting was held in February (year 2). Chaired by the site manager, it presented an informal forum where issues could be raised, discussed and action decided. In addition to the obligatory attendance of the leaders, quality team and task team representative, attendance was open to all permanent employees. Representatives were selected by the various work teams to attend the meetings. Each meeting followed a fixed agenda.

A suggestion box approach was used to identify areas for improvement. The intention was that, if a point raised was considered a priority, then the person who made the suggestion would be asked to put together a task team, which would then attempt to solve the problem, thus handing over ownership for the workplace to the workforce. Although many suggestions were received, it had been considered that the task teams should initially focus upon problem situations of low importance, in order to gain experience of the problem solving process. However, it was realised that if an important problem situation was tackled, its success could provide much needed momentum to the programme. However, failure could have the opposite effect, building up resistance and reducing participation.

Attitude problems experienced included:

- "what's in it for me?"

- "although I make a suggestion, someone else should take action on it."
- "any suggestion made by me should be actioned by me alone."
- "a suggestion made by someone else has nothing to do with me."
- "I'm not going to make a suggestion because someone else may get the credit."
- "I'm not interested".

It was found that the ability of the task teams to perform, reflected member's individual interpersonal skills. A task team leader was expected to select his team members, explaining to them the issues involved, assigning responsibilities and identifying the resources and training required. (S)he would update the CIT until such a time the team could present their findings, make recommendations and seek approval for implementation.

Assistance to the improvement process was being provided by the European Quality Assurance Group, with the European Quality Assurance Manager providing advice as how to go about things on a step-by-step basis. In setting up the programme, difficulties were experienced with getting the task teams to function. This was viewed as partly due to lack of experience of the CIT members and their failure to understand the theory of how teams operate. The manufacturing resource, with his extensive experience of teams, was able to guide, advise and develop the teams. Through a combination of trail and error and expert assistance, the teams gained a better understanding of what they were trying to do, with each person developing their interpersonal skills.

In March (year 2), a European Quality Meeting was held at the French site, attended by Giga (Product) Quality personnel, including, from Bristol, the technical manager and the quality systems specialist. The aim of this meeting was

"to
develop thinking on Quality issues...
in a way that
...a European consensus is evolved
...takes into account global successes and approach
...builds on the strengths and successes of each site
...such that everyone is involved
so that
...increases our contribution towards accomplishing the business mission"

The meeting provided a forum for the participants to learn about each other's experiences.

Three issues were identified as central for a successful Total Quality programme:

customer focus
improved thinking
quality techniques: SPC - to aid prevention
Quality costs - to aid detection
PPM - to aid evaluation

Included in the meeting's conclusions was the recognition that the "Quality organisation" can exist independently of IS09001; IS09001 emphasises documenting the system, not perfecting it. Documentation need not require additional manpower or costs, but can be achieved by providing personal responsibility. However, this implies attending to the issues of documentation control. With these insights, the participants returned to their respective sites.

Whether this meeting had any impact on the site or upon the activities of the CIT cannot be gauged. However, it may be assumed that it developed the attendees' understanding of both their colleagues' experiences and perceived problems and of

more general Quality issues, which would be fed back to the site at the appropriate times.

In terms of the three issues identified, the issue of "quality techniques" appeared to be the least developed on-site, with PPM being the only technique in regular use. Quality costs, although considered to require attention (figure A.7), were viewed by the quality systems specalist as desirable but complex and hence time consuming, thereby assuming a lower priority with respect to the other quality related activities. The focus was upon SPC. The implementation of SPC throughout the site was viewed as a means by which people could self-assess their performance and support them make improvements.

> "It's clear to me, to be able to look at improvements, you have to measure what you are doing..."
> "...we need to define these kind of measurements for the different areas, processes, people... we are not very good at that yet."
> "I strongly believe we don't spend sufficient time ourselves on the subject and that is something which I might have to change... to spend one day a week and try to establish our strategies on quality with the business team, to ensure firm commitment from these people."
>
> site manager (August, year 2)

However, this was slow in implementation, since it was being left to the technicians to adopt, though their awareness of its benefits was being developed through training. PPM (figure A.9a) had been introduced on-site in year 1 following a directive from off-site senior management. It was undergoing continuous modification. Other quality techniques included those used by the technicians during the inspection activity.

During an interview, the quality technician commented

> "people are tending to be managing more" (April, year 2)

This comment reflected his perception of the more autocratic management style of the technical manager, particularly when compared to that of the manufacturing resource. The extent this could be applied to other leaders was unknown.

In May, the European Quality Assurance Group performed a site audit. The auditors concluded that working practices in use provided a healthy basis for an acceptable quality system. However, the existing state of the quality system was not in compliance with the requirements of the Giga (Products) European Quality Manual. The main issue concerned the supporting documentation to current working practices, job responsibilities and individual capabilities. Documentation was either lacking, poorly controlled or not adhered to. The auditors suggested establishing a formal plan to ensure working practices were documented, assigning to individuals specific tasks with completion dates. It was viewed that the site may be able to comply with the European Quality Manual by the end of the year, given sufficient support.

A.2.4 ...a year later (July-August, year 2)

In general, the quality function had not experienced much change. The increased detail presented (figure A.9) reflects better observational techniques. Although there was an improved on-site awareness of the issues surrounding quality, this had not resulted in any marked transformations. Indeed, the manufacturing resource had perceived that already

> "there appears to be a change in enthusiasm".

The initial enthusiasm of the CIT appeared to have "dwindled to a flicker".

figure A.9 Quality function (July - August, year 2)

(Quality function - figure A.9a)

Purpose:
"to provide a strategy which enables a system to be put together to make available the techniques and tools for the maintenance and improvement of process and product"
"to put in place on-site, the mechanisms which will facilitate better quality control of the activities on-going on the site"
"to monitor the actual manufacture of the product to the customers' requirements"
using specific procedures and techniques.

Actors:
Technical Manager
Quality team: Manufacturing & Quality Systems Specialist
Quality Technician
"Goods-inwards" inspection contractor
Production area technicians
Material Review Board
Continuous Improvement Team

Regulatory Factors:
Giga Quality Policy (in particular: Complaint Handling Procedures)
world-wide PPM procedures)
Giga European Quality Manual
site "Quality Vision"
Bristol Quality Manual (in the process of being written)
International Standards: ISO9001
Canadian Standards Organisation
Underwriter Laboratories

Performance Measures:
customer complaints:
i total as % of sales [plant controlled; plant average; goal (0.3max)]
ii technical as % of sales [plant controlled; technical average; goal (0.3max)]
iii administrative as % of sales [warehouse controlled; administration total; administration average; goal (0.1max)]
Daily Complaints Report
PPM (parts per million)
i PPM1 - non-functional
ii PPM2 - functional, but still a problem
iii PPM3 - minor defects, e.g. label askew; bag not sealed properly; product with a visual problem (e.g. scratched)

(ACTIVITIES OF THE ACTORS - figure A.9b)

TECHNICAL MANAGER (with regard to Quality)

to promote "Quality" on the site,
to consult and advise the Quality Team, particularly with regard to exceptional issues; generally, he "hardly has to step in any more" - the most interaction required is with the Quality co-ordinator (2/3 times a day).

