CRANFIELD UNIVERSITY

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THE APPLICATION OF THE THEORY OF CONSTRAINTS THINKING PROCESS TO MANUFACTURING MANAGERS IN IMPLEMENTING CHANGE

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The application of the Theory of Constraints Thinking Process
to manufacturing managers in implementing change

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Abstract

This research is concerned with the problems faced by managers within manufacturing when they are expected to successfully implement a major change within their organisation. It uses, as the vehicle for the research, the Theory of Constraints Thinking Process (TOC/TP) first developed by Dr Goldratt between 1986 and 1994. The TOC is used by managers to determine what requires to be changed within their organisation and then to develop both the solution and the implementation strategy.

The research has used the access obtained by the researcher to examine the approaches adopted by manufacturing managers in implementing improvement projects, which involve significant change. The primary focus of the research was to confirm the existence of a significant barrier to change and to determine whether this was a function of the individual. Once the obstacle had been identified in specific situations, the second step was to consider whether the obstacle could be described in a generic form with application to a much wider range of change environments.

The final stage was to replicate the exploratory stage in other companies in other countries through the involvement of colleagues of the researcher and then consider what might be included in any change project, which would overcome the obstacle so defined.

The primary method of data collection was through the application of action research and the development of the data in the form of case studies. The number and types of companies that took part in the study and the range of countries was intended to ensure a reasonable spread of data.

The results suggest that one of the key obstacles to change is that outlined in the research problem and that the TOC/TP, through the use of the cloud technique, can describe this obstacle and give direction to the way of successfully dealing with it.

CONTENTS

FIGURES

Glossary of TOC Terminology

UDEs - Undesirable effects

CRT - Current Reality Tree

Evaporating Cloud - the term used to describe a conflict resolution diagram

FRT - Future Reality Tree

NBR - Negative Branch Reservation

PRT - Pre-Requisite Tree

TrT - Transition Tree

Chapter One

1.0 Introduction to the research

The aim of this chapter is to introduce the environment in which this research study took place and in which all of the companies that took part were a function. It considers briefly some of the key issues that affect manufacturing industry and some of the strategic directions companies are trying to adopt in their drive for improved performance. Each of the companies that took part in the study shared at least one key objective - to improve their performance. Whether it is measured in delivery performance, profit, return on investment, cash flow or any other appropriate measure, the aim was the same, to improve.

In each case, the people attending the various programmes taught by the researcher were keen to try to develop a manufacturing environment which enabled them to compete with the best in their market, and to increase their market share. They also recognised that, although they had attempted other similar projects previously, each had fallen short of expectation, and in some cases they had not even completed the whole project. It is in trying to determine the reasons for the failure to complete that this research is primarily concerned.

The chapter will present the research problem, as a broad statement, which forms the basis for further, and more precise, definition in the research questions and the hypotheses. This, in turn, assists with the placement of a boundary around the research. Justification for the research is presented giving scope to the research and is followed by a brief discussion on the methodology used. The thesis is outlined, each chapter being briefly described, followed by setting the key assumptions that were established at the outset of the research study.

1.1.0 Background to the research

Ensuring the ability to meet the demand of the market in terms of due date performance and ever shorter lead times, coupled with the never ending pressure on price, means that many companies are trying to focus on how to achieve such levels of performance without risking the company.   This is usually linked to the need for very lean manufacturing environments, as argued by commentators and researchers such as Pascale (1991), Schonberger (1982 and 1986), Womack, Jones and Roos (1990), and Hayes, Wheelwright and Clark (1988). The emphasis today is on the ability to bring to market, on time, products that meet specification and can be made effectively within the production facility without significant problems. This emphasis is also closely allied to the goal of the company and the environment in which it exists, which in turn determines its corporate strategy. This process requires the ability to see the manufacturing function as part of the whole company and not as a single entity without reference to the rest of the organisation.

In writing about what they called the new competitive challenge for manufacturing, Hayes and Wheelwright (1984) wrote "Studies of manufacturing firms in a variety of countries have persuaded us that the economic problems facing US companies in the 1980s - and particularly the productivity problem - have been due less to foreign pressure and governmental pressure than to some critical weaknesses in the way that US managers have guided their companies. These weaknesses have called into question some of the basic assumptions and practices that govern the way top US manufacturing companies have reacted to their strategic challenges." (p3).

Though it is always easy to blame others, especially outside the company, the real responsibility may lie within. Hayes and Wheelwright (1984)

present a powerful argument for dealing with this problem. They recognise, as does Goldratt (1990), the problems associated with focusing on just the short-term financial measures. They argue for the development of a strategic and coherent manufacturing philosophy linked to the overall business objectives.

Ishikawa (1989) considers that "Even when good improvement proposals are made, they often cannot be executed satisfactorily. Everyone rushes around shouting that they are eliminating defectives and increasing production, but in the end nothing is improved. This is because they are confusing control with improvement. If we want to make improvements we must first have total control. Only when control is sufficiently well implemented do significant improvements become possible." (p201). Though referring to quality improvements the lesson is clear. Only when the enterprise is under control and the direction is clear can real improvements be considered. Therefore the ability to control is a key feature of any enterprise trying to achieve a goal, and improve the performance towards that achievement.

Manufacturing organisations exist for a purpose. Their owners to provide for perceived need within the market place create them. The owners determine the goals of the organisation whether it is making money, serving the customer or any other deemed appropriate by the owners. Buchanan and Huczynski (1985) suggest that organisations ". exist where individuals acting alone cannot achieve goals that are considered worthwhile pursuing." (p5). They go on to confirm that "Organisations do not have goals. Only people have goals.........Senior Managers may decide on objectives and attempt to get others to agree with them by calling them 'organisational goals'; but they are still the goals of the people who determined them in the first place." (p6).

Porter (1980) considers that "The essence of formulating competitive strategy is relating a company to its environment." (p3). He then considers that the goal of the competitive strategy for "..a business unit in an industry is to find a position in the industry where the company can best defend itself against these competitive forces or can influence them in its favor." (p4). Porter considers the primary forces driving industry competition to be 1. suppliers, 2. potential entrants to the market, 3. buyers, 4. rivalry between existing firms, and 5. substitutes, either in terms of products or services. Given these forces it is essential to develop a clear strategy to combat them. He further argues that the three primary avenues that are successful include the following - overall cost leadership, differentiation, by which he means the ability to segment the market to develop a unique position, and focus which involves targeting either a specific market or group of people.

As noted earlier, Goldratt and Cox (1984) considers that the overall goal of a commercial organisation is the ability to make more money now and in the future, through sales. Compared to Porter this suggests a different focus. Porter argues that the primary focus is cost control. Whilst not suggesting that such approaches are not important, Goldratt argues that just concentrating on cost control is not enough, the focus must be on making money not saving it, and that means sales. If the objective is about sales and therefore about the ability to meet market demand with both current and new products, then time becomes an important factor. This emphasis on reducing the manufacturing cycle time is not without reason. If, in any market, competitors are able to deliver earlier, then any company is immediately at a disadvantage, and that means lost sales, and that in turn can lead to closure. Therefore any technique that can reduce this time is worthy of closer examination.

Tichy (1983) suggests that "The argument is made that an effective organisation is one in which there is good strategic alignment, that is the organisational components are aligned with each other, and the political, cultural and technical systems are in good alignment with each other." (p47). Thus developing a successful strategy involves a clear understanding of the goal of the organisation as determined by the people who own the organisation, the ability to bring together the various elements of the organisation in a coherent structure which demands that each part of the organisation is seen as part of a chain rather than as a series of independent links. The strength of the organisation is therefore judged by the strength of the weakest link and it is here that the strategy should focus.

One such approach that has met with increasing support over the past three or four years is that of lean manufacturing. Womack, Jones and Roos (1990) in their study of the car business highlighted the concept of lean manufacturing and defined it as follows: "Lean production is lean because it uses less of everything compared with mass manufacturing - half the human effort, half the manufacturing space, half the investment in tools, half the engineering hours to develop a new product in half the time. Also it requires keeping far less than half the needed inventory on site, results in fewer defects and produces a greater and ever growing variety of products." (p13).

Skinner (1974) in describing the focused factory suggests that "Focused manufacturing must be derived from an explicitly defined corporate strategy which has its roots in a corporate marketing plan. Therefore the choice of focus cannot be made independently by production people. Instead it has to be a result of a comprehensive analysis of the company's resources, strengths and weaknesses, position in the industry, assessment

of competitors' moves, and forecast of future customer motives and behaviour." (p65).

In the same way others, notably Schonberger (1982, 1986), and Pascale (1991), have all described the need for the same degree of flexibility and ever improving performance within the manufacturing environment. Goldratt (1986) describes one method of such an environment with the technique known as Drum Buffer Rope. Goldratt further examined this in 1990 with the aim of demonstrating the requirement for a clear understanding of all the factors that affect the ability of the system to meet its objectives. What is clear in all of these methods is the impact that turbulence can have. For example Goldratt makes it clear that the concept of a time buffer is precisely to combat the absolute predictability that some unforeseen problem will strike. The lesson is clear, with any drive to lean manufacturing, by whatever means, the dangers of such problems become extreme. The old days of excess have rightly gone away, but the safety that such excess might have been perceived to have offered needs to be met in a more powerful and less wasteful way. Skinner (1974) supports this view when he argues "The prevalent use of 'cost' and 'efficiency' as the conventional yardstick for planning, controlling and evaluating US plants played a large part in the increasing inability of many of the approximately 50 companies in my research to compete successfully." (p74).

The organisation, if attempting to operate within the commercial environment, must demonstrate its ability to achieve the goal set for it by the owners. The responsibility for this lies within positions of management, from the board of directors down to the shop floor supervisors. Each person, irrespective of his or her position, has a responsibility to try to meet the goal of the organisation. Buchanan and Huczynski (1985) consider that "Organisations are concerned with performance in pursuit of their goals. The performance of an organisation

as a whole determines its survival. The performance of a department determines its survival within the organisation and the amounts of resources allocated to it. The performance of individuals determines their pay and promotion prospects." (p5).

1.1.1 The use of measures

In order to determine whether the goal is being achieved or not most owners will apply a set of measures. Within the manufacturing industry these are usually Net Profit, Return on Investment (ROI) and Cash Flow. At the end of each period the accounts are examined to determine the performance of the organisation and to see if improvement has taken place. This focus on the measures then determines the Goal, as expressed by Goldratt and Cox (1984) as being to make more money now, and in the future, through sales.

However, the three measures of profit, return on investment and cash flow are usually referred to as global measures with little or no relevance to the supervisor, operator and first line managers. There is a need for local measures to enable people to determine the impact of their decisions on the global performance of the company. The local measures proposed by Goldratt (1988) are Throughput, defined as sales revenue minus the cost of raw material within a time period; Inventory, defined as the cash tied up in the business; and Operating Expense, the money needed to turn inventory into throughput. Perhaps the best overview of the use of measures and comparing the Theory of Constraints (TOC) based measures to the normal cost based measures is provided by Noreen, Smith and Mackey (1995) in their study of TOC and management accounting.

1.1.2 The need for change

If this were all that concerned managers, though appearing tough, it would not be impossible; however there is also the fact that change is taking place. Likert (1967) argued "Every organisation is in a continuous state of change. Sometimes the changes are great, sometimes small, but change is always taking place. The conditions requiring these changes arise from both within and without. As a consequence there is a never-ending need for decisions which guide adjustments to change. The adequacy of these decisions for meeting an organisation's current and developing internal and external situations determines the well-being, power and future of that organisation." (p128).

If the statement expressed by Skinner (1974) earlier is accepted, that many of the rules and measures etc. used in most organisations are erroneous then when linked to the notion that measurements should motivate the people within the various parts of the organisation to do what is best for the organisation as a whole, some measurements do not achieve that purpose at all. They do not induce people to do what is good for the organisation. At the same time, if training conditions people, and there is a lot of training taking place, based on the erroneous factors already described then it is very likely that many people are conditioned to follow rules, even erroneous, ones. Of course, the intuition most people have is very strong so there is the real possibility that many people are, at least subconsciously, disagreeing with their own actions. If people are rewarded according to their performance versus the measurements, and these same measurements are also erroneous, then people are forced to behave in line with some erroneous measurements and often find themselves valued somewhat arbitrarily.

This leads to two conclusions. The first is that if people find themselves at odds with their intuition, yet are forced to behave that way, then they find they are in conflict with common sense. Also if they feel valued in that way then some will feel that they are undervalued whilst others overvalued. Given that satisfaction is important to people then frustration is a normal outcome. As this then requires an outlet people start to fingerpoint and the blame culture becomes apparent, or some people just give up and become apathetic. If there is a real sense of injustice then the likelihood is that there will be considerable activity behind the scenes and political manoeuvring. This in turn leads to a sense of protecting one's back and the whole scenario leads to walls of distrust between levels and functions.

The outcome of this rigid application of measures and rules coupled with training and education based on erroneous assumptions is a company that is facing real difficulties and certainly no real chance of improving performance in the long term. Tichy (1983) has proposed one response to this problem. He considers that "The response to managing in turbulent times requires organisations to return to basic questions about their nature and purposes. The fundamental character of their technical system will need re-examination resulting in new missions and strategies, major re-structuring and revamping of the financial, marketing, production, and human resource systems. Organisations' political systems as reflected in who gets ahead, how they get rewarded, and who has power to make decisions would also need overhaul. Organisations' cultures are perhaps the most complex and subtle yet most pervasive on their effectiveness. Thus major change will require addressing issues of values and beliefs of organisation members." (p45). Tichy is referring to the need in times of economic and political turbulence for the ability continually to examine the direction and nature of the organisation. This must include a review of the basic assumptions that led to the formation of the organisation in

the first place. This, in turn, should cover the cultural, political and technological dimensions of the company and include all the people within it. This review ought to go right to the heart of the organisation and challenge these basic assumptions. It also requires the examination of the many causalities that exist, teasing out the real and the erroneous, and starting the organisation once more on a process of on-going improvement.

This final statement, concerning on-going improvement, is found throughout the writings of people such as Goldratt (1990), Deming (1986), Imai (1986) and Feigenbaum (1991). They each recognise the importance of ensuring that performance is continually reviewed and upgraded. For them any organisation that did not improve was already slipping behind the competition, hence the need to analyse performance, seek out the areas of non-performance and deal with them properly. This is the starting point for such approaches as the fourteen points of Deming, the statistical approaches of Feigenbaum and Imai and the TOC of Goldratt.

1.2 The Research Problem

Given all the available approaches to improvement that exist, including some of those described above, one would expect to find many organisations experiencing rapid and sustained growth. The reality is that many organisations find that the expected improvements do not appear. This suggests that there is a further obstacle to improvement not defined in the usual methods adopted. If it is accepted that most, if not all, improvements involve change, often significant change, then the combination of a need to improve with the requirement to change, suggests that the obstacle concerned lies with the people involved. If this is the case then it can be argued that, given the need for change, the behaviour appears dysfunctional. The observable effect, which prompts

this problem, is that of a dysfunctional constraint preventing an individual from implementing a solution. The question is what kind of dysfunctional constraint is this? Can it be determined, described, and if so can it be done in such a way as to both illuminate and suggest a way to alleviate the impact of this constraint?

1.3 Justification for the research

The research is justified by the importance of understanding the process by which people tasked with managing a change programme within their organisation actually do so. This is linked to determining the causes for the creation and maintenance of personal obstacles in the change process. If there are obstacles, which prevent the successful outcome, then they need to be identified and solutions developed. The whole area of change has attracted a great deal of research and analysis in many countries. Although this has been introduced already within this chapter it will be discussed in more detail in chapter two.

Due to the relatively new nature of one aspect of the research, the application of the Theory of Constraints Thinking Process (TOC/TP), little has been researched in the use of TOC/TP for problem-solving of this nature. This research examines the application of this approach by managers in manufacturing and uses the approach itself as the method of describing the problem area.

Finally it is intended that those tasked with examining the area of change and change management will be able to build on the results of this research in their own field.

1.4 Methodology

Though discussed in greater detail in chapter four the research used the access gained by the researcher as part of his teaching activities. This led to the adoption of a case study approach, involving a qualitative analysis of the data. The TOC itself was used as part of the analysis method, in particular the cloud technique.

A key aspect of the research was the involvement of the researcher in the active analysis of the problems alongside those being studied. This drew the research into the area of action research. This is discussed in greater detail in chapter four.

1.5 Outline of the thesis

Chapter one sets the scene for the thesis in the context of manufacturing industry. It is the first statement of the research problems and the questions that the research sets out to answer.

Chapter two is concerned with the current literature relating to change and change management. It is concerned with an understanding of the field of change including aspects such as the issues that change raises for the people involved. This leads to an analysis of the soft systems approaches and the need to develop organisational learning.

Chapter three is concerned with the development of the research questions thus setting the scene for the research methods to be used. Given the drive to solve a problem there is often a need to implement a change within the organisation. This chapter introduces the research questions and the importance of exploring the causality those questions.

Chapter four discusses the research methodology used. This involves an analysis of qualitative methods, case studies, participant observation and the use of action research. It also introduces the technique used for the analysis of the problems identified and collected as part of the data collection process. The chapter ends with an overview of the process used to collect data, the boundaries of the research and the limitations of the research.

Chapter five describes the case studies captured as a result of the data collection process. The chapter discusses the results through the use of the cloud technique, and highlighting the assumptions that lie behind them, thus giving clues to the nature of the obstacles, which are preventing successful change.