The Technical Manager, from his involvement at a European Management level and his technical expertise, is in a position to provide the necessary information concerning overall policy, thus ensuring consistency with company policy.

PRODUCTION TECHNICIAN

to inspect material / products when required
Receives: Product Inspection List (PIL) from Printroom co-ordinator
Inspection equipment from Quality co-ordinator
Transmits: Inspected product to Warehouse co-ordinator
Inspection sheets to Quality co-ordinator
rejected materials to reject warehouse (Quality co-ordinator)

to maintain record of scrap levels
Receives: Scrap from the Production Team
Transmits: Scrap to Warehouse co-ordinator (scrap is collected weekly by sub-contractors)
Scrap level records to Quality Systems Specialist

MATERIALS REVIEW BOARD

Actors: Control & Systems Supervisor / Business analyst
Production planning and scheduling co-ordinators
Technical manager
Quality Team

To decide whether rejected goods manufactured in-house should be
i sold at a lower price
ii reworked
iii scrapped

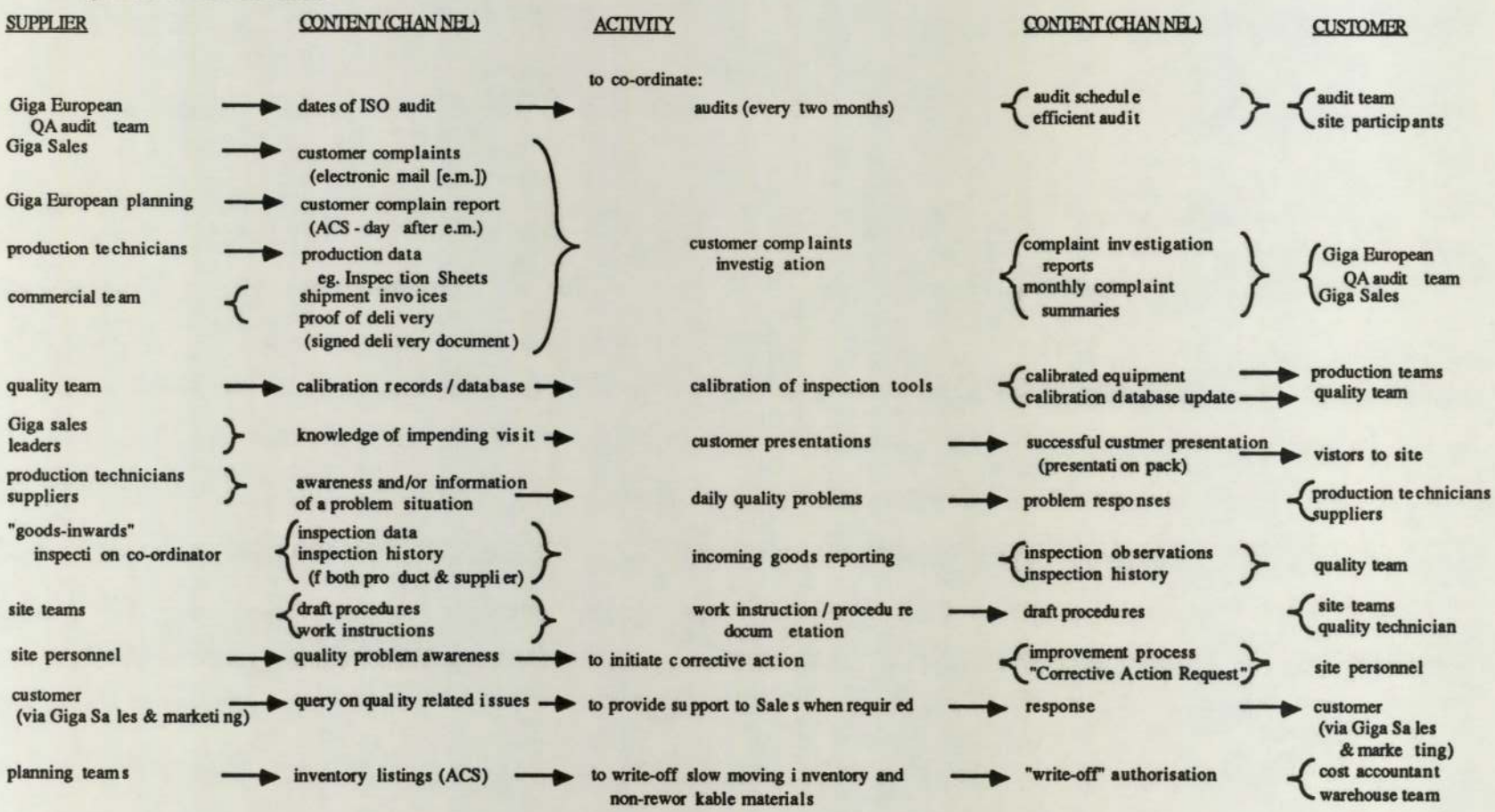
QUALITY SYSTEMS SPECIALIST

SUPPLIER	CONTENT (CHANNEL)	ACTIVITY	CONTENT (CHANNEL)	CUSTOMER
software house production teams	statistical software product / process data eg. dimensions, quantity, attributes (data sheets, computer o/p)	to initialise and maintain data collection and perform data analysis (in order to understand and quantify the process to facilitate process control)	product / process information (reports, graphs, discussion)	production teams site manager technical manager manufacturing leader ATO leader
leaders Giga consultants External consultants	expertise (literature, discussion)	to generate problem solving discussion, thereby facilitating process improvement	problem solving discussions	site personnel
Giga consultants Academic expertise	tools / techniques (literature, discussion)	to provide site employees with techniques and tools for improvement by means of education and training	tools / techniques (overheads / handouts / videos)	site personnel
computer suppliers	computer sofware	to implement SPC for control of processes	SPC techniques	production teams
production teams	product / process data complaints data (reports)	to transform data into information that can be used for improvement	eg. material waste, defects, customer complaints (graphs)	site personnel
site personnel	requests	to provide education in the use of PC's and to modify software when requested	PC education / training modified software	site personnel
Giga consultants External consultants personal contacts	expertise (literature, discussion)	to encourage and improve the site attitude towards quality	quality programmes / courses	site personnel
site personnel	suggestions	to facilitate "suggestion" evaluation	ranked suggestions	CIT
ATO team production teams	machine / process test data	to assure process quality by producing "Process Release Procedures"	"Process Release Procedures"	printroom
business analyst technical manager manufacturing leader ATO leader	costing data product information machine / process information	to identify opportunities for improvement	improvement recommendations	site personnel
site manager	general site information	to provide expertise	(literature, CIT minutes)	CIT

PERFORMANCE IS EVALUATED BY: changes in attitude and behaviour
process improvement (aim for zero defects)
annual pay review outcome

(Quality systems specialist - figure A.9c)

QUALITY TECHNICIAN



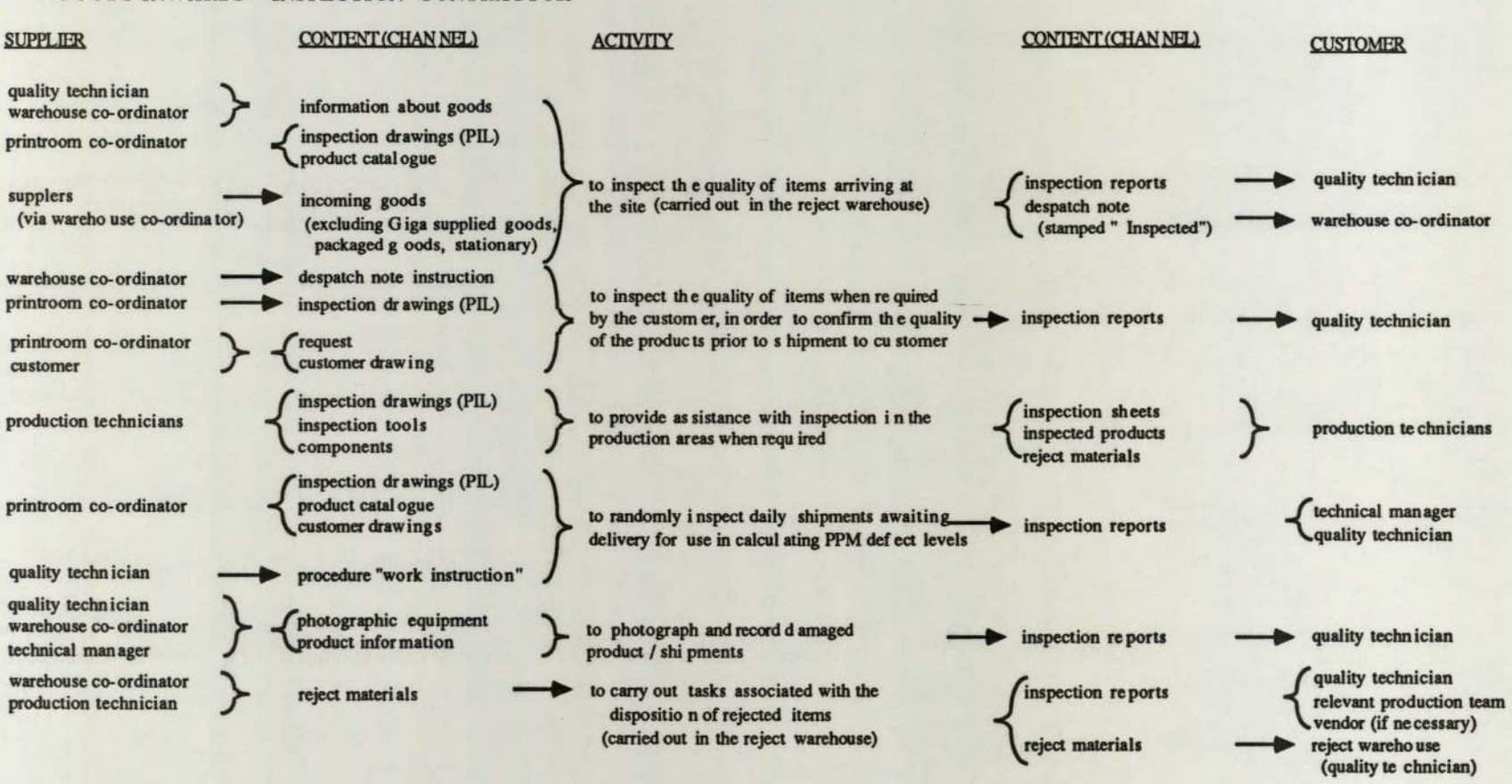
PERFORMANCE IS EVALUATED BY: the effectiveness of the action taken and the time taken

Variables offering potential for measurement:
- customer complaints
- corrective action
- repeated incidents
- total of defect / failure incidents per location

(Quality technician - figure A.9d)

("Goods-inwards" inspection contractor - figure A.9e)

"GOODS-INWARDS" INSPECTION CONTRACTOR



Inspection drawing specification may be tighter than that required by the customer. If a product passes the customer specifications but fails the inspection specifications, the product will be sent to the customer BUT the relevant on-site area will be informed

Variables offering potential for measurement:
- duration of products in reject warehouse
- time for requested information to be supplied
- total value of products in the reject warehouse

figure A.10 Function definition and improvement

OBJECTIVES:

To define the purpose of each element of the total system with particular reference to its function within the Bristol site
To define the input and output requirements of each system element
To understand the interfaces between elements of the total system
To continually improve each element so that the total system is more effective
To document the procedures needed for the efficient operation of each function

METHOD:

1. Each group of people performing a function to meet for discussion and definition of their present operation
2. Each group to define:
   Their customers and suppliers and resulting output and input needs
   Their purpose and its relationship to the organisation's objectives
3. Chart relationship of existing elements in Bristol using existing information and knowledge
4. Each group to define performance parameters to measure existing status and improvement
5. Each group to define improvements and plans to put these in place
6. All stages to be documented in accordance with ISO9001 where appropriate
7. Interfaces between elements to be verified and efficiency of total system evaluated

Similarly, when the site manager was asked in August about how he viewed the progress of the CIT, he commented that although he was happy with the learning experience and the development of individuals,

"I'm not happy at all with the progress we make".

The initial energy of the CIT had dwindled to the point that

"we need to review how we can develop / revive this. Maybe I have to play a more important role in it".

There had been a suggestion that the membership to the CIT should be confined to the business team. However, concern was also expressed that this move would alienate other former members, creating an "us and them" attitude. The suggestion was not implemented. A new role of Quality "facilitator" was recognised as offering value. This full-time role would attend to the more general issues surrounding quality, acting as a "quality" champion to "spread the word". However, it could not be decided at what level this should occur.

The site manager reflected that there was no structured quality strategy, this being perceived as possibly where the problem lay.

"people do not maybe recognise sufficiently the top commitment, the structure, how you do things ... its not structured, its not visible enough, the strategy is not there yet".

"but we have to come up with something. I think its going to be of essential importance for surviving".

"its not going the way I had hoped, but that's maybe because we don't have a clear strategy".

Problems had been experienced within another Giga division which had pioneered the drive for Quality within Giga. They had felt that

"it is a very difficult, lengthy process. They started to measure their cost of Quality and put that into dollar figures, which allowed them to get more buy-in from top management; because they could make visible that there is a lot of money in there; if you have a clear strategy".