Chapter six is the analysis of the case studies and the development of conclusions. The chapter returns to the research questions to examine whether they have been answered or not and whether there are remaining issues to be dealt with and if so what they are.

Chapter seven is a brief discussion about the wider implications of the research. It also covers further work carried out by others to replicate the work of this research. The chapter compares the results of this research with that of others and determines the contribution that this research provides. The chapter concludes with some final thoughts about the study and the methods adopted.

1.6 Key assumptions

For the purposes of this research a number of basic assumptions were made. These refer primarily to the programmes being attended but in turn also apply to this research. First, that all of those attending the

programmes were seeking to improve the performance of their organisations. Second, that the measures used to determine the improvement were, at the commencement of the programmes, rooted in the cost-based approaches, any change to throughput based measures not yet having been taken. Third, that the people attending the programmes included those who had the position and authority to implement the required changes at the appropriate time. Fourth, that those attending the programmes had sound intuition about their organisation, the products they made, and the processes that were used to do so and the markets they were aiming at. Indeed the assumption is that they had sound intuition about all aspects of their company and the environment in which it operated. Fifth, that they cared about their company and the people who worked there and that they were not seeking to use the skills and techniques taught as part of the programmes to simply cut cost by laying people off. The five basic assumptions exist prior to any programme and were deemed to be true of all those attending, unless proven otherwise.

Each person attending, and in particular the senior managers and directors, came to the programme seeking improvement in their organisation and, in some cases, their own performance. Though they began with a desire to deal with at least one specific function or area of their business, they each recognised that the core issues they were dealing with centred on their ability to solve problems. Though each problem was related to at least one function within the business, and others crossed functions, the key issues that the programmes focused on were that of problem solving, decision making and the implementation of solutions.

1.7 Conclusions

This chapter has laid the foundation for the thesis. It has discussed the background to the research, the environment in which all that took part were working, and the demands and constraints placed upon them. It has raised the issues surrounding the non-implementation of many improvement projects and, through the discussion of the research problem, started the process of focusing in on the key aspects.

This chapter introduced the research problem, followed by a justification of why this is an important area to examine. Finally research methodology was briefly discussed and justified, the overall thesis outlined and the key assumptions stated. The next chapter examines the current literature around the area of problem-solving, change management and the related organisational issues.

Chapter Two

2.0 Introduction to the literature concerning Problem-Solving, Managing Change, and Organisational Learning.

In the first chapter, the area of this research is first raised, the issues that surround the non-achievement of many improvement projects. This chapter examines the literature about the subject, to determine what is known, and more importantly, what remains to be discovered.

The chapter follows a simple path. Improvement projects are designed to deal with a problem. The starting point is the recognition that a problem exists. This leads to a careful analysis of the problem and from that to develop a solution. Once the solution has been determined it is important to implement it properly. This usually involves change, from a small minor adjustment to considerable upheaval throughout the whole organisation. To be successful this change must be properly managed. This cycle of problem - solution - implementation is also linked to the ability of the organisation to learn, from both failure and success.

This then sets the tone and content of this chapter. If the research sets out to examine why improvement projects fail then it is important to examine the process by which the individual determines his or her plan of action. Hence an overview of the common approaches to problem solving and solution development acts as a check to ensure that those taking part in the research followed common accepted practice. Once this has been covered it is important to check the literature concerning the management of change to see what is said about the potential barriers to successful change. This in turn leads to the ability of the organisation to learn. What are the factors that lead to successful change and which prevent it? Dealing with problems and managing change have been part

of organisations since they began. In many cases the problems are not new and the need for change, and indeed the change itself is not new. Therefore it can be argued that organisations, to be really effective must learn from these problems such that they do not occur again.

The approach adopted in this research for problem solving, managing change and the wider dissemination was the TOC/TP a description of which appears later in the chapter.

2.1 Problem-Solving Tools examined

Newman (1995) defines problems in four ways. "A performance deviation is where something odd or unexpected has occurred. A matter of difference is the gap between where we are, and where we want to go." (p21). He then adds two further aspects "An open problem is one without a correct solution and a closed problem is one which can be precisely defined, and has clear parameters and a correct solution" (p22). In the sense of this research, the types of problems being discussed are often seen to be open. There is no clear solution. Indeed when the deeper questions raised by the research are concerned, the individual is almost always convinced that there is no solution. They are also convinced that the gap is too large, that there is no process that can bridge the gap. Newman recognises the impact that mindset can have on this element of problem solving. He also recognises the importance of learning through problem solving.

For Newman the first stage is to define the problem. He then discusses a number of techniques to do just that. Analytical tools such as fishbone diagrams, multiple cause diagrams and force field analysis are described by Newman as viable tools for achieving the level of understanding required. Once the data has been analysed, Newman suggests using such

techniques as brainstorming for the generation of solutions. Once a number of potential solutions have been identified it is then necessary to choose one. Once this task has been accomplished it is then necessary to implement the solution.

VanGundy (1988) has defined a problem as "...any situation in which a gap is perceived to exist between what is and what should be. If an actual and a desired state are viewed as identical, then no problem exists." (p3) VanGundy summarises the pre-conditions he feels are necessary in order to begin the problem-solving process as being:-

" 1. The existence of a gap between what is and what should be

2. An awareness that a gap exists

3. The motivation to decrease the gap

4. An ability to measure the size of the gap

5. The abilities and resources required to close the gap" (p4).

VanGundy describes what is almost the definitive sequence of events in problem-solving. Starting with problem analysis and redefinition, through idea generation to idea evaluation and selection and ending in implementation, this sequence is deemed to be the norm. He, and Newman, describes a whole range of potential methods that can be used, but they are all stand-alone. This suggests that a more systematic approach would be of greater value. One such approach is that proposed and outlined by Checkland (1981) and Checkland and Scholes (1990) called 'Soft Systems Methodology', which will be discussed later.

Newell and Simon (1972) suggested that human cognition be based on the ability of the individual to process information. This includes the ability to store and retrieve information from long-term memory, and at the same time have the capacity to handle information in short-term memory. This led to the recognition of two key phases in problem-

solving, identifying the problem space, and being able to use some form of means/ends analysis for solutions. The first element is part of the intuition and knowledge of the individual, being able to recognise problems, or the patterns that determine problems, based on the previous experience of Newell. The second element is about the ability to determine, or select, actions which take the individual closer to their goal. These actions are then implemented.

Of course, for many situations, more than one type of action is possible and it is not always feasible to either remember each one, or to determine the impact it might have. There are also occasions when the correct path is to take actions that appear to move away from the goal, but which are in fact necessary in order to achieve the goal. These actions can often be in conflict with accepted practice.

Newel and Simon (1972) indicated several ways in which the second element could be successfully implemented. These include: specifying and attaining sub-goals, working backwards from the goal to the solution, using old analogous solutions on the current problems and using diagrams of various sorts to delineate the problem space.

The role of intuition is recognised as vital if the initial analysis is to have any merit. The ability to properly define the problem space and thus the core problem, is the first step in determining the solution.

The approach described by Bransford and Stein (1984) known as the Ideal Problem Solver recognises the importance of finding assumptions that might be limiting the problem resolution. They consider a number of mechanisms for the surfacing of assumptions such as making prediction, seeking criticism and others.

2.2 Soft Systems Methodology in Problem-Solving

Checkland (1981) sets his problem-solving methodology into a scientific context. Drawing on the research developed in the area of general systems theory, Checkland considers the importance of placing problem solving firmly in the scientific domain. For Checkland the importance of applying the scientific approach is in the determination of explanations which, for him, "...requires the elucidation of chains of causes and effects, and testable prediction" (p30). For Checkland, logical analysis is a vital part of understanding what is happening within the system. He does sound one note of caution however. He writes "Scientifically acquired and tested knowledge is not knowledge of reality, it is knowledge of the best description of reality that we have at that moment in time" (p50) Checkland argues strongly that "Science is an enquiring or learning system." (p50). He goes on to write "science is a way of acquiring publicly testable knowledge of the world, it is characterised by the application of rational thinking to experience, such as is derived from observation and from deliberately designed experiments." (p50).

This application of the scientific method is a key feature of the approach adopted by Checkland. In terms of hypotheses, he argues "..a hypothesis refuted is a more valuable experimental result than one in which the hypothesis survives the test." (p56). Given this background in the scientific method Checkland developed his approach to problem solving as comprising the following steps.

1. The problem situation: unstructured.
2. The problem situation: expressed.
3. Root definitions of the relevant systems.
4. Conceptual models comprising both a formal system concept and other systems thinking.

5. A comparison between the conceptual model and the problem situation.
6. The development of feasible, and/or desirable changes.
7. The action (s) to improve the problem situation.

What is clear from the work of Checkland (1981 and 1990) and Katz and Kahn (1978) is that the systems approach differs greatly from that of Newman (1995) and VanGundy (1988). The systems approach takes note of the causality that exists within organisations. This is very much in line with the TOC/TP approach that demands the viewing of the organisation as a series of links in a chain whereas that of Newman and VanGundy makes no such assumptions. The traditional approach considers each link in the organisation to be separate and that the improvement of any one will lead to an overall improvement. The systems approach, with the focus on the links being part of a chain, notes the importance of the interdependence of the links and argues that this must be taken into consideration when trying to deal with problems.

Goldratt (1997) argues the organisation must be viewed as a series of links in a chain, then the efforts in terms of solving problems must be focused on the weakest link in the chain. Equally, any actions that are taken as a result of the problem will inevitably have impact elsewhere, due to the linkages. Therefore the importance of managing the change process assumes a greater degree of significance. If the impact were in only one area with little or no impact in any other area then the process of change would be primarily in that one area. If there are linkages, the change process will impact a far wider environment than before and create new problems, in particular the need to resolve potential conflict.

Recognition of this impact means that anyone attempting to use the TOC/TP approach to problem-solving must be aware of the systemic

nature of the process. This requires a careful understanding of many of the key issues raised by managing a change process.

2.3 The Theory of Constraints approach to problem-solving

This research uses the problem solving approach developed by Dr Goldratt. The approach centres on the need to answer three questions, What to change? What to change to? and How to effect the change? This is very much in line with the approaches already described within the chapter. As part of the first stage the individual starts with the undesirable effects within his or her area of control and through the use of effect - cause - effect logic builds a picture of current reality that determines the core problem under review. Once the core problem has been determined it is necessary to build a picture of the solution through the use of the same logic this time building the future reality. The final question involves the use of logic to determine the implementation path including key milestones. The approach depends heavily on the intuition of the people building the logic and their desire to deal with the problems they are experiencing.

Stein (1996), Levinson (1998), and Dettmer (1997) have described the step by step approach contained with the TOC/TP in some detail. This research is not concerned with the details of the TOC/TP approach to problem solving and change management though it will use one of the thinking process tools, the cloud, as part of the analysis. This will be described in greater detail in chapter four.

2.4 Managing Change

Brooks (1980) described the elements of organisational change as shown below:
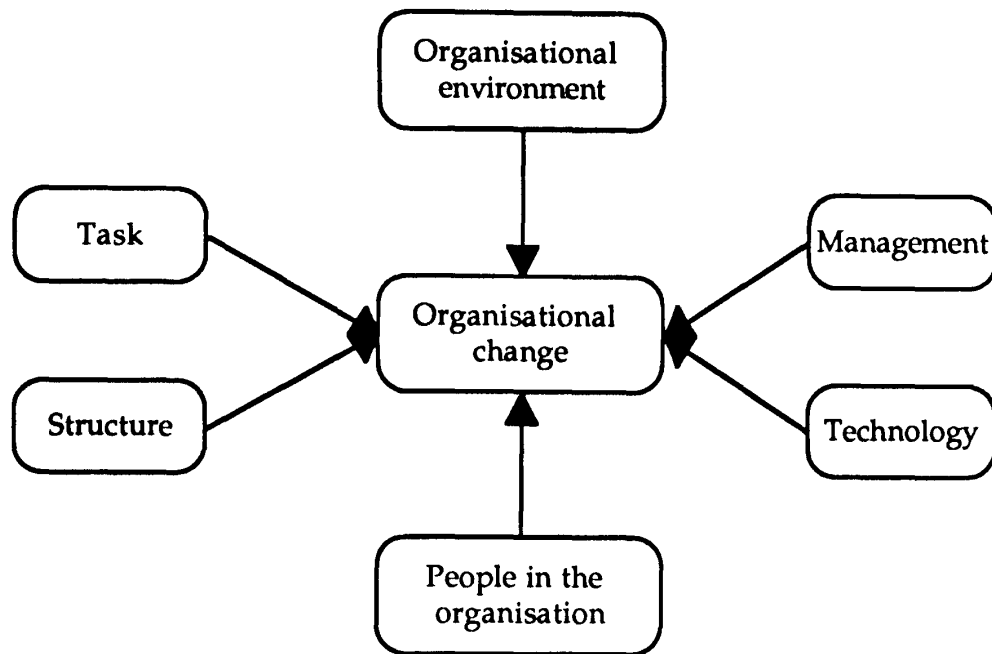
Figure 2.1 - Brooks Organisational Change Model

From this Brooks derives five major areas which management must take into account if it is to aid rather than hinder organisational change. Brooks considers, "The model provides a conceptual framework which focuses on the key variables influencing the success or otherwise of management change initiatives" (p74). These five are the aims and objectives of management, the technology being applied, the people involved, the current structure, and the range of control in the environment.

Of course when considering the forces that act on organisations, the structure of that organisation has important connotations for the way in which it responds. It is implied that if the organisation and the environment in which it exists is about to change then it is equally likely to require a change within itself in terms of structure and culture if it is to

remain responsive and adaptive. There have been many studies, which show that there are many effective organisations operating in stable environments or with stable technologies that are characterised by rigid structures with power concentrated at the top, and clearly defined roles at lower levels. It is equally true to say that where the environment is rapidly changing then the effective organisation is characterised by less reliance on formality and greater reliance on interdependence of unit operation. This is coupled with greater emphasis on joint planning and problem-solving with greater responsibility and authority placed at lower levels. (Burns and Stalker 1966; Emery and Trist 1965; Lawrence and Lorch 1967; Pettigrew and Whipp 1996)

Thus if an organisation is in the process of change, fixed rules and procedures will rapidly become outdated and severely hinder the process. As change often involves the unexpected, with unforeseen influences, a joint participative approach is to be preferred, as is the case with the TOC/TP methodology. Of course some organisations still feel that change will not affect them. This view is dismissed by Hersey and Blanchard (1972) who take the view that such is the nature of a dynamic society that the question of change has shifted from whether it will happen to one of when. They state "..how do managers cope with the inevitable barrage of changes which confront them daily in attempting to keep their organisations viable and current. While change is a fact of life, effective managers......can no longer be content to let change occur as it will, they must be able to develop strategies to plan, direct and control change." (p6).

2.4.1 The risks associated with change

The fact that change has become commonplace involves the organisation in risk-taking. Moore and Gergen (1985) place risk-taking as "...a crucial element in change, transition and entrepreneurship. In turn, fear of risks

is a key factor in resistance to change both for managers who need to decide whether or not to initiate change and for employees required to adapt for change." (p72). Thus risk has two primary elements, the risk to the organisation and the risk to the individual. Both of these are recognised by Moore and Gergen who then outline four key structural/cultural factors that influence risk-taking. These can be summarised as listed below:

1. Organisational expectations where the managers need to clarify what changes need to occur, why they are necessary and what is expected as a result of those changes.

2. Reward systems, whether formal or informal.

3. Support systems, which apply to the entire workforce.

4. Available resources to allow the risk taker to discover a working system.

In order to achieve change Moore and Gergen consider that organisations need moderately high-risk takers and it is this risk that requires careful consideration. They conclude by saying " asking people to change is asking them to innovate: to try new tasks, skills and work methods at all levels to make the change work well for themselves and the organisation." (p76)

2.4.2 The challenges of change

Risk is not the only challenge facing managers when change is required. Leonard-Barton and Kraus (1985) identify a number of key challenges which include the dual role within the company of those involved with the task of change, the variety of internal markets to be served, legitimate

resistance to change, the right degree of promotion, the choice of the implementation site, where appropriate and the need for one person to take responsibility. In consideration of the dual role they note that "Those who manage technological change must often serve as both technical developers and implementers. As a rule, one organisation develops the technology and then hands it off to users, who are less technically skilled but quite knowledgeable about their own areas of application." (p102).

Though their focus is that of technological change what they argue here is also true of almost any change process and certainly true of the TOC/TP change process. This imposes a responsibility for the implementor to design the changeover in such a way that it is almost invisible. When the people are transferring the TOC/TP knowledge into their own environment it is vital to ensure that the others within the organisation are ready to accept the new approach without question. There is also a major question here for the TOC/TP developer and educator. If they are to be successful then they must also be able to integrate the needs of both parties. For Leonard-Barton and Kraus (1985) the way forward is through a marketing approach. They argue that the "Adoption of a marketing perspective encourages implementation managers to seek to use involvement in the: (1) early identification and enhancement of the fit between a product and user needs, (2) preparation of the user organisation to receive the innovation and (3) shifting of "ownership" of the innovation to users." (p103). The time given to achieving the buy-in of the other members of the organisation is felt to be a prime factor in the success, or otherwise, of the process.