Although the Bristol site was attentive to the experiences of the other division, the site manager felt that the site was not yet ready to adopt their findings. Further the subject of "Total Quality" had been raised at more senior management levels with the response from these managers being "well, go and do it". Despite the site

manager's desire to establish an on-site culture which dealt with quality in a manner similar to that of safety, which was institutionalised throughout Giga in terms of systems and practices, senior management commitment to quality appeared to be weak. Commitment appeared to be limited to the intonations that something needed to be done. The site manager's view of this was

> "That's not enough in my mind. It does not mean, however, that we as a site cannot contribute our part in going about own strategy on the site just because they aren't doing it..."
> "...we have to make things much more visible"

A.2.5 ...a renewed effort (August, year 2 to March, year 3)

Developments were temporarily superceeded by the need to overcome the "us and them" attitude developing among a number of the contractors. In May, the Site Manager permitted the long-term contractors to attend the morning rack-up as a symbolic move to encourage increased contractor involvement in the site's activities and overcome their feeling of exclusion. However, this had limited success. It was decided that the focus for the second The Bristol Way review in October (year 2) should be concerned with the functioning of teams and ways to breakdown the barriers between contractors and technicians. A consultant had been engaged during the summer to investigate this problem. He used the review to develop the leaders' understanding of the problems associated with teams and those experienced on-site.

Over the latter half of year 2, site employees were sent on a number of quality courses, in particular, those relating to ISO9000. This marked the start of an increased effort to educate the site workforce about quality. Reflecting over this the Site Manager commented

> "we feel it is more important to change the attitude and behaviour of the people, through training... I would say that the confusion starts where people feel that... they don't see how they can contribute... When they went on a ISO9000 training course for one day, they could understand the system, but they could not see how they fitted into that. A "goods-inwards" inspector... can easily identify himself with the system; see how he has to write procedures and make sure that things are controllable. The Site Secretary had more difficulty." (March, year 3)

When this was realised, it was decided

> "to have everyone going through the process of looking at their own functions, seeing what inputs and outputs they get, see where we duplicate and start to build on that."

This reinforced the training by developing each person's appreciation of what they were doing, who they interacted with and what was expected from them (figure A.10). It also permitted the quality systems specialist to gain a better understanding of how the site functioned and aid her enquiry into how to measure performance. However, the quality systems specialist found the process to be very slow, with people responding in a very ad hoc manner. Six months later, there had still not been much progress.

The announcement in December (year 2), that the technical manager was being transfered to another location in January resulted in the re-allocating of his responsibilities among the remaining leaders, including the site manager. The site manager assumed responsibility for both quality and safety.

It was at this time that a new function appeared on the organisational chart: "education and training" under the responsibility of the site manager, this suggesting the growing awareness of its importance. Initially conceived in March (year 2), the education and training programme commenced in January (year 3). The delay was attributed to the difficulty in gaining acceptance for the need for such a programme by senior management. The programme was aimed at site employees

only, i.e. excluding the contractors, and consisted of two stages. The first stage was concerned with developing a common understanding of quality related issues. Workshop orientated presentations using videos and other aids, were to be given each month on specific topics. The programme commenced with a presentation on "organisational communications", given by the site manager. This was to be followed by presentations on "products", "customers", "manufacturing strategy" and "systemic and experimental understanding". The effect of these presentations was to be assessed by informally interviewing attendees, gauging whether there was an improvement in their understanding of the subject-matter. The second stage was concerned with the specific tools and techniques of quality, to be provided as and when required.

Although the European Quality Assurance Manager had only been in that position since January (year 2), in January (year 3) he was promoted to a new position. He was replaced by an experienced manager with a marketing background.

In February, an on-site announcement was made that the site manager was being promoted and was leaving the site in March (year 3). The week prior to his departure, the site manager passed comment about the progress that the site had made with regard to quality

> "The CIT hasn't achieved what we were expecting a year ago. When we implemented the CIT a couple of things were kicked off, but did not really result in an attitude or behavioural change as far as quality / continuous improvement is concerned..."
> "the returns and the complaints have been reduced dramatically... but I think that's partly, or maybe for the majority, due to us building up a lot more experience and paying attention" <<to producing the products>>
> "I haven't seen great changes... It's ongoing. I think the basic fundamentals have been laid down by the training we have provided on ISO9000, but are still not in place..."
> "I think that some of us at the top haven't completely understood the whole impact of what it is and what it means".

With regard to the quality team, the site manager recognised the difficulties associated with the changes in leader and the lack of continuity, commenting

> "I think they have suffered a bit. We started a few months ago to have weekly meetings... I think we started to progress, but very slowly... this has probably led to some frustration of the members of the team... they were very disappointed of the announcement that I would leave. As I translate it, its the discontinuity of something which they felt was going in the right direction. It's sad but it's part of life."

The site manager agreed that there did not appear to be any strong on-site leadership for quality. In terms of the site's progress with ISO9000

> "ISO9000 is not noticable, that's probably very true. There is some commitment in having it implemented. Not because of obtaining the certificate and the piece of paper. But we feel it is more important to change the attitude and behaviour of the people..."

Recognising that quality still had a very low profile on the site, particularly when compared with the profile of safety

> "I think that's a very difficult thing to change in the culture of any Giga employee after a number of years; to change the quality way of life and see that as important as the safety way of life."

Using this analogy of safety for the development of quality

> "we say that we believe that any incident can be prevented in safety... We do not set the same objectives for quality... we don't have the same values for quality."

With regard to the whole effort towards quality

> "I think that commitment has to come first of all at the top level. The director of Giga (Products)... indicated that we should give quality the same profile as we did to safety. But that's again the words, saying "go and do it". It's not enough... One should become passionate about it."

The departure of the site manager provided a convenient break to the continuous monitoring and study of the site. Although the continuous improvement programme had not progressed as desired, it did have the effect of making the site more quality conscious. Coinciding with the arrival of the new site manager came news of major changes for the site, which diverted much attention away from the programme. However, the following event revealed that a spark still existed in the programme.

In April (year 3), the manufacturing resource was approached by a task team, assembled to investigate the implementation of SPC within the production areas. He was asked if they could give a presentation to the business team outlining how they could implement SPC. The manufacturing resource's response was

> "Great, something coming from the team. This must be encouraged irrespective of the cost. If we can get this working, then this can act as an example for the whole site. Even go to the length of rewarding the team, say by giving them a weekend break. By setting this team up as an example, this may set the ball rolling."

APPENDIX B

MODELS OF A SMALL COMPANY

Although quality was a hallmark of the service offered by Femto, it was not Quality certified. However, the company prided itself upon its skill, its sophisticated precision technology and its on-going efforts to be the best. However, increasing demand by customers for evidence of the standard of their "system" had prompted the decision to seek BS5750 approval. This was in addition to the pressure of specific customer requirements for conformance to their own quality "systems" and specifications. Although customisation of the process was part of the service, it was felt that customer "involvement" often focused upon the wrong issues, in particular their "systems" and their Quality Manual. The company's size and commitment to doing things right created the conditions whereby few "mistakes" were perceived to occur. Good informal interpersonal relations and a knowledge of each other's work supported this. Customer suggestions could be unrealistic, failing to take account of the company's size and resource constraints. On the other hand, the customer had the opportunity to involve the company more at the component design stage, with the potential for significant cost savings through precious metal usage. The flexibility and precision of the process offered potential that component designers tended not to be sufficiently expertise to take advantage off. However, instances arose where customers were being told at a late stage that their designs were not feasible. Further, component inspection variances were questioned by customers without their appreciation of their significance to the product or the process. Nevertheless, the company appeared to have few serious customer problems.

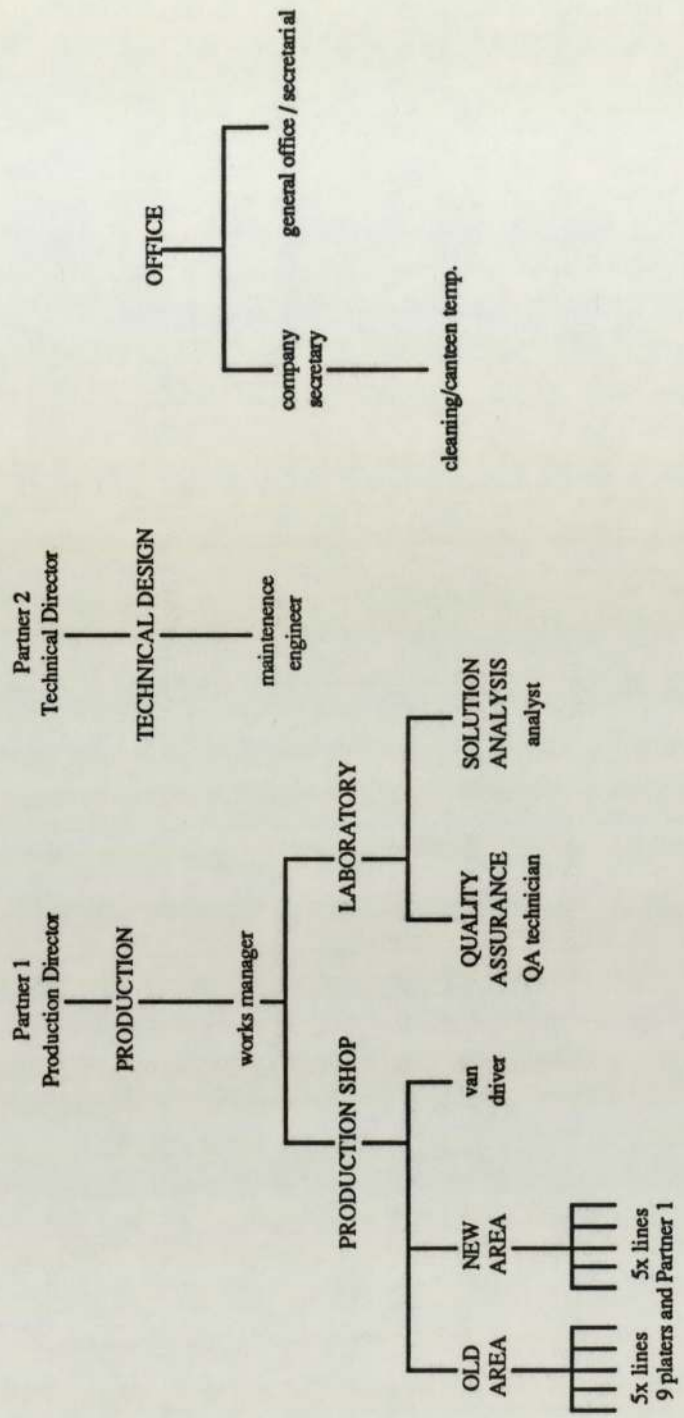
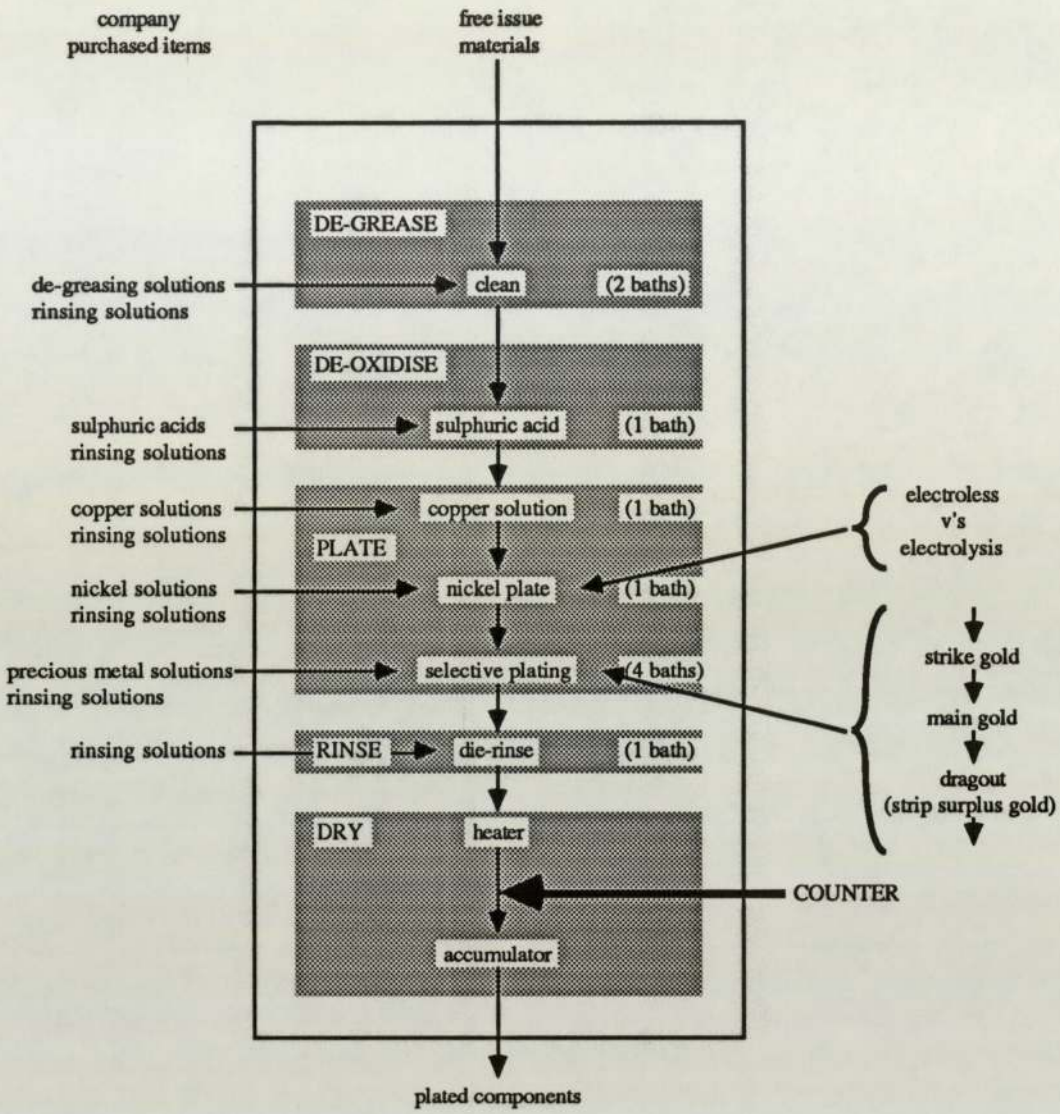