2.4.3 Managing the introduction of change

Wooldridge (1982) notes the concerns of managers facing the introduction of change by saying "...the prospect of introducing technological change has brought about increasing despair amongst line managers. They cannot believe it when faced with outright opposition to change from employees and their unions, even when that change is blatantly vital to the survival of their organisation." (p40). One of the major problems facing anyone concerned with this is that the reality of the situation is both complex and subtle. Again Leonard-Barton and Kraus (1985), who argue that the marketing approach will assist in the change process, have found that many implementations fail because "someone underestimated the scope of importance of such preparation." (p103). The idea that the technical superiority of the innovation will guarantee acceptance and that pouring abundant resources into the purchase and development of the technology at the expense of the implementation process will provide success is scorned by Leonard-Barton and Kraus. They propose "not only heavy investment by developers early in the project but also a sustained level of investment in the resources of user organisations." (p103).

Without proper implementation there is no improvement process and if the involvement of all the people concerned is not achieved then the likely outcome is not what might be expected. The whole point of the third question "how to effect the change?" in the three questions of TOC/TP is to fully prepare the people for the change and indeed to involve them in that process. This is done through the surfacing of the obstacles that stand in the way of success and the raising of reservations, which refer to the possible negative outcomes of implementing the proposed solution. The notion of the marketing approach also implies that there are multiple markets within the organisation, which require to be addressed. At each level of the company there needs to be a planned

strategy, which applies at that level. Managers on one level will require a different response to managers or users at a different level. Leonard-Barton and Kraus believe that "Top management and ultimate users have to buy into the innovation to make it succeed but marketing an idea to these two groups requires very different approaches....... We believe this executive must view the new technology from the perspective of each group and plan an approach accordingly." (p104).

This buying-in to the proposed innovation leads to the concept of "ownership" of the proposed change. Though the exact meaning will vary depending on the size and nature of the change project, the term implies the full involvement of all interested parties. Of course one set of difficulties not expressed here is when there is full buy-in from the people but not from the innovator for reasons which will be examined later in this study. Of course any change of this nature involves a transfer from one set of technology to another. Therefore the identification of those who will influence the workforce is paramount. The opinion leaders within the organisation play a vital role at this stage. Equally important is the realisation that the opinion leaders may not be the actual managers within the departments, but others who though they do not have the functional leadership, may have the de facto leadership.

2.4.4 The Change Agent

Whoever is responsible for the change, they all share one thing in common, they are agents for change. Atkinson (1985) notes the importance of the change agent when he notes that "The key to change is recognising that a need to take action is an important aspect of the change process, and that a 'change agent' or 'catalyst' is imperative to the successful implementation of new technologies." (p14). It is the nature of this person that is crucial to the success or otherwise of the

implementation. Atkinson suggests the following description of the person who can deliver such change; "The individual, the catalyst who makes things happen, is central to effective implementation strategies. Whoever occupies this role must possess the requisite attitudes, skills, knowledge and experience to develop an objective overview of the problem, and create decisions, which work in the long term. This 'facilitator' must also be able to harmonise enthusiasm, grasp opportunities, explore the sources of resistance and change attitudes in order to promote a healthy and effective organisation......change cannot create itself. It must be welcomed as an opportunity for those who work in the organisation to take some responsibility, and help prepare for, and create their own future." (p14).

Hersey and Blanchard (1988) picked up the theme of motivation and leadership, two key aspects of a successful change agent, when they described what makes a good leader. Through the development of situational leadership they sought to provide a "common language to help solve performance problems" (p2). They go on to suggest that their approach can be used to "diagnose leadership problems, adapt behaviour to solve these problems and to communicate solutions." (p2).

In their analysis of what they call a "real change leader", RCL, Katzenbach and his team (1995) consider the key elements or attributes of a successful change manager. He defines such major changes as "...those situations in which corporate performance requires most people throughout the organisation to learn new behaviours and skills. These new skills must add up to a competitive advantage for the enterprise, allowing it to produce better and better performance in shorter and shorter time frames." (p6). He also describes the common characteristics of the RCL as:

"1. Commitment to a better way.

2. Courage to challenge existing power bases and norms.

3. Personal initiative to go beyond defined boundaries.
4. Motivation of themselves and others.
5. Caring about how people are treated and enabled to perform.
6. Staying undercover.
7. A sense of humor about themselves and their situations." (p13). This leads to their definition of the term 'real change leader' as "Individuals who lead initiatives that influence dozens to hundreds of others to perform differently - and better - by applying multiple leadership and change approaches" (p16). Throughout his study Katzenbach uses cases to describe what kind of effect RCLs can have, in particular they go after "..specific performance improvements based on building new skills and attitudes, and getting commitment from all hands." (p34).

The close relationship between what Katzenbach calls an RCL and a TOC/TP practitioner is not surprising. Both have a focus rooted in the market, both are working to a vision of what can be, and setting out to achieve it. Words that are part of the language of a TOC Business Analyst, known as a Jonah, such as enthusiasm, commitment and trust are also part of the RCL vocabulary. Katzenbach recognises the importance of vision in the process of change. He writes, "You have to start out with a vision that isn't well articulated. You have to sense that it can be grey, it can be murky, but it should have at least the attributes of things you want. Then I think it is helpful to talk long and hard to a lot of people." (p93).

The next stage in the process is to determine whether the agent of change should come from inside the organisation or outside. In one sense given the nature of this research and the role of the researcher the answer to this question is both inside and out. The primary force for change is with the people attending the various programmes, however the researcher in his role of educator is also influential in the change process. Atkinson (1985) considers both, "...clearly there are many advantages associated with using

personnel within the structure to bring about change. Organisational knowledge, relating to structure, organisational culture, departmental and work groups, managerial responsibility etc., is an important asset, which the internal change agent possesses. Unfortunately there are disadvantages regarding subjectivity, bias and dependence for future career and promotion prospects. These negative factors all tend to suggest that the internal agent for change is not sufficiently detached from the situation to perform his function with discretion." (p14).

When considering the position of the agent being external Atkinson argues that their advantages lie in areas such as "..skill attainment, experience of change programmes in different cultures and structures, objectivity etc. All this helps the external practitioner to take a detached and professional view. Unfortunately, external consultants take a great deal of time to become acquainted with organisational philosophy, policy and practice." (p15).

Caruth (1974) in his examination of the systems analyst as a change agent noted that there are "..four areas of major concern to the systems analyst: (1) basic human motivation, (2) why people tend to resist change, (3) the ways in which people resist change in the workplace, and (4) how to overcome resistance to change." (p10). Of the first area Caruth considers that this is a key area on which to focus. It is necessary for long term improvement and change to reinforce the motivation of the workforce and that the "greatest opportunities for motivation lie in the areas of egotistic and self-fulfilment needs." (p11). It is often due to the lack of opportunities for most employees to use the creative side of their personality in their work and to a lack of recognition and appreciation that they become stagnant in their approach. Again Caruth makes the point that "There are areas in which management must concentrate its motivational efforts. These are the areas which the systems analyst

should utilise in his efforts to bring about change with a minimum of disruption and resistance." (p11).

Atkinson (1985) considers that the best approach centres on what he calls the team approach. This he describes as the "..coming together and grouping of external specialists who possess expertise, skill and experience, coupled with the organisational strengths of the internal practitioner, helps bind the partners of change. The team approach develops a 'synergistic' learning climate where the experience, knowledge and creation of ideas can be maximised." (p15).

Leonard-Barton and Kraus (1985) also considered the formation of the implementation team and argued that it should include "(1) a sponsor, usually a fairly high-level person who makes sure that the project receives financial and manpower resources and who is wise about the politics of the organisation; (2) a champion, who is a salesperson, diplomat and problem-solver for the innovation; (3) a project manager, who overseas administrative details; and (4) an integrator who manages conflicting priorities and moulds the group through communication skills." (p107).

2.4.5 Resistance to Change

For resisting change itself, Caruth (1974) puts forward the suggestion that there are a number of key factors. The first is that change, in any form, is perceived as a threat. "It is seen as a source of frustration, an obstacle which prevents an individual from satisfying a basic need." (p12). It is precisely this fact that is a function of one of the key hypotheses of this research. It is not so much that the need is not satisfied rather it is threatened.

Caruth continues to detail what he considers are more specific reasons, the first being economic security where the change is seen as threatening the source of income. De-personalisation is a further cause for resistance to change, as Caruth puts it, "..if he feels that the change will carry with it the notion of powerlessness, loss of autonomy, or a loss of identity with the product's of one's efforts." (p12). Job status is a further causal factor where change could imply that some of the trappings associated with the present position might be swept away or reduced in status after the proposed change. Change is also seen as introducing levels of uncertainty about competence and the re-skilling or worse, de-skilling, which may result. All this produces a situation where change is seen as disruptive and also possibly a destructive force to the social group within the workplace and hence people tend to resist such change.

The methods used in such resistance can vary widely from the merely outspoken response to the quiet yet positive sabotage of the implementation. Caruth examines a number of possible methods of opposition, ranging from open aggression to the spreading of spurious rumours about the new implementation and the effect it will have on staff. Some will just withdraw and lend no support to the new changes, which in turn leads to the situation where there is no sense of involvement and responsibility shown towards the new system. Others will be totally negative expressing the opinion that the new system will never work and should never have been introduced in the first place. Finally there is the point when the person withdraws totally and this will often lead either to the person being transferred to another department or even leaving the company altogether. Any implementation process that results in the kind of negative outcomes as described by Caruth is already a failure as it has resulted in lose-lose rather than win-win.

This situation is full of potential danger for the change agent as he, or she, has an interest in the success of the implementation. It is important therefore to overcome the barriers to change. Top of the list according to Caruth is that of communicating with the interested parties. If the people who are going to be affected by the change are directly involved with the change from the outset then they have a stake in the development of the system. The people in the organisation are important sources of information, often knowing the underlying methods of operation that exist in the company. It is important that this participation is honest. As Caruth explains "If participation is used simply to placate employees they will very quickly see through the ruse and resistance, perhaps more fiercely than ever, will soon develop." (p13). Hence when such change is being considered the management should consult with employees from the earliest point. Again Caruth states "Management should carefully explain the reasons for the change, how it will be implemented, what requirements the new system will impose, the benefits to employees etc." (p13).

Caruth also emphasises that the negative as well as the positive aspects should be explained. In conclusion he writes, "People can be conditioned to accept change as a normal occurrence if rewards for acceptance are positive. People will seek out opportunities for change if the right climate has been created by management...the majority of people will come to accept change if they are allowed to participate in developing the change, if management communicates openly with them concerning change, and if they are taught to accept change as a way of life." (p13).

Leonard-Barton and Kraus (1985) also accept that resistance to change is a major factor and argue that there are two main types of resistance. These they define as firstly overt resistance which forms as a function of mistakes or issues that have been overlooked within the implementation

plan and secondly tacit resistance which is a function of underground feelings which develop into action against the implementation.

2.4.6 The Politics of Change

The issue of power, the use of power in organisational contexts, and the problems that surround it have been researched and discussed by writers such as Handy (1985), Drucker (1980), Kakabadse and Parker (1984), Pfeffer (1981 and 1992), Lee and Lawrence (1985) and Morgan (1986). What is central to all of these commentators is the fundamental importance of recognising the political dimension associated with organisations and in particular that of change management. The individual who is tasked with managing the change process must recognise the power dimension of what he or she is doing and the likely impact it will have on themselves and others within the organisation.

The person tasked with change has to be aware of whatever power he or she has and be able to determine how this power might be properly used. Leonard-Barton and Kraus (1985) call this person the product champion who will nurture and attempt to anticipate opposition from the person they call the assassin who will equally try to destroy innovation. This the assassin can sometimes do with one careful shot, which means that the champions have to marshall, their forces carefully. The most common reasons for this opposition are the fear of de-skilling, loss of power or lack of personal benefit. Leonard-Barton and Kraus feel that a good implementation plan should "..try to identify where a loss of power may occur so that managers can anticipate and possibly avert any problems arising from that loss." (p108). Thus any innovation must offer an obvious advantage over the old system or there will be little incentive to use it. The implementers have considerable power at their fingertips,

which can be seen in two primary aspects, positional power and personal power.

Leonard-Barton and Kraus also identify one more character, the hedger. These people sit on the fence waiting for signals that can give them some idea of which way the implementation is going. These people tend to avoid risk and can be found at any level within the organisation. The best way to counter their influence, according to Leonard-Barton and Kraus, is for those in charge of the implementation to send out the right signals so that the hedgers are in no doubt. This can take almost any form from a speech or presentation to a simple quiet word. It is also crucial that the managers at all levels are speaking the same words at the right time. Finally, Leonard-Barton and Kraus consider the important step to be that "Managers...bring the criteria used to judge the performance of the users of the innovation into conformance with the demands of the new technology." (p109).

They conclude by saying that the task of converting hedgers is not an easy one to achieve but it is the most inescapable. Indeed "..as the competitive effects of new technologies become even more pronounced, the work of implementing those technologies will increasingly pose for managers a distinctive set of challenges - not least the task of creating organisations flexible enough to adjust, adapt and learn continuously." (p109).

Power is a key feature of change programmes. Etzioni (1961) discusses the difference between position power and personal power, the distinction springing from his concept of power as the ability to induce or influence behaviour. Etzioni postulates that the best situation for a leader is when he has both personal and position power. It is then necessary to consider the use of this power as to whether it will result in success or effectiveness or both. Hersey and Blanchard (1972) consider this by saying, "Success has

to do with how the individual or group behaves. On the other hand, effectiveness describes the internal state or predisposition of an individual or group and thus is attitudinal in nature. If an individual is interested only in success, he tends to emphasize his position power and uses close supervision. However if he is effective he will depend also on personal power and be characterised by more general supervision. Positional power tends to be delegated down from the organisation, while personal power is generated from below through follower acceptance." (p8). This leads Hersey and Blanchard to the conclusion that "..a manager could be successful, but ineffective, having only short-run influence over the behaviour of others. On the other hand if a manager is both successful and effective, his influence tends to lead to long-run productivity and organisational development." (p8).

2.5 Change/Implementation Models and Conflict Resolution Examined

Katz and Kahn (1978), like Checkland, developed their approach to organisations with a clear association with open systems theory. A key feature of their work is the careful definition of aspects such as cycles of input, throughput and output in a systems framework. They also recognise the different levels of systems and the interrelationships that exist within the system. It is precisely this relationship that is at the core of the effect-cause-effect logic of the TOC/TP. Through the connection of the logic the TOC/TP attempts to reveal the true causality that exists within the system, and thus the core problem. Katz and Kahn also recognise the importance of conflict and dynamic outcome of such. They cite a number of potential sources of conflict, but offer little in the way of conflict resolution. They do suggest that "...conflicts can have both dysfunctional and functional consequences" (p104).

Katz and Kahn go into the area of conflict in some detail, to them "conflict requires direct resistance as well as a direct attempt and influence or injury" (p617). Though focusing on conflict at an organisational level they do suggest there are three commonly used concepts of conflict, conflict of interest, competition and conflict itself by which they imply incompatible interaction. This last concept of conflict is precisely the type of conflict most identified with this research. They go on to argue that "...every aspect of organisational life that creates order and co-ordination of effort must overcome other tendencies to action, and in that fact lies the potentiality for conflict" (p617). With respect to change, they suggest that "Organisational change is necessary for survival, but an organisation with no internal resistance to change would be no organisation at all; it would move in any direction, and in response to any suggestion. Change and resistance to change, however, mean conflict." (p617). It is the recognition that conflict is inevitable that is so encouraging. Whilst many people are trying to avoid conflict, they are actually trying to avoid what is natural in organisations. The key to the reality of conflict lies in the knowledge that the conflict can be used to good effect, much in the way that Follett (1995) suggested. This means that some form of conflict resolution is vital to on-going improvement and change.

Therefore the reason why many improvement programmes fail to achieve the expected targets and benefits claimed of them is the absence of a conflict resolution mechanism. These conflicts can occur at almost any point of an improvement process but are most prevalent at two key points. The first is when the core problem of the area under review has been identified and verbalised, and the second during implementation. These two points are part of any improvement process.

Hutchin (1986) described such a process as comprising decision making - implementation - consolidation - expansion, shown in figure 2.2:

Decision - Making   Implementation   Consolidation   Expansion
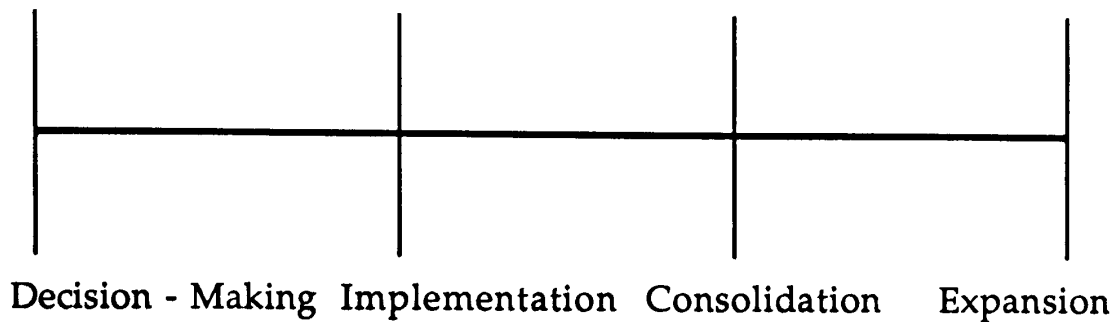
Figure 2. 2 - Hutchin Change Model (1986)

The process was assumed to proceed smoothly through each stage and at the time, the research confirmed the importance of the first stage as being the most crucial to the final outcome. This first stage included the basic decisions about what was required and the decision to go ahead made. Central to the ability to make the right decision were factors such as what must be done? Which areas are the most important? and what level of investment is required? The implementation, which included any training that might be required and the necessary preparation within the organisation for the new systems being installed followed this.