figure B.1 **An organisation chart**



NB. Each bath is followed by a rinse

figure B.2 A plating line

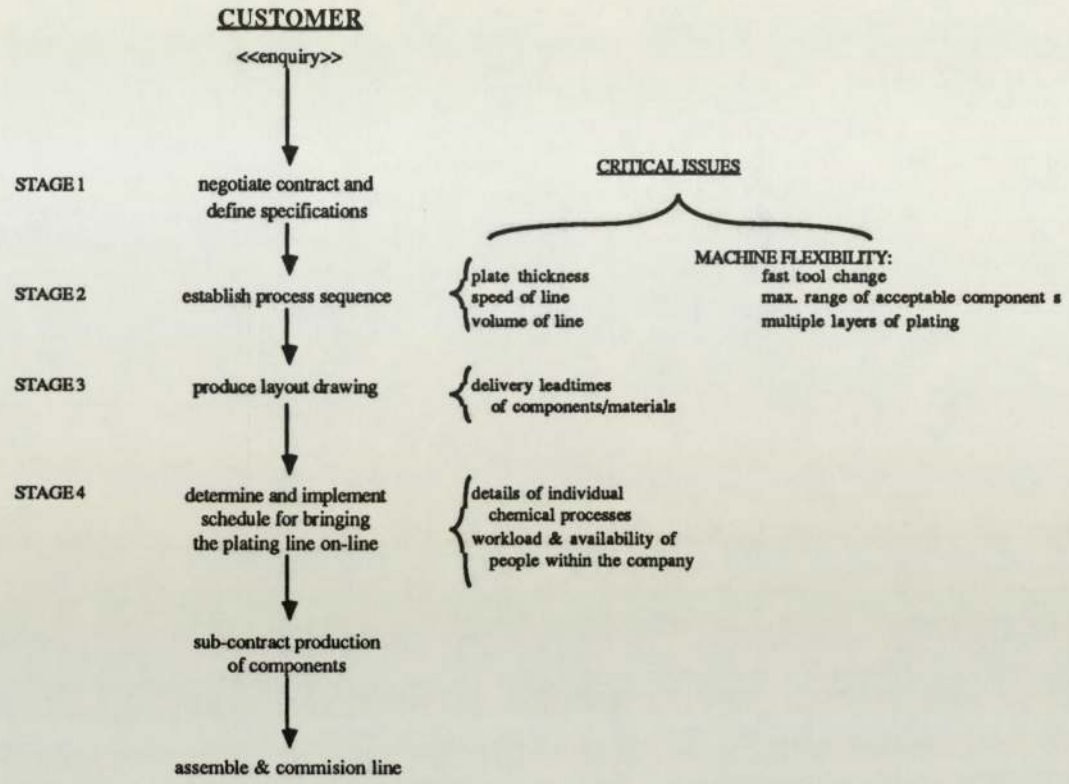


figure B.3 **Providing technical solutions to meet customer requirements**

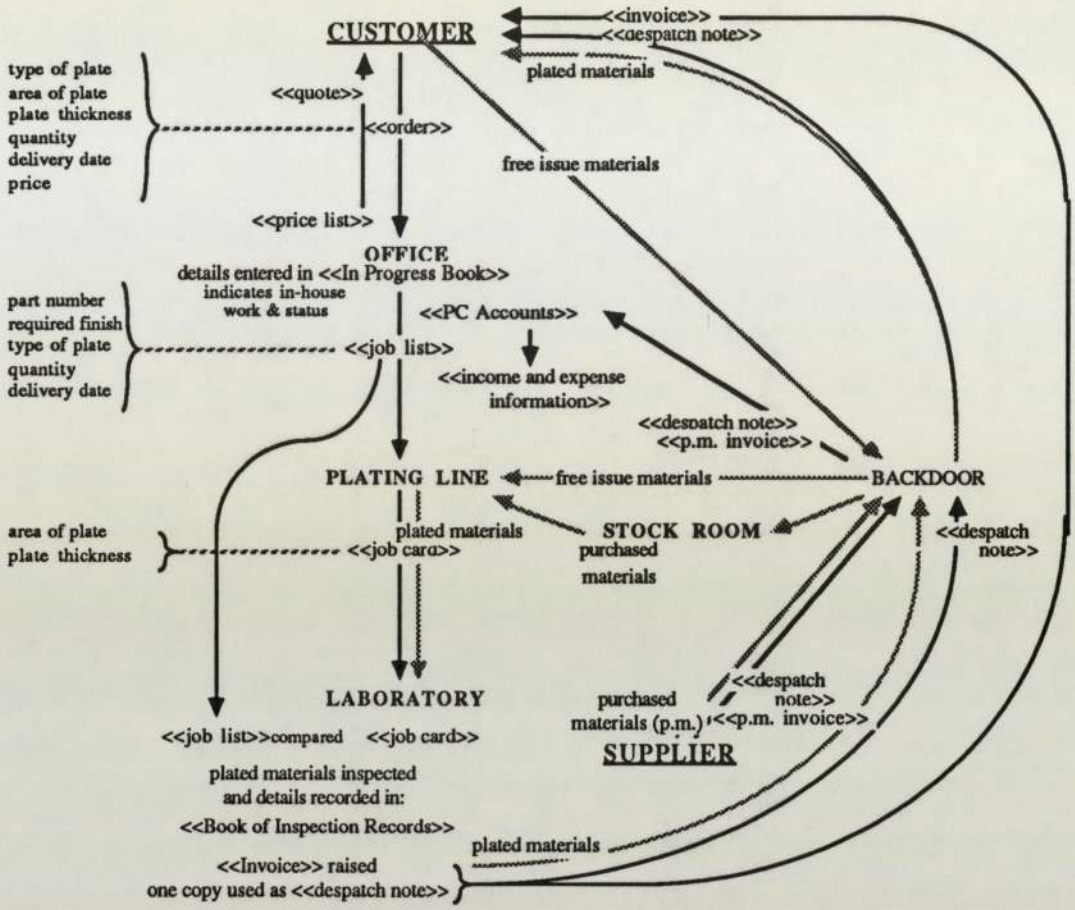


figure B.4 The basic flow of information within the company

TECHNICAL DIRECTOR:

Primarily concerned with the technical aspects of the plating process.
Activities include:
- the Research & Development into new plating techniques
- the design and build of equipment and tooling
- the running of the company in partnership with the Production Director
- "filling in" on the shop floor when people are absent
- solving technical problems

PRODUCTION DIRECTOR:

Primarily concerned with the operational aspects of the company.
Activities include:
- the running of the company in partnership with the Technical Director
- "filling in" on the shop floor when people are absent
- solving operational problems
- running a plating line

WORKS MANAGER / QUALITY MANAGER:

Primarily a supervisory role, responsible for
Shopfloor and
Inspection & Chemical Laboratory.
Activities include the
- organisation of people on the shopfloor to cover for absentism
- allocation of work according to machine capability
- provision of plating information / support to plater
- trouble shooting
- overseeing QA procedures
- dealing with customer production enquiries / complaints

PLATER:

Responsible for
the performance of the assigned plating line
Activities include:
- monitoring the line for potential problems: aim is prevention
- inspecting the quality of samples as they are being plated, eg. every 10 minutes;
  The heavier the plate of gold the more attention that is required.
- replenishing bath solutions as required; (2 to 4 times / week according to usage)
  Replenishment is at Platers discretion, though will be informed of specific requirements by Solutions Analyst (weekly / fortnightly). Plating solution are unlikely to require a complete change if well maintained. Cleaning solutions may need to be changed every 2 - 5 days according to usage.
- receiving deliveries
- delivering completed work to customers (if the Driver is unavailable)

figure B.5 Line management role definitions

level 1	level 2	level 3	CRITICAL ISSUES
Femto Ltd			Company revenue & expense Quality of plate Speed of response (same day if req uired) Price Number of employees Gold usage
	TECHNICAL		Machine downtime Self-sufficiency with regard to to oling Fast tool change Max. range of acceptable component s Multiple layers of plating Job: Component delivery lead-times / plate specifications / volume (sp eed of line (slower - thicker the plate))
	SHOP-FLOOR		Minimising precious metal wastage Job: Quantity / Plate type / Deliv ery date
		PLATING LINE	Plating capability of line (gold u sage / volume (speed)) Plater's technical competence Job: plate finish / thickness / ar ea
		BATH	Solution concentration / pH / dens ity / level Current level (stronger - thicker the plate) Temperature

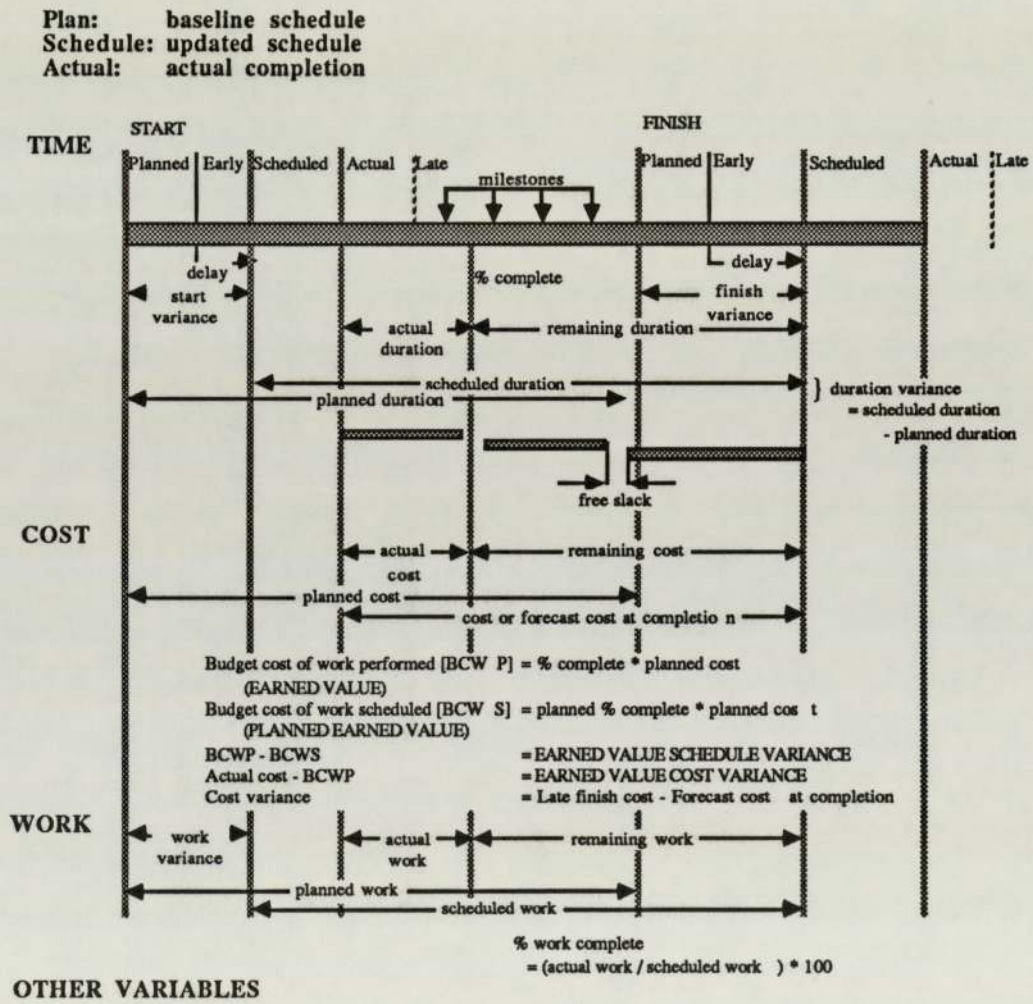
figure B.6 Critical parameters within the company

APPENDIX C

MODEL OF A PROJECT PLANNING "SYSTEM"

A project can be described in terms of its intitial plan, its updated plan and actual events. The plan permits resources and activities to be identified (named), structured and managed. Progress tends to be monitored in terms of three key variables: time cost and work. Each of these variables can be viewed in terms of relevant distinctions thereby enabling comments to be passed regarding the state of the project. For example time can be unfolded to reveal a start time, finish time and intervening periods. These in turn can be unfolded to reveal further distinctions. By combining these time distinctions with cost rates and work requirements, insights are provided into both the cost and work dimensions associated with the project.

figure C.1 Model of a project planning "system"



OTHER VARIABLES

Resource cost per use (fixed cost)	Resource name
Number of units of resource availa ble	Activity name
Overtime rate	Activity ID
Standard rate	Outline level / number

APPENDIX D

ESTABLISHING ROLES IN THE SITUATION OF BRINGING ABOUT A CHANGE IN THE WAY THINGS ARE DONE WITHIN THE ENGINEERING DIVISION

job title	role		observations of the Facilitator
Understand the existing system			
Managing Director	Intervenor	acted	entrepreneurial owner of the company: Engineering's existence is his decision: understanding arises from on-going daily contact: has expectation that management understands what is going on
Technical Director	Owner/Actor	espoused	recognised the need "to provide direction regarding how Engineering should function on a long-term basis": expectation that Engineering personnel understands the Engineering systems and practices
		acted	too many meetings and not enough time: relied upon day-to-day contact with Engineers for understanding of how Engineering functioned: no formal approach for ensuring that Engineering personnel understood how Engineering should function
Engineering Manager		Owner/Actor espoused	as manager of the Engineering function is "expected to understand how Engineering functions in order to control it" and "ensure that the Engineering personnel had this understanding so that they followed the system"
		acted	few initiatives: poor communication: his understanding was an outcome of day-to-day activities: no formal approach to establish what actually was happening: Engineering personnel did not understand the Engineering systems - widely held perception that Engineering was out of control
Engineer	Actor/Owner	acted	users of the systems on a day-to-day basis; individual practices reflect hear-say communication regarding how things should be done
Product Manager	Customer/Actor	acted	needs to design products in an effective manner: understanding of system is such that develops own approaches for doing things to overcome system deficiencies
QA Manager	Supplier	espoused	concerned with adherence of Engineering systems to British Standards and the correct specification of the product
		acted	only concerned with the documentation of the systems
Production Manager	Customer	acted	primary interest is in Engineering "getting it right": disinterested in how Engineering achieve this: lack of confidence in Engineering to produce problem-free product designs, this giving rise to direct confrontation with responsible Engineer(s)
Supervisor	Customer	acted	disinterested in what happens within Engineering: main concern is that Engineering don't create problems for them and when they do they sort them out quickly

Financial Director	Intervenor	acted	concerned over daily Engineering problems and the perceived lack of control over Engineering activities, these affecting project schedules and costs
Accountant	Supplier	acted	provide cost information to the Technical Director and the Engineering Manager, both monthly and as required
Sales Director	Customer	acted	indifferent to how Engineering functions as long as Engineering deliver what sales have agreed with the customer
Facilitator	Facilitator/Actor	acted	understands what is happening at a level which enables him to create the conditions whereby all participants can understand the situation in a manner which permits further discourse and action

Recognise a need for a new system

Managing Director	Intervenor	espoused	"unhappy with the way that projects tend to be late, over budget and of poor quality of work"
		acted	expressed concern regarding bad Engineering practices to Engineers the Engineering Manager and the Technical Director
Technical Director	Owner/Actor	espoused	view that "things were not as bad as people made out"
		acted	on-going discussions with the Engineering Manager and Facilitator, though did not necessarily see the need for change as a major issue: did start to take a long-term view of the functioning of Engineering and what was required for its development
Engineering Manager		Owner/Actor espoused	"the systems need improving"
		acted	few initiatives appeared to be forthcoming with regard to getting others to recognise the need for change
Engineer	Actor/Owner	espoused	"lack of control, too much fire-fighting, too many interruptions"
Product Manager	Customer/Actor	acted	poor systems hinder the product
Production Director	Intervenor	espoused	"unhappy with the level of production problems that were due to poor engineering"
Production Manager	Customer	acted	lack of confidence in what Engineering were currently doing
Supervisor	Customer	acted	frustrated at lack of Engineering support for production problems: lacked confidence in the quality of information provided by Engineering
Financial Director	Intervenor	espoused	"concerned over Engineering inefficiencies"
Sales Director	Customer	espoused	"the quality of the engineering tended to be poor"
Facilitator	Facilitator/Actor	acted	created the conditions where the strengths and weaknesses of the Engineering could be discussed by the Intervenors, placing emphasis upon the weakness that concerned how people were handled: identified issues which management did not recognise

Decide upon requirements

Managing Director	Intervenor	espoused	"Facilitator and Engineering Manager should be doing this"
		acted	made his own views clear regarding how and what should be done
Technical Director	Owner/Actor	acted	quietly expressed his own views regarding how and what should be done
Engineering Manager		Owner/Actor espoused	"this is what I would like"
		acted	general view as to what would like but has not established whether it is feasible nor examined the details

Engineer	Actor/Owner	acted	has views but not necessarily in line with what the Engineering Manager desires: not consulted
Product Manager	Customer/Actor	acted	establishes his own requirements to ease the product design process
Production Director	Intervenor	espoused	"needs Production Engineering support for his production lines and reliable product information to help with the product build"
Financial Director	Intervenor	acted	expresses requirement to assess Engineering performance based upon budget variance and schedule attainment
Facilitator	Facilitator/Actor	acted	interpreted differing requirements and established a portfolio of potential scenarios

Design a new system

Managing Director	Intervenor	espoused	"this activity will be carried out by the Facilitator"
		acted	decides that engineering is an autonomous P&L centre and has views regarding what issues are important
Technical Director	Owner/Actor	acted	makes decisions regarding the acceptability of models
Engineering Manager		Owner/Actor espoused	"this is what we've been thinking all along"
		acted	was involved in discussions with technical director and facilitator regarding possibilities
Engineer	Actor/Owner	acted	expressed their views regarding what they expected from the new system
Product Manager	Customer/Actor	acted	determines how his needs are best served
Financial Director	Intervenor	acted	concerned that progress was slow
Facilitator	Facilitator/Actor	acted	translates different perceptions of what is required into models for discussion: creates environment whereby models can be discussed

Make the new system a reality

Managing Director	Intervenor	espoused	"empowerment of the workforce"
		acted	not happy with the slow progress
Technical Director	Owner/Actor	acted	authorised that things were to be done in this way
Engineering Manager		Owner/Actor acted	hesitantly accepted the various proposals from the Facilitator and introduced them after much deliberation
Engineer	Actor/Owner	acted	involvement in Task Groups to address specific issues arising from the overall plan though eventually start questioning why they are doing this
Product Manager	Customer/Actor	acted	puts into practice his own mechanisms deemed appropriate
QA Manager	Supplier	acted	concern that new systems are appropriately documented to comply with BS5750
Financial Director	Intervenor	acted	concerned over the progress being made
Facilitator	Facilitator/Actor	acted	communicated the value of the new system to the intended users and customers

Use the new system

Managing Director	Intervenor	acted	expected that there would be an improvement in performance as a consequence of the new system being implemented
Technical Director	Owner/Actor	acted	expectation of improved performance, but questionable whether had fully accepted some of the proposals, e.g. failed to call the meeting of the Engineering Steering Committee on several occasions due to involvement in other matters, much deliberation over the development of individual career plans
Engineering Manager		Owner/Actor acted	"this is mine" (but only with regard to the project planning software)
Engineer	Actor/Owner	espoused	"little has changed, still fire-fighting"
Product Manager	Customer/Actor	acted	personal mechanisms are used

Production Director	Intervenor	espoused	"too early to say, but there appears to be some improvement"
		acted	frustration at the problems arising from incorrect information from Engineering
Production Manager	Customer	espoused	"things don't appear to be any better"
Supervisor	Customer	espoused	"need production packs which are complete and accurate: things don't appear to be any better"
		acted	ready to complain at the first opportunity
Financial Director	Intervenor	espoused	"lack of visible progress": "schedule attainment measure indicates deteriorating performance over the last few months"
Sales Director	Customer	acted	was being confronted with a more formal Engineering system for the acceptance of work into Engineering - fewer "back-door" opportunities
Facilitator	Facilitator/Actor	espoused	"do not expect instant results: will one day realise that Engineering has significantly improved: current emphasis is upon creating the conditions to support effective design engineering"
		acted	observed that there was an increase in the time spent upon added value engineering by the existing resources with a corresponding decline in emphasis upon low added value work and re-engineering work: certain projects were observed to be better managed with higher moral (reflecting the personal qualities of the new project manager)