The third stage, consolidation, came once the initial implementation had been completed. At this point the system was either moving to a successful implementation or significant problems were being experienced. If these problems could not be overcome then the final stage, that of expansion, could not be reached. This stage was concerned with the growth of the new system within the organisation into new areas and perhaps beyond into other aspects of the organisation.

The final stage in this analysis of the literature is to consider what happens when changes have taken place. Every time a change is implemented in an organisation something can be learned. It may be from failure or from

success, but either way there is an opportunity for learning to take place. This learning is vital if the organisation is to learn from mistakes, and to ensure that they are not made a second time. What is equally clear is that many organisations miss this opportunity.

2.6 Organisational Learning

This final section of the chapter covers the area of organisational learning. In the field of managing change, a key feature of successful change programmes is the way in which the organisation learns from what has happened. This may apply to either the individuals concerned on their own or collectively or to the organisation as a whole. Whichever is applicable, and it may be both; the opportunity to learn from the experience should not be missed.

Kolb, Rubin and McIntyre (1971) outlined such a learning model as shown below: -
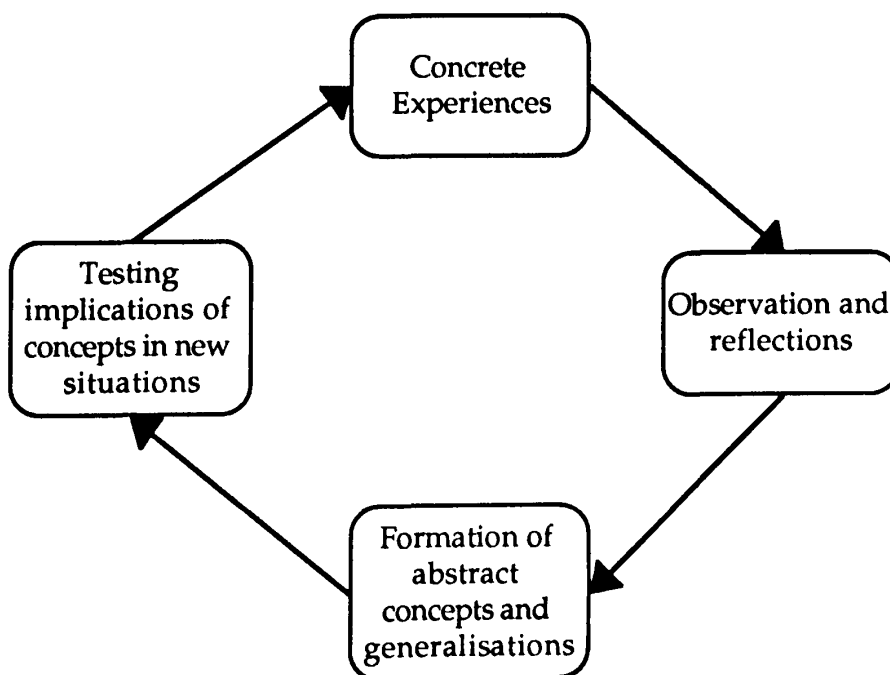
Figure 2.3 - Kolb Learning Cycle Diagram

They observe that "...this learning cycle is continuously recurring in living human beings, Man continuously tests his concepts in experience and modifies them as a result of his observation of the experience. In a very important sense, all learning is re-learning and all education is re-education. Second the direction that learning takes is governed by one's needs and goals. We seek experiences that are related to our goals, interpret them in the light of our goals, and form concepts and test implications of these concept that are relevant to our felt needs and goals. The implication of this fact is that the process of learning is erratic and inefficient when objectives are not clear." (p28).

Checkland (1981) in his application of soft systems methodology (SSM) also considers the importance of learning. He argues that the methodology of SSM is a learning system in itself. If the process is being used to address problems, in particular soft, fuzzy, unstructured problems then as far as Checkland is concerned "..the methodology is a learning system, and in tackling unstructured problems, could only be a learning system, rather than a prescriptive tool, is due to the special nature of human activity systems." (p214).

This raises the question of why do people do what they do? Checkland argues that this is a function of the view the individual has of the world. Their actions are conditioned by their thinking. The interpretation of what is happening is also conditioned by this view of the world. Checkland uses the term "Weltanschauung" to describe this, though usually abbreviates it to "W". Checkland describes this in more detail when he writes "We attribute meaning to the observed activity by relating it to a larger image we supply from our minds. The observed activity is only meaningful to us, in fact, in terms of a particular image of the world or Weltanschauung, which in general we take for granted." (p215).

This suggests that the W any one individual has determine actions. Another term for W is paradigm. For many years a particular paradigm may be appropriate for a particular set of circumstances. However reality changes and with that change pressure is placed on the ruling paradigm, until it gives way to new thinking, a new paradigm. This is what Kuhn (1962) defines as "paradigm shift". Hence, given a set of problems, the way in which the problem is addressed is a function of the W or paradigm of the problem-solver. If the solution is successful, the paradigm continues to be valid. If the solution is unsuccessful then the paradigm eventually faces a major challenge to the assumptions of validity that lie behind it.

Checkland observes this when he writes "It is characteristic of us that we cling tenaciously to the models which make what we observe meaningful. We celebrate Newton and Einstein as the very greatest scientists precisely because they forced the establishment of new Ws. Both were able to establish hypotheses which survived severe tests and hence became public knowledge, and were based on revolutionary frameworks, on Ws different from the prevailing ones of their time." (p216). He then goes on to note "The Ws of an individual man will in fact change through time as a result of his experiences. And the Ws of a group of men perceiving the same thing will also be different. It is because of these two facts that there will be no single description of a 'real' human activity system, only a set of descriptions which embody different Ws. In a certain sense, human activity systems do not exist; only perceptions of them exist, perceptions which are associated with specific Ws." (p219). For Checkland the power of SSM is in bringing about the ability to break out of one W and move to another.

2.6.1 An Analysis of Change Control Models.

Within most systems the normal procedure is for some kind of input to the system to trigger, or lead to, an output of the same system. There is also usually some form of feedback to give a degree of control to the system, as shown in the diagram below:-
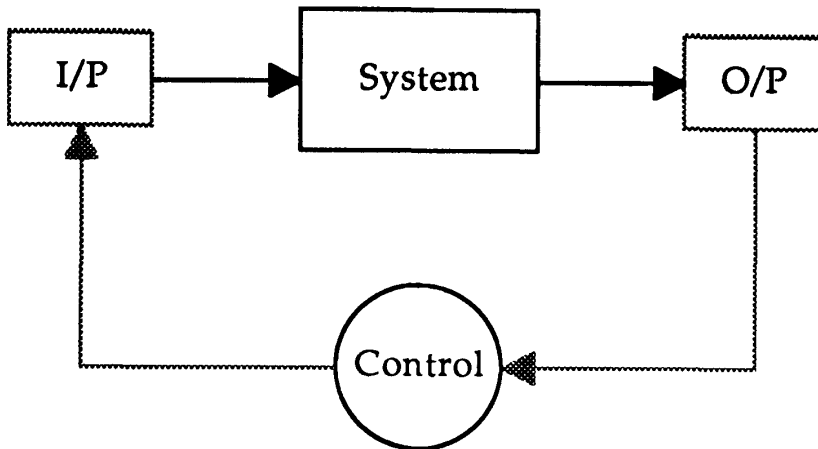
Figure 2.4 - Basic Control Model

The control mechanism usually serves to regulate the input in line with the output in order to prevent the system moving to an out of control position. This model is a fairly standard description of such systems. It is equally applicable to human activity systems or to most other types of systems. It does have limitations however, particularly when one important aspect of the system is the ability to learn and thus avoid errors in the future. This ability to learn is a necessary function if the ruling paradigm of the organisation requires changing at any time. This ability to change paradigm has been discussed at great length by Argyris (1990, 1992, and 1993), Argyris and Schon (1996) and also by Argyris, Putnam and Smith (1985). They have developed a number of key concepts within the process of organisational learning.

These include the distinction between espoused theory and theory in action; the nature of single and double loop learning; and the relationship these all have for organisational learning.

The model developed by Argyris (1992) is shown below: -
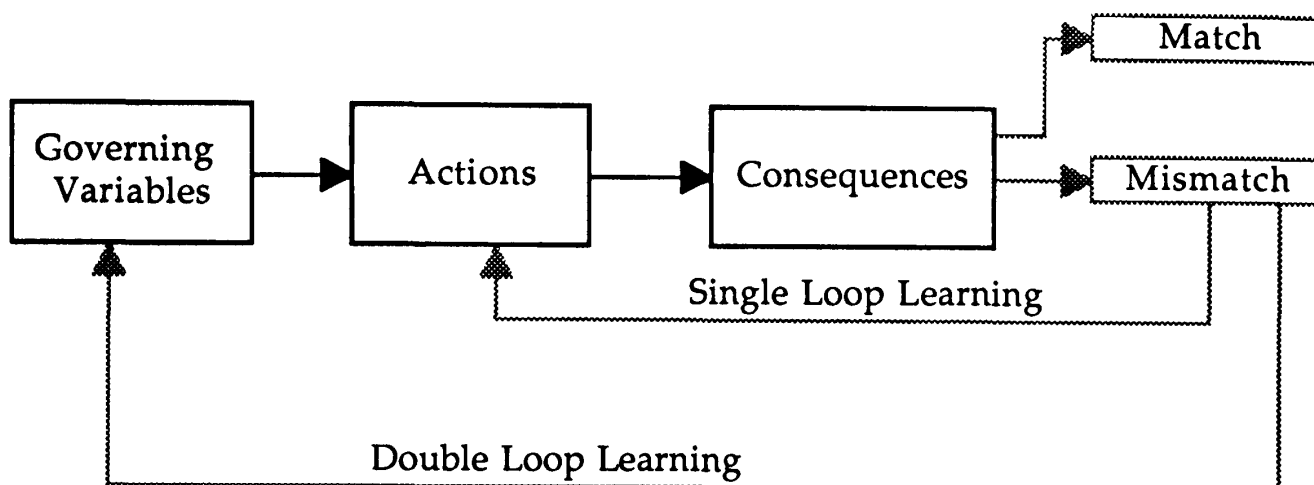
Figure 2.5 - Single/Double Loop learning (Argyris 1992, p8)

Argyris notes "Learning is defined as occurring under two conditions. First, learning occurs when an organisation achieves what it intended; that is, there is a match between its design for action and the actuality or outcome. Second, learning occurs when a mismatch between intentions and outcomes is identified and it is corrected; that is a mismatch is turned into a match." (p8). Referring to the models, Argyris defines them in the following way: " Single loop learning occurs when matches are created, or when mismatches are corrected by changing actions. Double loop learning occurs when mismatches are corrected by first examining and altering the governing variables and then the actions. Governing variables are the preferred states that individuals strive to 'satisfice' when they are acting." (p9). When change is necessary, Argyris suggests that single loop learning is very much in line with the model first introduced by Lewin comprising three stages, these being unfreezing, changing to a new pattern and then refreezing.

However the model proved to be inadequate when change of a deeper nature was required. Thus the need for double loop learning is established. Argyris (1992) argues that "Such significant changes require changes in the organizational governing variables and master programs, that is double loop changes. But double loop changes cannot occur without unfreezing the models of organizational structures and processes now in good currency. These models, in turn, cannot be unfrozen without a model of a significantly different organizational state of affairs; otherwise, toward what is the organization to change?" (p11).

There is however an important aspect to what Argyris is saying here. The current model, though still working is no longer valid. This implies that people are using an approach, which they already know is not the one that is required. This leads to the distinction between espoused theory and theory in use.

Argyris (1992) argues that "One of the paradoxes of human behaviour, however, is that the master program people actually use is rarely the one they think they use. Ask people in an interview or questionnaire to articulate the rules they use to govern their actions, and they will give you what I call their 'espoused' theory of action. But observe these same people's behavior, and you will quickly see that this espoused theory has very little to do with how they actually behave." (p89). He then goes on to say "When you observe people's behavior and try to come up with rules that would make sense of it, you discover a very different theory of action - what I call the individual's 'theory in use'. Put simply, people consistently act inconsistently, unaware of the contradiction between their espoused theory and their theory in use, between the way they think they are acting and the way they really act." (p90).

At this point Argyris returns to the governing variables when he argues that "..most theories in use rest on the same set of governing values. There seems to be a universal human tendency to design one's actions consistently according to four basic values:

1. to remain in unilateral control;

2. to maximize winning and minimize losing;

3. to suppress negative feelings; and

4. to be as rational as possible - by which people mean defining clear objectives and evaluating their behavior in terms of whether or not they have achieved them.

The purpose of all these values is to avoid embarrassment or threat, feeling vulnerable or incompetent. In this respect, the master program that most people use is profoundly defensive." (p90).

This last element of Argyris is fundamental. If the change is of some significance then double loop learning is likely. If that is the case then the governing variables must also change. This is the same as the paradigm shift of Kuhn or the change in W of Checkland. However Argyris suggests that at this point the whole approach of the individual becomes negative. If at the same time they are also aware of the conflict between the espoused theory and the theory in use the individual can now find him, or herself, is a degree of difficulty. They have to make decisions about change and whether they are prepared to take that challenge.

2.7 Conclusions

This chapter has set the scene for this research in terms of what has already been studied and researched. The key elements include the need to solve problems in a way, which removes them altogether, therefore the need to deal with core problems and not symptoms. It recognises that such problem solving tools must be robust in all environments and answer the three main questions of "what to change", "to what to change to" and finally "how to effect the change". Change of this nature will involve the panoply of change management issues, all of which must be addressed if success is to be the outcome. Finally there are the questions of how the individual faces up to the challenge of change for either him or her, and for the organisation. This final element implies the ability of the organisation to learn from what it is doing, to challenge the basic assumptions that govern the way it is managed and to be ready to change where appropriate. Contained within this final stage is the recognition that the differences between espoused theories of action and theories in use may also be driven by the measures that exist within the organisation at the time. Measures determine action, they determine the decisions that are made, and if they are also erroneous then people are already aware of the dichotomy that exists.

In terms of the research question raised in chapter one little has been said about the need to change the ruling paradigm of the individual. Argyris notes the importance of the governing variables but does not offer any mechanism to either describe the potential barrier or to determine the impact it might have. Checkland notes the power of "W" but does not explore the impact it might have on the ability of the individual to change them. Though there is a wealth of knowledge about the process of problem-solving, managing change and developing the learning

organisation there is little within the literature to give guidance about the research problem.

The next chapter will develop the research problem raised in chapter one, taking note of what has been discussed within this chapter in order to develop the research questions which lie at the heart of this analysis.

Chapter Three

3.0 Introduction to the research questions.

This chapter sets the agenda for the remainder of the research and this thesis. The research area was first introduced in chapter one, which raised the question of why do so many improvement projects fail? Is there an obstacle to the process of change that so many improvement projects demand, an obstacle as yet undefined?

The previous chapter explored current thinking contained within the literature to determine whether this obstacle had already been described. Though some came close the area remains unclear and requires further examination. This chapter lays out the research area in more detail, and develops the problem area of chapter one into the research questions, which lie at the heart of this research. The chapter will also set the boundaries for the research thus allowing for both focus and objectivity.

Chapter one noted that whilst many companies are embarking on improvement projects many do not achieve the expected levels of results from their efforts. This is particularly true when the improvement involves significant change. This lack of results gives rise to greater concern when the people in the organisation use a detailed, logic-based approach whose whole emphasis is on ensuring successful change. Though this raises the question why this is so it should noted that not all failed and there were successes. Many had success in implementing the changes required in order to gain performance improvement. They felt no conflict either with others or with themselves. They simply did it. Others however did not achieve what was expected. They all went through the same process, often at the same time, in the same class. So why did some fail? As noted earlier this was the starting question of the

research. It wasn't that they did not know what to do, they often had a clear and implementable plan to follow. In some way they were blocked.

This chapter therefore brings together the research questions first introduced in chapter one and the questions raised in chapter two from the analysis of the current literature. The intention here is to pull these two strands into one coherent basis for the research, developing the research questions more fully and then determining the hypotheses that lie at the heart of the research.

Selltiz (1966) suggests that "The purpose of research is to discover answers to questions through the application of scientific procedures."(p2). In particular the questions being asked here are of an exploratory nature, exploring the variables that surround the use of problem-solving and change processes, in this case the Theory of Constraints, in the pursuit of a successful implementation. Questions within this area of research are more concerned with issues such as "what", "who" or "where".

Again Selltiz, "In order to be answerable by research, questions must have one characteristic in common: They must be such that observation or experimentation in the natural world (including, in the case of the social sciences, the behaviour of human beings) can provide the needed information."(p3). She then goes on to remind the researcher that "This does not mean that research will always emerge with an answer, let alone a definitive answer. Research is oriented towards seeking answers, but it may or may not find them. Characteristically, modern science, and especially social science, is an unfinished business." (p4). When considering the nature of inquiry she suggests that "Scientific inquiry is an undertaking geared to the solution of problems. The first step in the formulation of research is to make the problem concrete and explicit."

(p31) She then continues by arguing that "The first step in formulating is the discovery of a problem in need of solution" (p31).

3.1 The Exploratory Phase - Determining the research problem

Given that research is setting out to determine answers, it is essential then that the problem, or set of problems, be clearly defined. Indeed without a clear formulation of the problem any solution that might be determined is likely to be of little value whatsoever. Thus if the nature of scientific inquiry is geared to the solution of problems the time spent in determining the problem is not wasted. The need for the problem to be both concrete and explicit is clear. It should also be noted that any such problem defined in this way is also in need of solution. Kerlinger (1973) recognised this aspect when he argued "It is not always possible for a researcher to formulate his problem simply, clearly, and completely. He may often have only a rather general, diffuse, even confused notion of the problem. This is in the nature of the complexity of scientific research. It may even take an investigator years of exploration, thought and research before he can clearly say what questions he has been seeking answers to. Nevertheless, adequate statement of the research problem is one of the most important aspects of research" (p15).

Kerlinger describes three key aspects of defining the problem statement. The first is the question of relationship, what is the relationship between two or more variables contained within the problem area. The second refers to the way in which the problem has been stated, is it clear, unambiguous and stated as a question? The third element that Kerlinger suggests is vital is that of the ability to empirically test what is being studied.

Given that the problem, or set of problems, is both concrete and explicit, the next step is to consider a solution, or range of solutions to these problems. This leads naturally to the creation of hypotheses. The role of hypotheses in research is to propose explanations for certain effects and to gain guidance in the investigation of others. This argues that if the intention is to take a step forward then it is necessary to start with a suggested solution to the problem that initiated the inquiry. These potential solutions might be drawn from the area under review itself often in association with previous knowledge. When they are formulated in this way they are deemed to be hypotheses. Thus the function of hypotheses is to direct the research and develop the ability to determine order among the various effects being noted. The solutions formulated in the hypotheses may or may not be solutions; the answer to that question is the task of the research itself.

Kerlinger defines the hypothesis as a "..conjectural statement of the relation between two or more variables" (p17). For Kerlinger the important aspects of hypotheses are that they are "...statements about the relations between two variables" (p17). Equally they also "...carry clear implications for testing the stated relations." (p17).

One aspect of this research is the importance of causality. A hypothesis can assert that a particular characteristic or occurrence is one factor in the determination of another. This is called a hypothesis of causal relationship. The hypothesis acts as a guide to the kind of data that must be collected in order to answer the research question, it also assists in the way in which the data can be organised efficiently in the analysis. Kerlinger argues that there are two major elements of the power contained within hypotheses. The first is related to the ability to use hypotheses to achieve dependable knowledge. Given that the starting point for any research study is an observable phenomena, which in turn

leads to speculation about causes Kerlinger argues that "Scientists insist upon subjecting explanations of phenomena to controlled empirical test. In order to do this, they formulate the explanations in the form of theories and hypotheses. In fact the explanations are hypotheses. Scientists simply discipline the business by writing systematic and testable hypotheses." (p23).

He then goes on to argue that the power of hypotheses extends into the area of prediction. Finally he suggests that there is little lost even when the hypothesis is not confirmed. He writes, "Negative findings are sometimes as important as positive ones, since they cut down the total universe of ignorance and sometimes point up fruitful further hypotheses and lines of investigation. But the scientist cannot tell positive from negative evidence unless he uses hypotheses." (p23).

Thus the process is as follows, there is a problem and the problem is clearly defined, the problem space is formulated. There is also a desire to find a solution to the problem. There is already within the problem a suggested solution or explanation which is rooted in our current intuition and knowledge.

3.2 Determining the nature of the research questions

There are some obvious questions of a general nature that might form the starting point for the development of the research questions themselves. The inability to change is a function of the level of the change required. Given that there are differing levels of change, the hardest and most difficult is when the individual has to change a paradigm, a deeply held belief or value. This level of change can only be done by the individual him or herself. But how to cause such change? Even when the process for change has been used properly there are still many who refuse to do just

that. The evidence for such a change can be overwhelming, they can even accept openly that such a change is beneficial to the organisation, and to themselves, and still they do not change. Why? There are many people who seem to prefer conflict without resolution. Why? There are many that continue to use conflict rather than deal with the core problem, even when it has been identified clearly and without reservation. This can even continue when they know not only what the core problem is but also the impact it is having on them, others within the organisation, and the organisation itself. Why?

Perhaps when a process that offers a solution to a core problem, which involves changing a deeply held belief, changing a core paradigm will be seen as a threat. If the intention within companies is to be able to develop and maintain a process of on-going improvement, it is clear from a great deal of current research that many managers do not know how to achieve this. The biggest constraint to improvement is the manager him or herself. Part of the knowledge gap is that there are few mechanisms to allow people to understand their role in the non-performance of their department or area of responsibility.

From this mix of problems the following questions were seen as encapsulating the issues raised above. Given the rigour of the process being used in terms of both problem solving and change management, why do some people fail while others succeed? Why do some people fail to deal with their core problems, which are directly under their control? Why do some people fail to deal with core problems when the process of analysis points sufficiently to what should be changed? Why do some people fail to deal with core problems even when it is hurting them and the organisations? Why do some people avoid taking responsibility for the area under their control - even if the process reveals their contribution

to the current set of problems, either in terms of the creation of the problem or the continued existence of the problem?

This research is very much about exploring a phenomenon. It is about the development of a theory. A theory explains why, it is all about causality. It is also about stating what needs to be done to change whatever requires changing, and it is about the ability to predict behaviour. Therefore this research sets out to both explore and to develop a theory. This is due to the nature of theories and their ability to provide an explanation, the ability to answer the question why. The theory attempts to explain why a phenomenon exists, and then hopefully leads to a statement of what needs to done to address the phenomenon.

The research questions to be addressed are as follows:

1. Can the block to improvement, which is, by definition dysfunctional, be identified?

2. Can the block be verbalised in a clear and logical fashion in such a way that allows for a proper analysis of the block?

3. Is it possible to verbalise the block in such a way that it is possible to determine the necessary actions that must be taken in order to remove the block?

3.3 The Explanatory Phase - Developing the Hypotheses

Kerlinger argues that ".. a problem cannot be scientifically solved unless it is reduced to hypotheses form, because a problem is a question, usually of a broad nature, and it is not directly testable." (p19). However there is also a requirement that the research allows for the development of a method which meets three basic criteria, these being; simplicity, generalisability and accuracy. Stuart (1983) has highlighted this problem when he considers that, "..we would all prefer

Generalisability to specificity

Simplicity to complexity

Accuracy to approximation or inaccuracy

In the real world we face the dilemma that only two of these desirable qualities are obtainable at any one time." (p239).

Kerlinger (1973) also recognises this dilemma when he states in a similar fashion to Stuart, "At any rate, some kind of compromise must be made between generality and specificity. The ability effectively to make such compromises is a function partly of experience and partly of critical study of research problems." (p22). The area of interest within this research is that which refers to the apparently dysfunctional and irrational behaviour of managers tasked with change. Questions abound such as, what kind of obstacle is this that prevents the implementation of a solution of such importance? Can this obstacle be defined, described, verbalised?

It is part of the hypotheses of this research that the individual is locked into his or her current, dominant paradigm. There are two stages to this. The first relates to the ability to verbalise this lock in the form of a conflict. This would allow the use of the conflict cloud technique to not only describe the conflict but also to surface the assumptions held by the person which lock him or her into the paradigm. It may be that the person is

afraid of the change that they do not know how to break free from this conflict.

The scenario for evaluating this is therefore to examine the area of failure and to determine whether the cause for the failure is either functional, that is part of the normal process and dealt with properly by the process of change, or dysfunctional. The assumption of the research is that dysfunctional failure, in combination with the existence of the obstacle of the paradigm lock leads to observable conflict. Through the use of the cloud technique it is possible to describe this conflict. If there are sufficient examples of this then it should be possible to develop a generic cloud out of the collected data. The test of the hypotheses comes in at this point in order to ascertain whether the generic cloud is indeed the representation of the obstacle, the paradigm lock.

The next stage is to invite colleagues to test the cloud in their own environments. This in turn gives, if proved correct, greater confidence in the existence and description of the obstacle. Finally the last stage is to postulate what options are open to deal with this obstacle and to test if possible. For the purposes of this research, this final stage was not seen as vital, only pointing the way forward.

The hypotheses are as follows:

1. That there is an obstacle to change related to the existing, ruling paradigm of the individual and his or her ability to change that paradigm.

2. That the tool of the TOC/TP known as evaporating cloud can verbalise this obstacle in a clear manner which also allows for the surfacing of assumptions that lock the individual into their current paradigm,

It is considered that this paradigm governs the decision-making process. This is particularly the case when the change affects them personally. This is very much in line with the "W" of Checkland (1981) and the "governing variables" of Argyris (1993). This research does not extend to the psychological development of values, beliefs and paradigms. For the purposes of this research it is sufficient to acknowledge that those taking part had basic paradigms about who they were and what they were. Education, training, and experience govern other paradigms, the rules by which people operate or manage within organisations.

The starting point for this research is the driving force for change, which is in conflict with the ruling paradigm thus creating the lock, and therefore the cause of the inability to implement the changes required. The framework for the obstacle is therefore proposed as being:

1. Change is required to deal with a major problem.
2. The change is perceived as a threat to the ruling paradigm of the individual.
3. The threat, and the conflict it contains, can be properly described through the use of the cloud technique.
4. The cloud, through the surfacing of assumptions, gives direction to the way forward.
5. Once the way forward has been determined there is a responsibility placed upon the individual to deliver, by implementing the original change.

This chapter has laid out the research questions developed from the analysis of chapters one and two. It has proposed, in line with the research questions the hypotheses that form the basis for the research. The next chapter describes the methods used to both answer the research questions and test the hypotheses.

Chapter Four

4.0 Introduction to methods of research and organisational analysis

This chapter is concerned with the research method used in this study. The research problem first introduced in chapter one and the research questions developed in chapter three form the foundation for the research. They also give direction to the application of the appropriate method for gathering and analysing data. The focus of the research is the way in which people make decisions. In order to understand the environment in which that activity takes place it is important to have a clear picture of that environment and the forces that affect the decision-making process. The answers being sought are very much related to the question 'why?".

This chapter discusses the methods adopted and provides justification for the methods so chosen. This includes the use of qualitative research methods such as case studies, participant observation and action research and the importance of causality.

The starting point for most research is the recognition that a problem exists, or there is a question to be answered. This may be driven by the researcher or by a client of some sort who approaches the researcher for assistance. The process of carrying out such research usually follows much the same path. Bennett (1983) describes the path as working through stages including literature review, possibly a pilot study and then the construction of a conceptual framework in order to develop a hypothesis. He then outlines the remaining steps as being testing the hypothesis, evaluation of the hypothesis leading to some form of interpretation of the results, the drawing of conclusions and making recommendations where

appropriate. The final steps involve some form of report and, where necessary, action, or actions, taken.

This broad overview is then broken down into the component parts where the actual implementation of the research process is determined. Given that research begins with a problem, or a question to be answered, or both, the actual processes used must be in line with this requirement. Linked to this necessary condition, the questions of access to the data source, the nature of the hypothesis and the position of the researcher must all be considered. The research problem and the questions it raises were dealt with in chapter three. From that starting position the research required an analysis over time of what people were doing which in turn lent itself to the use of case studies which then determined the data collection and analysis process. The collection of the data also involved the active involvement of the researcher, which implied a form of participant observation linked to the whole concept of action science research.

Bouchard (1976) argues that "The key to good research lies not in choosing the right method, but rather in asking the right question and picking the most powerful method for answering that particular question. Methods are neither good nor bad, but rather more or less useful for answering particular questions at a particular time and place." (p402). Bennett (1983) defines management research as "...a systematic careful enquiry with anything to do with management." (p25). In considering the research process he goes on to argue that it "..usually starts with a problem or question. The problem/question may be the researchers - they may wish to know which learning theory best explains different levels of performance in different situations. The problem may be initiated by the manager who wants to decide on the best technique for developing greater participation. In either case the requirement is for some information that

will shed light on the problem and help make a decision to solve it. It may be that solutions are not the result of the research: an outcome might be the development of a new theory or body of knowledge. Whatever the result, the starting point is represented by an urge to find out, to explore, to evaluate - in short, to do research." (p25). For Bennett research is "..concerned both with 'truth' and 'usefulness'. Some research - the theory-oriented - seeks often what is true, to find out exactly what the 'facts' are and, through a process of trying to refute the theory which explains these facts, present the real state of knowledge." (p39).

Kerlinger (1973) supports this view when he describes the method of science as a process for knowing and goes on to state that "The scientific method has a characteristic that no other method of obtaining knowledge has: self correction. There are built-in checks all along the way to scientific knowledge. These checks are so conceived and used that they control and verify scientific activities and conclusions to the end of attaining dependable knowledge. Even if a hypothesis seems to be supported in an experiment, the scientist will test alternative plausible hypotheses that, if also supported, may cast doubt on the first hypothesis. Scientists do not accept statements as true, even though the evidence at first looks promising. They insist upon testing them. They also insist that any testing procedure be open to public examination." (p6). This is very much in line with the aims of this research. Not only must the approach deliver verifiable results; they must be capable of test and replicability. On proposing that the "basic aim of science is theory" (p8), Kerlinger claims that science sets out to explain what is happening, the explanation being termed a theory. This he defines as a "..set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting phenomena" (p9).

This research was primarily about people and the way in which they make decisions related to change. These decisions may be clear or fuzzy; they may be simple or complex. A key feature of the research was the ability to follow the progress made by those involved, to examine what they were doing and the success they were achieving. This led to the application of qualitative methods of research. This sets the initial context of the research as being exploratory, focusing on the research problem and questions developed in earlier chapters. Only once the exploratory phase is completed can the hypothesis be tested. The method used for the exploratory phase will be discussed later in this chapter. (section 4.5)

4.1 The development of the research process - qualitative research

Robson and Foster (1989) considered that "Qualitative Research is best used for problems requiring insight and understanding. It deals with explanatory concepts." (p3). They define qualitative research in the following way; "The best definition of qualitative research is that it answers the question 'why?'. Through its inherent flexibility, its detailed and direct approach, it provides an explanation and an understanding of the consumer as an individual." (p24).

In terms of this research it is precisely the need to answer the questions in the previous chapters that the whole study was started. Equally, given that the programmes that form the basis for data collection were each different with different people and organisations, flexibility in approach was a fundamental requirement of the research process itself. Strauss and Corbin (1990) defined qualitative research as "...any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification." They go on to suggest that "It can refer to research about people's lives, stories, behaviour, but also about organisational functioning, social movements, or interactional skills."

(p17). They consider that the qualitative approach is an important means to uncover the true nature, and causality, of what people do. The researcher therefore has to "...step back and critically analyse situations, recognise and avoid bias, obtain valid and reliable data, and to think abstractly." (p18). They continue to argue that Qualitative Research can be used to "...uncover and understand what lies behind any phenomenon about which little is yet known." (p19)

Dey (1993) suggests that the emphasis of Qualitative Research is "...on generating theories rather than testing them. This reflects a concern with developing adequate conceptualisation of the social world before we develop elaborate theories." (p52) he goes on to argue that "...we are often at the stage where the problem is to know what the problem is, not what the answer is. The qualitative analyst is cast in the role of a discoverer who unearths problems, identifies indicators and formulates hypotheses rather than investigating pre-determined problems within an established theoretical framework." (p52)

Within the work context, Cassell and Symon (1995) support these views when they state that "...qualitative methods are more appropriate to the kind of research questions we want to ask in our own work, that is: focusing on organisational processes as well as outcomes, and trying to understand both individual and group experiences of work." (p1). They also highlight an important dimension of this research with respect to the position and involvement of the researcher when they argue that "Because qualitative methods are frequently more interactive, more intensive and involve a longer -term commitment, researchers are more likely to build up a social relationship with the organisational members and therefore gain more insights into their collective understanding by actively sharing that experience." (p4).

This raises a fundamental aspect of the research. The ability to really understand what people were doing, and why, involved the development of trust between the researcher and the various students taking part in the research process. Recognising that the researcher was also trying to learn and understand more about the process enhanced significantly the relationship and allowed for a free flow of information and critical comment. Research in organisations is fundamentally a practical endeavour and must be approached as such. It is vital to develop a genuine relationship with the subject though, at the same time, recognising that both might change as a result.

4.2 The use of Case Studies

Within the area of qualitative research the use of case studies is common. This research focused on the experiences of the people taking part over a six to nine month period. Throughout that period of time the researcher was involved in checking the process being used by the people.

Sommer and Sommer (1991) consider, in support of both Emery and Bouchard, that the "case study is an in-depth investigation of a single instance. It can involve a unit as small as an individual or as large as an entire community or region. It provides the opportunity to apply a multi-method approach to a unique event or setting. Unlike other methods that tend to carve up a whole situation, community, or life into smaller parts, the case study tends to maintain the integrity of the whole with its myriad interrelationships." (p193) This final comment is particularly true of this research. If the obstacle is to be found it will be in its normal setting, organisations and organisational change. Sommer and Sommer also argue that "Another use of the Case Study is to test a theory. While a single exception is not sufficient for discrediting a theory, a supportive finding increases confidence in a theory's predictive power." (p195)

Katz (1953, in Kerlinger) gives two broad categories of field study - the exploratory and explanatory or hypothesis testing. The former seeks to identify what is present now rather than predict relationships in the future. The three purposes, which are attributed to this category of field study, are: -

1. To discover significant variables
2. To discover relationships amongst them
3. To lay the groundwork for more systematic and rigorous testing of hypotheses.

As these three purposes align with the needs of this research the case study approach was deemed the most suitable. According to Kerlinger and Katz the advantages of field studies lie in the strength of realism, significance, variable action, theory orientation and heuristic quality. This also makes the point that the individuals taking part in the study are in familiar, known surroundings, thus reducing the level of disruption to their normal routine. Emery (1967) favours the use of case studies, as they are a valid method for "...studying a problem by the detailed examination of the characteristics of single objects or events." (p1). In arguing the case for the wider use of such studies Emery argues that "...there is the overwhelming practical consideration that our scientific generalisations are called upon to help or explain problems to individual persons, families, work groups etc. These individual cases have to be studied in all their uniqueness if we are to decide what generalisations are appropriate and what action is to be taken in view of the particular condition of their existence. Secondly, there is also the dilemma in our research methods that the more the reliability of a survey is increased by taking more cases, the fewer the variables that can be studied for the same expenditure of research funds and time. Thus as a general research procedure, the case study has been

used by many investigators to obtain detailed qualitative descriptions. " (p1).

However, many researchers, quoted by Emery, such as Paterson (1960) have considered the case study to be of limited value suggesting that what can be learned from the case study alone concerns the case. Equally, Fensham and Hooper (1964) observed that the disadvantage of case studies is that they can never establish general laws or theories. Their strength however is that they can reveal important factors in complex social situations and generate powerful hypotheses. Emery (1967) considers these criticisms and offers the following insight "..the contribution of a single case will not (under any but perhaps experimental conditions) clinch an hypothesis; it will only add to its probability." (p2). Bearing in mind the question of causality which lies at the heart of this research Emery then goes to offer the following reason for supporting the case study approach "..the value of the case study method is not to be found in the process of adding but one more 'fairly typical' case to our statistical tables but rather in the selection of cases where we have reason to believe that the necessary and sufficient conditions for events may be most easily discovered or most easily verified." (p3).

When the question being researched involves the implementation of problem-solving approaches and the management of change, the case study approach is relevant. Emery (1967) argues that the case study can be used to serve many differing purposes including "... illustrations, to develop new hypotheses and concepts, to refine existing generalisations and to test hypotheses." (p5). In the case of this research each of those have a place though the most important is that of hypothesis generation and testing. This research with the identification of the various factors being a crucial element meant that the ability to develop and test the hypothesis, which would allow for application to a wide range of

organisations, was seen to be vital. Again, Emery feels that for the development of the hypothesis "...the case study is probably the most suitable method for opening a new field of study or for breaking new ground in a field wherein existing theory appears to have reached an impasse. By focusing the collection of information on a single, or small number of cases, each piece of information will throw some light on, or be illuminated by, each other piece." (p6).

Emery goes on to consider what he feels are the two major results of such case studies. The first is that from the observations it will be possible to define concepts. Secondly that it will be possible to postulate causal connections. Of course, to be able to justify the use of case studies is only part of the process; it is also necessary to ensure that proper procedures are followed. These include the normal scientific criteria of relevance, validity, reliability, consistency and comparability, all of which must be equally applied to case studies as to any other approach. This leads to the conclusion that any generalisations should be fully supported by the available evidence and also be defined with due consideration of that evidence. Second that those factors that are reputed to be causal must be shown to exist and also to contribute to the interrelationships.

Field research of this type is also supported by Bouchard (1976) who argues that "...from the point of view of both science and society, field research is as important as laboratory research. This is because the field is where generality, applicability and utility of psychological knowledge are put to the test. The field researcher is the mediator of a relevant sociopsychological science." (p363). Bouchard recognises the problems discussed by Emery above when he states that "...field researchers have not developed adequate intellectual justification for their role among their experimental or applied colleagues. The experimentalist disparages field research and calls for rigor, while the applied practitioner ridicules the

sterility of the laboratory and calls for relevance. The field researcher finds himself hard put to meet one demand without sacrificing the other. Thus his dilemma." (p364).

Sommer and Sommer also suggest the requirements for a case study researcher as first proposed by Yin (1989). These include the ability to ask good questions, the ability to listen, to be adaptive and flexible in approach and capable of responding to the unexpected and see such perturbations as challenges and opportunities in the pursuit of knowledge. A good working grasp of the issues being studied is also a key aspect, as is the need to avoid bias.

Hartley (1995) considers case study research to consist of "..a dedicated investigation, often with data collected over a period of time, of one or more organisations, or groups within organisations with a view to providing an analysis of the context and processes involved in the phenomenon under study. The phenomenon is not isolated from its context (as in say, laboratory research) but is of interest precisely because it is in relation to its context." (p209) Hartley goes on to suggest that "The strength of case studies lies especially in their capacity to explore social processes as they unfold in organisations. By using multiple and often qualitative methods including observation, the researcher can learn much more about processes than is possible with other techniques such as surveys." (p212) She goes on to say "Case Studies are also useful when it is important to understand those social processes in their organisational and environmental context. Behaviour may only be fully understandable in the context of the wider forces operating within the organisation, whether these are contemporary or historical" (p212) She continues by arguing that case studies are "..tailor made for exploring new processes or behaviours or ones which are little understood. In this sense, case studies have an important function in generating hypotheses and building

theory." (p213) It is this final element that is of particular interest to this research.

Hartley concludes her analysis of the case study approach by arguing that "....the key feature of the case study approach is not method or data, but the emphasis on understanding processes as they occur in their context." (p227). This is a fundamental aspect of this research. Without the contextual base of the TOC programmes and the working environment of the people attending, much of the potential richness of the data would be lost. It is, as Hartley argues that "...case study research, because of the opportunity for open-ended inquiry, is able to draw on inductive methods of research which aims to build theory and generate hypotheses rather than primarily to test them." (p227).

In order to develop the case studies the researcher had to gain access to the right people who would provide the necessary data for the research itself. In this case the primary data source were the programmes developed and delivered by the researcher. This meant that he was more than just watching the people in order to collect data, he was actively involved in the whole process. This meant that the case studies were collected through the active participation of the researcher, which takes the research method into the areas of Participant Observation and Action Research.

4.3 Data Collection through Participant Observation

Waddington (Cassell and Symon 1995) describes Participant Observation as "...involving social interaction between the researcher and the informants in the milieu of the latter, the idea being to enable the researcher to study first hand the day to day experience and behaviour of subjects in particular situations and, if necessary, to talk to them about their feelings and interpretations." (p108).

Bouchard, quoting Hader and Lindemann (1933), describes participant observation as "...based on the theory that the interpretation of an event can only be approximately correct when it is a composite of the two points of view, the outside and the inside. Thus the view of the person who was a participant in the event, whose wishes and interests were in some way involved, and the view of the person who was not a participant but only an observer, or analyst, coalesce in one full synthesis." (p384). Bouchard argues that participant observation is often considered suspect but balances this by citing a significant number of classic studies in industrial and organisational psychology which are based on this method. (Blau, 1967; Dalton, 1959).

Bouchard argues that there are a number of advantages in the use of participant observation. The first is that it "..focuses the researcher's attention on the behaviour of individuals rather than simply on their verbal interview or test-taking behaviour." (p385). The second advantage is "..that it tends to force the researcher to look at the whole man, the whole organisation, and whole environment (social and physical) in an integrated way. Behaviour in the field doesn't make sense otherwise." (p385). A third advantage proposed by Bouchard is that it "..puts him in the context of discovery and facilitates what Merton (1949) calls the serendipity pattern of social research." (p385). Bouchard then quotes Merton "The serendipity pattern refers to the fairly common experience of observing an unanticipated, anomalous strategic datum which becomes the occasion for developing a new theory or extending an existing theory." (p385).

Participant observation is often described as occurring at four different levels. These are listed by Bouchard as being first, complete participant; second, participant as observer; third, observer as participant and fourth,

complete observation. In the case of this research, the author was fully involved in the process, was completely open about the dual role, that of educator and researcher, and given the nature and rigour of the thinking process being used this was considered not to affect the outcome in any significant way. When using participant observation Bouchard argues strongly for the investigation to "...construct some sort of structure prior to entering the field or he will be overpowered." (p388). It is the structure of the cloud technique discussed later that provides that insurance against the danger Bouchard describes.

One key issue discussed by Bouchard is that of objectivity "..a goal for which all researchers should strive, but one which is only approximated never achieved" (p391). He goes on to suggest a number of key factors in trying to achieve objectivity. These include the need to gather data from other sources, the need to separate facts from interpretation, the need to distinguish between informant and respondent data. There is also a need to be alert to the prejudices of the researcher and the possibility of bias in the interpretation of the data being collected. This same concern also applies to those taking part in the research process. It is important to examine both sides of the same equation, the ability to see the same situation from at least two perspectives. It is necessary to take note of changes in the attitudes, beliefs and emotions of the researcher, such changes often being clues to a lack of objectivity. It is equally important to recognise that the group taking part in the study are not a random aggregate but a social network who have been gathered together for a purpose. There is a danger in being over familiar and of getting too close to the group; linked to this is the need to ensure that they recognise the position of the researcher. Waddington argues that the "..overall strategy is inductive rather than deductive, the participant observer uses his or her initial observation as the starting point from which to formulate single or multiple hypotheses. These hypotheses may subsequently be discarded or

refined to take account of any unanticipated or contradictory observations which may emerge." (p108).

Sommer and Sommer (1991) offer this when discussing Participant Observation; "A Participant Observer has a defined and active role in what is happening, as distinct from being a spectator, bystander, or customer." (p56) They go on to argue that "Research through Participant Observation is a means of understanding the experience" (p56).

As a result of the involvement of the researcher and the need to derive from the research positive outcomes of benefit to both researcher and student the study was also rooted in the field of action research.

4.4 The application of Action Research Method

As this study set out to examine the process of change centred on the management of manufacturing companies, a key feature of the research was the ability to create knowledge, which was usable. This meant that the study focused not only on developing knowledge that could be used in taking actions, but also contribute to the theory of action. Argyris (1985) argued that such an action science could be used to "..... articulate the features of a science that can generate knowledge that is useful, valid, descriptive of the world, and informative of how we might change it." (px). He goes on to argue that "Leading social scientists distinguish action research from basic research by asserting that the intention of action research is to solve an important problem for a client and not necessarily to test features of a theory. "...We believe there is value in combining the study of practical problems with research that contributes to theory building and testing" (px). Gummesson (1988) suggested that "A greater awareness of the possibility of carrying out research by means of qualitative methods and via the role of the management consultant ought

to lead to improvements in the quality and usefulness of academic research in business administration." (p9).

In their study of set-up reduction, Gilmore and Smith (1996) used the action research approach in order to find facts and carry out experiments with the aim of developing action solutions. It was chosen also for its ability to develop collaboration between researcher and the problem owners. They describe the action research process as following five stages these being: 1. Client perception of the problem; 2. Client/researcher consult and contract; 3. Data gathering and joint diagnosis; 4. Feedback to the client group; and 5. Joint action planning. For Gilmore and Smith the main benefit was the "...participative nature of action research and the resulting extensive collaboration and employee involvement attained during the course of the exercise produced a sharing of knowledge." (p16). Westwood (1995) also used the action research approach in his study of information systems for batch manufacture. The reasons for this stemmed from their goal, which was felt to be the development of new theory. He writes "... because we aimed to develop theory out of practice, we needed to collaborate with managers on the design process in an efficient way. The prescriptive approach evolved from earlier projects and enabled later projects to be conducted more swiftly. Fundamentally this was possible because the multisite action research approach enabled us to focus the research question.." (p295). In the same way Grant (1996) described the action research methodology as following five stages these being diagnosis, action plan, action taken, evaluation and learning. Once more the active participation of both researcher and client is seen as fundamental to the approach and to the outcome.

Clark (1972) in his study of organisational change compared five types of research, Pure Basic, Basic Objective, Evaluation, Applied and Action. In examining action research he felt its strength lay in "...influencing the

stock of knowledge of the sponsoring enterprise. In that sense it is a strategy for distributing knowledge.." (p22). He then goes on to adopt the definition first put forward by Rapoport (1970) for action research as being the ability to "...contribute to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within mutually acceptable ethical framework" (p23). He then goes on to add that action research is "... a type of applied social research differing from other varieties in the immediacy of the researcher's involvement in the action process" It is this very immediacy that is the determining factor in the use of action research in this study. As the programmes progress, the students are experiencing the generation of knowledge, which is of value to their company at the same time as learning about themselves. This is precisely the process that the research seeks to focus on. Clark considers that action research "..must possess an aspect of direct involvement in organisational change" (p23).

Given the nature of this research, drawn from the programmes run by the author for people within manufacturing companies, it was clear from the outset that there were two key strands. The first concerned the ability of the individuals to address a major problem within their own organisation and the decision - making process associated with the problem. The second strand was the ability to examine closely the path that each individual followed and the methods adopted by them to deal with conflicts that arose out of the decision-making process. This second strand was seen as the key to the understanding of the research problem and the research questions described earlier.

Because of these two strands, the research undertaken fell into the category of action research. Argyris (1985) argues that this type of research "....generates and tests propositions concerning (1) the variables embedded in the status quo; (2) the variables involved in changing the status quo and

moving towards liberating alternatives; (3) the variables in a science of intervention that will be required if the previous proposition are ever to be tested; and finally (4) the research methodology that will make change possible and simultaneously produce knowledge that meets rigorous tests of disconfirmability." (pxii).

Within this research the importance of understanding the variables affecting the decision-makers was recognised as fundamental to the exploratory phase. The first step in understanding what people did, and why, was to be able to verbalise their own environment in a clear and objective manner. It was vital that the current reality of the individual was clearly determined. This is very much in line with normal scientific research. Action science recognises the limitation of this approach in that first there is no focus on changing the current reality, and second, the picture developed will not include the defensive mechanisms that exist in order to maintain the status quo. This could be seen as a reason not to focus on current reality at all. However this particular study set out to use current reality to begin the process of change by surfacing these deeper conflicts over a period of time.

Argyris (1985) suggests that "A corollary to the premise that the purpose of science is to describe reality is that generating knowledge about change is a second step, one that must wait until basic descriptive knowledge has been accumulated. In action science we agree that it is important to understand the world if we are to change it." (p xii)

It is important to recognise that in building the knowledge surrounding current reality; defensive mechanisms may be surfaced which can be seen as potentially threatening to the individual. However these defences may lead to an inability on the part of the individual, and the organisation, to improve through learning and adapting. This inability could affect the

ability of both to survive let alone flourish. Recognising the threat that surfacing such defensive mechanisms might pose to the individual was a key feature of this research, indeed it was precisely these mechanisms that offered the greatest insights to the obstacle to change and the conflict that surrounds it which lies at the heart of the hypotheses. What was vital to remember was that the research itself should not harm the individual or expose their weaknesses. Hence, in this research, it was clearly necessary to agree beforehand the limits to which both sides would go, either in open forum or in closed one to one sessions. Without the active collaboration of the individuals the research would not have been possible.

In considering action science, Argyris (1985) quotes Lewin "To proceed beyond the limitation of a given level of knowledge, the researcher, as a rule, has to break down methodological taboos which condemn as 'unscientific' or 'illogical' the very methods or concepts which later on prove to be basic for the next major progress." (p1).

In this particular study the researcher was fully involved with each person taking part. He was fully involved in working with them to deal with a major problem under their span of control. He was actively involved in teaching a set of logic based problem solving tools, in the analysis of the problem, the construction and validation of the solution, and the implementation. This placed the researcher as an active participant with the problem owner whilst examining the process being followed. Action science also involves working on change experiments applied to real problems in social systems. The focus is on a particular problem, which the owner brings to the research and the intention is to deal with it. This in itself suggests an iterative process working round a cycle of problem analysis, implementation and review, and then repeating for each successive problem.

Action science argues that this will often involve re-education as the change process itself will involve the challenging of current paradigms related to thinking and taking action that may exist within the individual and the group. This re-education can only take place however if the problem owners themselves are involved in the activities of problem analysis, diagnosis and the choice of the action required to deal with the problem. This in itself suggests that action science challenges the status quo. In this way it can be argued that action science is, as proposed by Argyris (1985) ".... intended to contribute simultaneously to basic knowledge in social science and to social action in everyday life. High standards for developing theory and empirically testing propositions organised by theory are not to be sacrificed, nor is the relation to practice to be lost." (p9).

The traditional approach to scientific research includes features such as the ability to collect hard data which can be validated by more than one observer. Kerlinger (1973) defines scientific research as being a "... systematic, controlled, empirical, and critical investigation of natural phenomena guided by theory and hypotheses about the presumed relations among such phenomena." (p10). He describes the approach, developed by Dewey, as comprising the following stages: Problem- Obstacle - Idea where the first steps in understanding the problem are developed. He considers that it is important to bring the problem into the open, to express the problem in a way that can be understood, and examined. This is followed by Hypothesis, a statement or proposition about the area under review and the relationships that exist around it. The final step is that of Reasoning - Deduction. There are a number of possible outcomes at this point, the researcher may find that the original problem is not what the real matter is about, that there are relationships previously not recognised, the researcher may even find that the present analytical tools do not lead

to a solution. Kerlinger considers that the greatest area of importance is the "controlled rationality of scientific research as a process of reflective inquiry, the interdependent nature of the parts of the process, and the paramount importance of the problem and its statement." (p14).

4.5 The use of the "evaporating cloud technique" for describing and analysing conflicts.

This part of the chapter will develop the analytical tool known as "Evaporating Cloud" or simply "cloud" first described by Goldratt (1990). The structure of the basic cloud is shown below: -
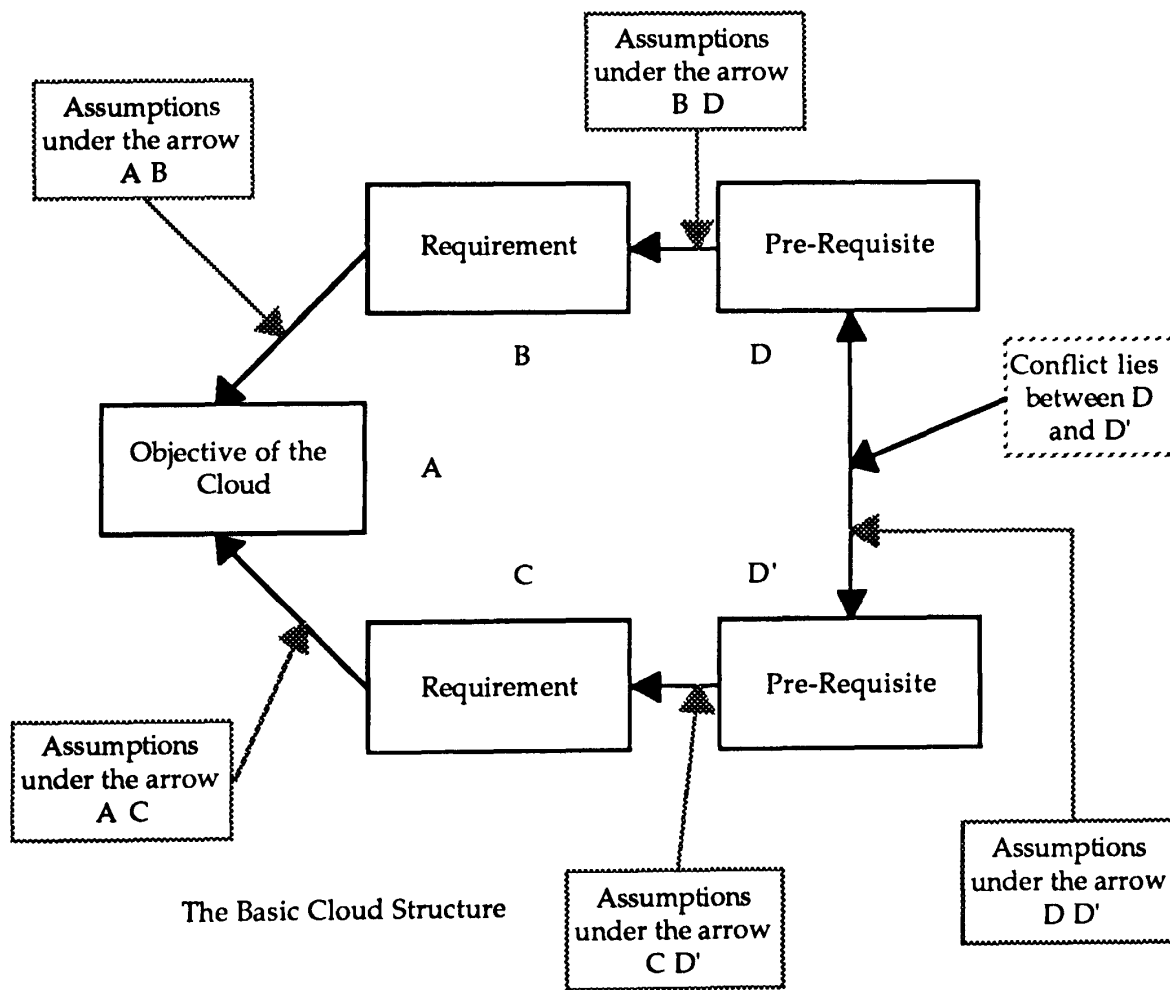

Figure 5.1 The Cloud Diagram

The main boxes, entitled A, B, C, D and D', make up the main structure of the cloud. The logic of the cloud is that of necessity. Thus A is the objective of the cloud and both B and C are the necessary conditions that are required for the objective to be realised. These are defined as necessary conditions but are not always sufficient in themselves for the existence of the objective. In the same manner D is the necessary condition for B and likewise D' for C. The conflict exists between D and D'. Once the cloud has been verbalised in this way the next stage is to ensure that the logic holds true by reading the cloud and amending the verbalisation where necessary. The cloud is read from the tip of the arrow to the tail. For example, "In order to have (A) I must have (B)"; In order to have (A) I must have (C)". The rest of the cloud is read in the same manner.

Once the verbalisation of the cloud is clear the next step is to surface the assumptions that lie beneath every arrow. This is done by adding the word "because" after the phrases above. For example "In order to have (C) I must have (D') because.......". The assumptions that are surfaced are then placed in the appropriate box. The next step is to examine the assumptions to see which of them are erroneous and which are not. If an assumption is found to be erroneous then it may be possible to break the seemingly unbreakable conflict that exists. In this way the cloud is broken and the objective can be reached. This would then involve other tools of the TOC/TP.

A key element of this research is the hypothesis that the cloud technique can be used to determine and describe the conflicts that lie at the heart of the research. This would then allow for answers to the questions first raised in chapter three. Once the data has been collected, this leads to the creation of explicit inferences which connect the data and theory. Within this study the hard data was essentially the conflicts which existed in the

environment of each individual with respect to the change being proposed within their environment

This is very much in line with Argyris (1985) who argues that "The test of truth is rather that a community of investigators beginning with different assumptions and free to criticise any aspects of each other's work, converge on a set of beliefs. They can never be certain that their beliefs are true, but they can approach truth through a self-corrective process of rational criticism in a community of inquiry." (p13).

Of course it is still possible to be wrong in terms of the analysis. It may be that the analysis developed is contrary to the existing paradigm (s) of the individual. If this is the case then the action taken by that individual becomes crucial to the successful outcome of their own improvement process. If they are capable of coping and implementing the new paradigm then potential conflict can be avoided. If however there is no opportunity, no possibility for the individual to accept the new paradigm then the whole process is at risk.

Gummesson (1988) argues that "Paradigm is associated with revolutionary discoveries and changes in the natural sciences. Periods of normal science are superceded by paradigm shifts when established scientific norms are challenged. When our personal paradigm is attacked, we tend to feel threatened - our 'place to stand on' is being snatched away - and we tend to react by raising our defences rather than a frank appraisal of a new position." (p20).

Popper (1992) has argued "To give a causal explanation of an event means to deduce a statement which describes it, using as premises of the deduction one or more universal laws, together with certain singular statements, the initial conditions" (p59). Argyris supports this when he

states "The validity of proposed laws can be tested by deducing from them, in conjunction with certain initial conditions, descriptions of events that should be observed. Thus explanation and prediction are symmetrical, differing only with respect to whether the deduction is made before or after the observation of the event explained or predicted. " (p13).

The practice in any examination or analysis of this type is to carefully observe without preconception, and then to generalise from these observable events. The strength of the analysis is rooted in the honesty and purity of observation and the ability to validate the logic so constructed. In terms of this study and the hypothesis contained within it, Argyris argues that "A proposal is tested by holding it responsible for the empirical implication that can be deduced from it. If these implications do not correspond to what is actually observed then the theory...may be rejected. If a theory has no empirical implication, it cannot be tested, and it is for that reason not an acceptable scientific theory." (p15).

A key feature of this research is the elements of both passive observation and experimentation. The nature of the programmes that form the core of the data collection is their focus on problem analysis and solution construction and implementation. Thus at two different levels, that of the students and their own specific problems, and the researcher, both are trying to predict what will occur and observe if the prediction is confirmed. Argyris argues that "Experimentation is the most powerful methodology for testing theories because, by manipulating the initial conditions, the researcher can rule out alternative explanations. " (p16). This focus on the whole process of problem solving from recognition to implementation ensures that this stage, implementation is fully contained within the study. If problem solving and decision making are core parts then the implementation must also figure in particular when leading to results in terms of organisational performance. The success or otherwise

of the solution is determined by the outcome of the implementation process and the measures used at that point. Though not always seen as a key element of such research Argyris supports the view that "From the perspective of action science, implementation is not separable from crucial theoretical issues" (p19).

4.6 The importance of causality within this research

The importance of causality as part of a hypothesis is a key feature of this research. Selltiz et al (1966) suggests that "A hypothesis of causal relationship asserts that a particular characteristic or occurrence (A) is one of the factors that determines another characteristic or occurrence (B)." (p80). They continue by proposing that "Studies designed to test such hypotheses must provide data from which one can legitimately infer that X does or does not enter into the determination of Y." (p80).

Research concerning causality therefore requires an understanding of the concept of causality. The usual way of considering causality tends to follow the line that a single event - the cause - always leads to another event - the effect - leading to the creation of effect-cause-effect relationships. Within science the emphasis is more usually with a multiplicity of determining conditions which together make any particular effect probable. Thus both common sense and scientific thinking are concerned with discovering necessary and sufficient conditions for any effect. Selltiz suggests that "...while common sense leads one to expect that one factor may provide a complete explanation, the scientist rarely if ever expects to find a single factor or condition that is both necessary and sufficient to bring about an event. Rather he is interested in *contributory* conditions, *contingent* conditions, *alternative* conditions - all of which he will expect to find operating to make the occurrence of the event probable but not certain." (p81).

Given that these conditions are seen as an important element of causality relationships it is necessary to define their meaning. A necessary condition is one that must occur if the effect of which it is the cause is to occur. If A is a necessary condition of B then B will never exist if A does not exist. For example experimenting with cigarettes is a necessary condition for becoming addicted to smoking, as it would be impossible for the addiction to occur if the individual had never smoked.

A sufficient condition is one that is always followed by the effect of which it is the cause. If A is a sufficient condition of B then whenever A occurs, B will always occur. For example should the optic nerve be damaged that is a sufficient condition for blindness as without the optic nerve it is impossible to see. There can also be situations where a condition may be both necessary and sufficient. This is described by Selltiz as when "...Y would never occur unless X occurred and whenever X occurred, Y would also occur. In other words, there would be no instance in which either X or Y appeared alone." (p81). If the two examples described earlier are considered then neither fit this particular situation. Although addiction to smoking cannot happen without experimentation, there are some people who smoke who do not become addicted. It can therefore be stated that experimentation with smoking is a necessary but not sufficient condition of tobacco addiction. If addiction is to be fully understood it is necessary to find other contributory conditions. Equally, although damage to the optic nerve will lead to blindness it is not the only way in which sight can be lost. In this case the damage to the nerve is a sufficient but not necessary condition of blindness. In order to fully understand all the possible causes of blindness other conditions that lead to blindness have to be determined.

Selltiz goes on to argue that "A contributory condition is one that increases the likelihood that a given phenomenon will occur, but does not make it certain; this is because it is only one of a number of factors that together determine the occurrence of the phenomenon." (p82). What this is saying is that for any given effect, in this context, there is no single cause, but there has to be a second cause at least, which combines with the first cause in the form of a logical "and" to lead to the existence of the effect. Without the second cause, the first is insufficient. This can be shown diagrammatically as below:
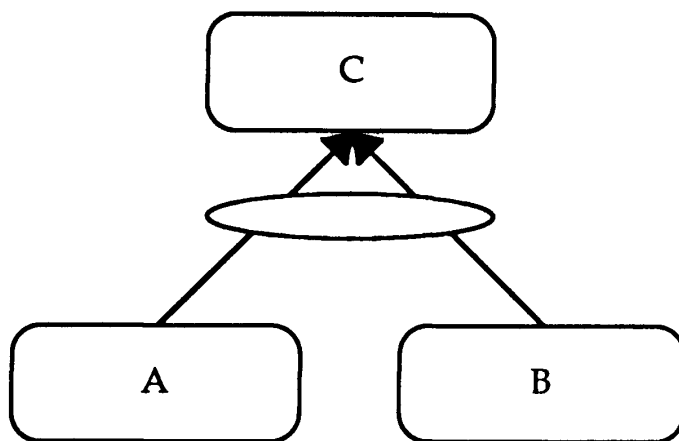
Figure 4.1 - The logical "And" Diagram

It would be read in the following manner. "If A AND if B then C" At the simplest level the meaning is clear, that for C to exist both A and B must exist together. Using the example of smoking, research in this field is not satisfied that experimentation with smoking is a necessary condition for addiction, as it goes on to examine the effects of family, peer group and other factors that may be conducive to experimentation and which of these factors have a greater impact in the addiction element.

If it is possible to consider the concept that there can be a multiplicity of contributory causes, then it is equally valid to seek alternative conditions that may make the occurrence of the phenomenon more likely. This

argues for the possibility of the logical or connection which can be described as shown below:
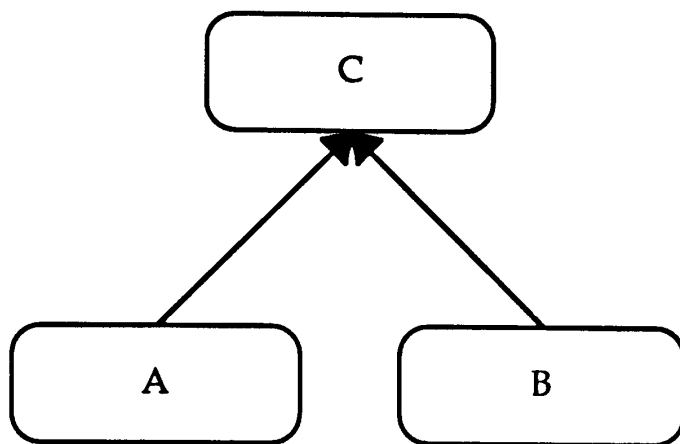
Figure 4.2 - The logical "Or" Diagram

This would be read in the following manner "If A OR if B then C" Now there is the need at this point to consider the relative weight of each of the alternative causes. The magnitude of the independent variable in this case A or B should be similar, thus leading to the even more likelihood of the dependent variable C. Where the magnitude is not equal, say in the ratio of 99 - 1 then the smaller of the two, though still a cause, and can be considered insignificant. This may still apply when the ratio reached 80 - 20 depending on the nature of the causality.

Bearing in mind that there are two separate issues to contend with, these being described by Selltiz as "necessary but not sufficient" (p81), and "sufficient but not necessary" (p81). It is important to make clear the distinction. Using an example of blindness, Selltiz argues that " The destruction of the optic nerve is a sufficient but not necessary condition for blindness, to understand all the causes of blindness we must seek alternative conditions that may produce it." (p81).

This means that if there is a condition of necessary but not sufficient there is a requirement to look for contributory conditions, i.e. there is

insufficiency. Equally if there is the condition of sufficient but not necessary then there is a requirement to look for an alternative condition, in other words there is additionality.

However it is also necessary to determine the environment in which the causality exists. Selltiz suggests that "A factor that operates as a contributory condition of a phenomenon under a set of circumstances may not do so under another. The conditions under which a given variable is a contributory cause of a given phenomenon are called contingent conditions." (p82). These contingent conditions are therefore a function of the initial state in which the system resides. It is almost a fact of life - one that determines the impact of a contributory condition. However to ignore or fail to acknowledge contingent conditions can lead to misleading hypotheses, and once the notion of dependency on initial conditions is considered, the contingent conditions become much more important.

When considering the debate with respect to research Selltiz argues that "Most hypotheses in social science are concerned with contributory or alternative conditions, and the contingencies under which they operate. However it is impossible to demonstrate directly that a given characteristic or occurrence X determines another characteristic or occurrence Y either by itself or in combination with other characteristics or occurrences (A,B,C, etc.). Rather we are always in the position of inferring from observed data that the hypothesis that X is a condition for the occurrence of Y is or is not tenable with some specified degree of confidence." (p83).

This is arguing the case for postulating causality, if A then B, and then postulating a second effect, unrelated to B but caused by A which in turn confirms the original causality. The ability to predict an effect, find it and then to confirm the original causality can be shown as overleaf:-
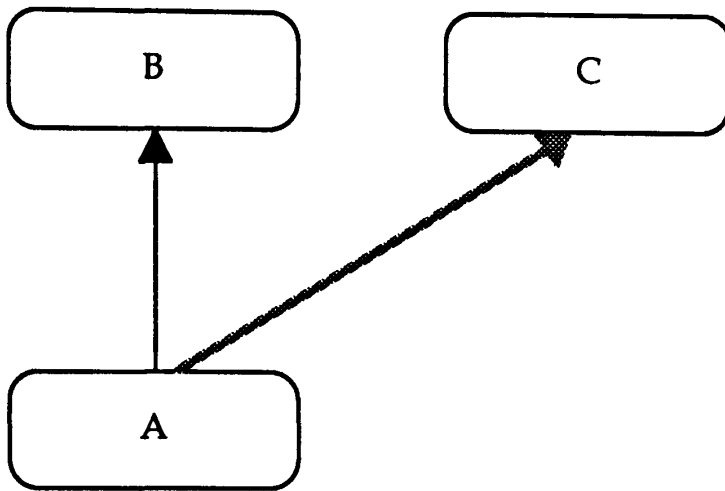
Figure 4.3 - Predicted Effect Diagram

C is the predicted effect the existence of which confirms the existence of cause A and therefore makes the causality of A to B tenable. Of course identifying a contributory condition under certain contingent conditions may not be enough. Other possible contingent conditions must be examined to confirm the original hypothesis otherwise it is possible to make an incorrect inference. One such example is the question of the time order of events. Selltiz describes it in the following manner; "One event cannot be considered the "cause" of another if it occurs after the other event. The occurrence of a causal factor may precede or may be simultaneous with the occurrence of an event; by definition an effect cannot be produced by an event that occurs only after the event has taken place." (p85).

A further function related to evidence concerns concomitant variation. Selltiz defines this as"...The extent to which X and Y occur together, or vary together in the way predicted by the hypothesis." (p83) She goes on to argue "Evidence of concomitant variation, that is, that X (the assumed causal or independent variable) and Y (the assumed effect, or dependent, or criterion, variable) are associated in the way predicted by the hypothesis. In the case of a hypothesis that X is a contributory condition of Y, this

would mean that Y should appear in more cases where X is present than in cases where X is absent. .... Evidence that Y did not occur before X ...... Evidence ruling out other factors as possible determining conditions of Y" (p88).

When examining behaviour in the social sciences the use of an experimental model offers the best scenario. Selltiz confirms this by arguing that "When an experiment is possible it is the most effective method of testing a hypothesis that one variable, X, causally influences another variable Y." (p90). There are dangers, which must be recognised however, and noted in constructing the research instrument. Given the nature of causality, and the nature of the variables involved, there is no way to be completely certain of the validity of the inferences being drawn. There is always the possibility that later research will reveal a new causality, or set of conditions, that were not taken into account in the original study. Einstein changed the description of the Newtonian world and Newtonian physics, but Newton could not have known what Einstein did and therefore can be excused and the limit of his theories properly recognised. Selltiz recognises this aspect and suggests that "This possibility of fallacious inference makes it necessary to evaluate experimental findings in the context of other knowledge. Confidence in a research result requires not only statistical evidence of its reliability....but, in addition, evidence that the interpretation is in keeping with other 'facts' about which one has confidence. This is why the establishment of confidence in the imputation of any causal relationship between events requires repetition of research and the relating of the findings to other research. " (p94).

Thus the requirements of such research become clearer. Selltiz puts it in the following manner "If one wishes to draw the inference that variable (X) is the "cause" of another (Y) three types of evidences are necessary:

(1) that X and Y vary together in the way predicted by the hypothesis; (2) that Y did not precede X in time; and (3) that other factors did not determine Y" (p422). She goes on "In addition - and sometimes more important - the investigation must consider whether factors other than X may the determinant of Y. In general this is done by introducing additional variables into the analysis and examining how the relationship between X and Y is affected by these further variables. If the relationship between X and Y persists even when other presumably relevant variables are introduced, the hypothesis that X is a cause of Y remains tenable." (p424).

If changes take place then a contingent condition (Z) has also been identified for when the X - Y relationship holds true. This now leads to the need to determine three possible conditions - (1) when the relationship is spurious; (2) when the process has been traced by which X leads to Y and (3) when a contingent variable has been specified.

4.7 Conclusions of the chapter

This chapter has introduced the primary methods used within the research to both gather and evaluate data. With respect to the first stage of the research, that of exploring the research questions, the use of the case study approach and the use of participant observation and action research were discussed as the main vehicles employed. The next chapter describes the actual collection of data; the development of the cloud technique for describing the data collected, and begins the process of analysis.

Chapter Five

5.0 Introduction to the data collection process

This chapter is concerned with the process of data collection and initial analysis. In chapter one the basic question of the research was first raised, namely the existence of an obstacle to successful implementation of change. The nature of the research therefore required access to a group of people who were seeking improvement in their organisation, in particular an improvement in the financial position.

During the period of the research, from 1993 – 1996, the researcher was able to gain access to such a group of people. They all met the criteria set in the initial assumptions outlined in chapter one. They were all involved in programmes in which the researcher was also involved. These programmes were part of the education offered by the Avraham Y. Goldratt Institute in the UK and included programmes covering production, project management, sales and marketing and strategic development.

5.1 Description of the analytical tool adopted for this research

For the purpose of analysis the tool used was the 'evaporating cloud' first described by Goldratt (1990). More usually referred to as simply 'cloud', the basic structure is as shown in figure 5.1

Figure 5.1 The Cloud Diagram

The main boxes, entitled A, B, C, D and D', make up the main structure of the cloud. The logic of the cloud is that of necessity. Thus A is the objective of the cloud and both B and C are the necessary conditions that are required for the objective to be realised. These are defined as necessary conditions but are not always sufficient in themselves for the existence of the objective. In the same manner D is the necessary condition for B and likewise D' for C. The conflict exists between D and D'. Once the cloud has been verbalised in this way the next stage is to ensure that the logic holds true by reading the cloud and amending the verbalisation where necessary. The cloud is read from the tip of the arrow to the tail. For example, "In order to have (A) I must have (B)"; In order to have (A) I must have (C)". The rest of the cloud is read in the same manner.

Once the verbalisation of the cloud is clear the next step is to surface the assumptions that lie beneath every arrow. This is done by adding the word "because" after the phrases above. For example "In order to have (C) I must have (D') because........". The assumptions that are surfaced are then placed in the appropriate box. The next step is to examine the assumptions to see which of them are erroneous and which are not. If an assumption is found to be erroneous then it may be possible to break the seemingly unbreakable conflict that exists.

5.1.1 The use of the Undesirable Effect (UDE) Cloud

A specific use of the cloud technique is when analysing conflicts, which exist for people when what they are trying to achieve is blocked in some way. This type of cloud is entitled an UDE cloud, first described by Dr Goldratt at a conference in London in December 1993. The structure of the cloud remains the same as earlier, but the questions asked of each box are as shown in figure 5.2.
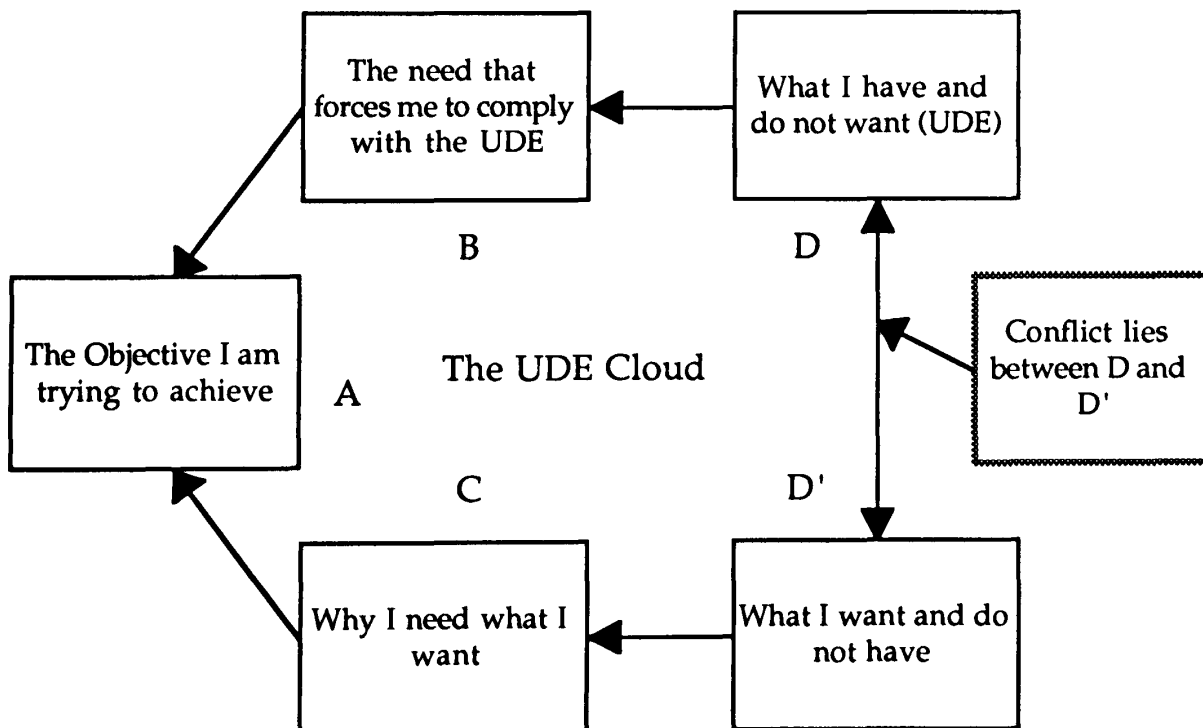

Figure 5.2 The UDE Cloud Structure

Once the cloud has been constructed it can then be checked by first reading the cloud, then the surfacing of assumptions. The level of rigour applied at this stage is vital if the cloud is to reveal the true nature of the conflict that exists. This starts with the nature of D and D'. In order to ensure clarity of conflict, the entries in the boxes must be a clear and precise statement of the entities. They should be written in present tense and be obviously in conflict. If the conflict is only apparent through the surfacing of assumptions between D and D' then the verbalisation requires further attention. Once all the boxes have been filled the strength of the cloud should be considered. This is checked be determining the impact of the cross-connection, that of D on C and that of D' on B. If D significantly, and negatively, impacts C, if D places C at risk, then that cross-connection is a powerful one. If the same applies to D' on B then the cloud is a particularly strong one. One such cross-connection is sufficient to give a cloud of some substance. Where both cross-connections are strong, then the cloud is extremely powerful. For further descriptions of the cloud process see Cox and Spencer (1998) and McMullen (1998).

5.1.2   Constructing the composite cloud

The process of building the composite cloud starts with collecting a reasonably large number of clouds from the data collected. These clouds were drawn from the available group of people, their companies and the range of problems they had chosen covered a substantial range of issues. It was not possible to select all the clouds collected. This was a decision made in line with the available time for the research and the restriction placed on the researcher by other work. The only person involved in the analytical stage was the researcher. There were other people who could have been involved at this stage in terms of assisting with both collecting and initial analysis. However the decision was taken not to include them

at this point in order to keep the research process manageable. This was also in line with the decision not to try and explain the clouds in great detail, merely to capture them and from that to develop the generic cloud. This was recognised by the researcher as an acceptable, and realistic, choice

Once the group of clouds was chosen from the total set, the next step was to begin the process of building the composite cloud. This next step starts by examining the chosen clouds chosen for a common thread. The process of selection starts with comparing two or three clouds at random to see if there is any pattern to the statements contained within the boxes. The first box chosen was the D box, then the D' and then on around the clouds in the sequence C – A – B. This sequence proved to be important as it was the B box which was to prove the most demanding when the generic cloud was being constructed and validated.

The ability to determine a pattern is rooted in the ability of the person doing the compilation. The first assumption that determined this approach was the skill and knowledge of the person carrying out the analysis. Without previous experience of both building and analysing clouds this would be a difficult activity. The second assumption is that it is a task best done by one person first and then the work of that person scrutinised by at least one other equally skilled practitioner. The third assumption is that such a person, in this case the researcher, has the skill to determine patterns from a wide range of initial conditions, problem areas and environments. Therefore it is unlikely that people without knowledge and experience of the problem areas, such as production or project management, would be able to determine the patterns that may or may not exist in clouds drawn from those problem areas.

Therefore the construction of the composite cloud is accomplished by searching for a statement which can be written in each box of the

composite cloud, which encapsulates the equivalent entries in the individual UDE clouds. Figure 5.3 shows this for the A and D′ boxes, to complete the composite cloud this is continued until all the boxes have been filled.
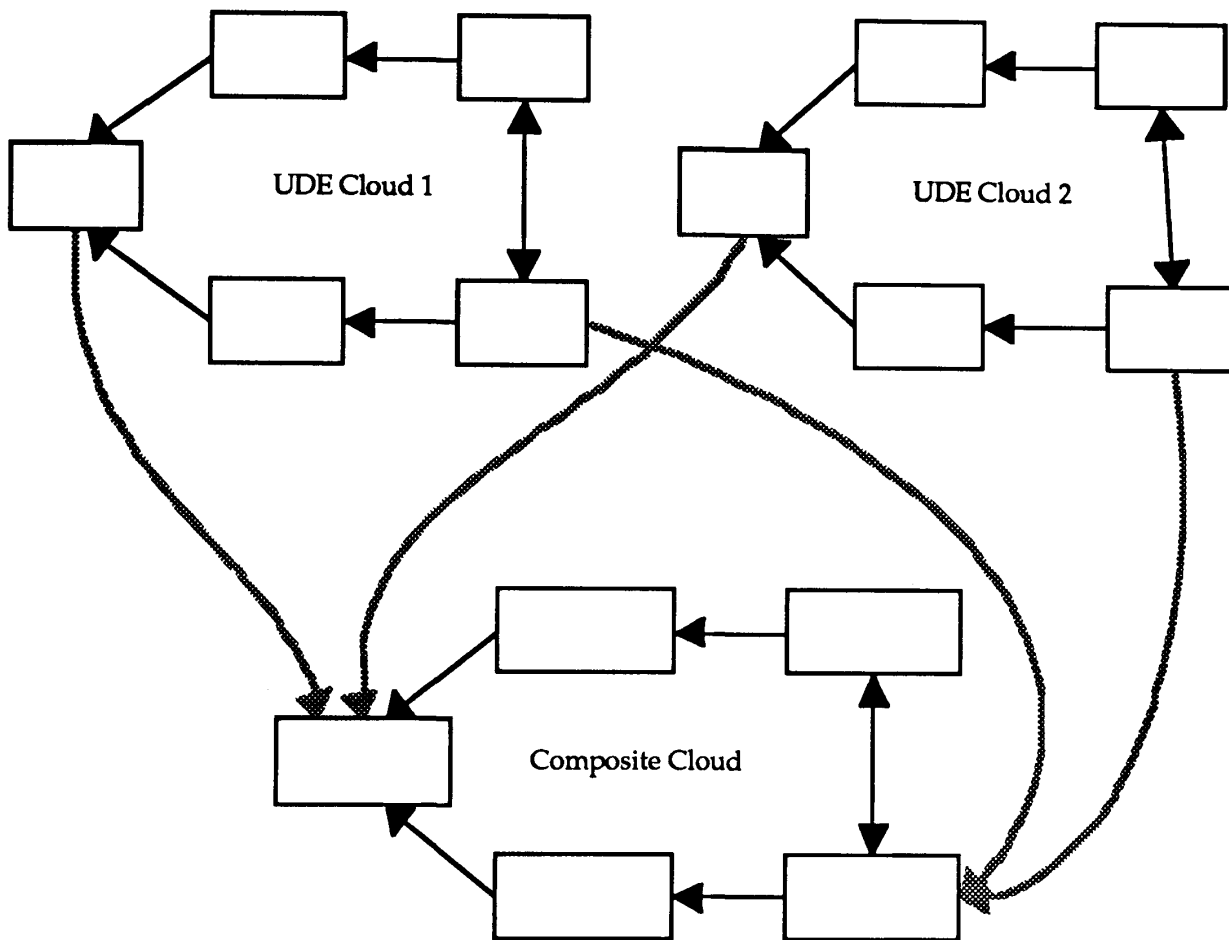
Figure 5.3 The Construction of the Composite Cloud

Once the composite cloud is constructed it can then be used to check with specific examples to determine whether the composite cloud still applies. If this is the case then the composite cloud can be considered to be a generic cloud for the situation or situations being examined.

The remainder of this chapter outlines the case studies from which the clouds were collected and the environments in which they existed. In all seventeen clouds are discussed drawn from the access given to the researcher. During the course of the research many more clouds were

collected than described here. This selection, from thirteen companies, four countries and over three hundred and fifty people, is indicative of the range of issues described. In the next chapter the composite cloud is discussed which leads to the creation of the generic cloud.

5.2 Introduction to the Case Studies

These case studies were developed over the period of involvement by the researcher. Each of the participating managers was involved in the creation of a solution to a particular problem within the organisation, and they were expected to implement the solution developed through the education taking place. What happened next was determined by the decision to proceed, or not. If the decision was to proceed then the process followed through to a logical conclusion and some degree of success achieved. Throughout the whole of the research period this did occur, but does not form part of the study. This study focuses on those programmes where, at the same point as the successful implementation, the decision was taken not to proceed.

There were also occasions when the implementation stalled. In these cases this was due to an inadequate analysis at some point in the process, and the process itself pulled them back to correct the situation. In other words, there was a perfectly justifiable reason for not proceeding and the people themselves recognised this and stopped the implementation before any major additional problems occurred. Reasons included the take-over of the company with new management with new and different ideas about how to tackle the issues under review and changes in the market, which removed the pressure to deal with the problems being considered. Other reasons included the key people involved moving to new companies, or simply promoted to new roles elsewhere in the company. The key feature for all of these reasons for not proceeding with the

implementation is that they were clearly seen as valid and could be explained in a straightforward manner.

There were also situations where there were no such reasons for non-performance. This is where the issue of conflict arose. This could either be conflict with an individual or with a group. In other words the non-performance and lack of successful implementation seemed dysfunctional, with no apparent reasons given.

The case studies that follow are all examples of this last situation.

5.2.1 Case Study One

The division of this company that took part in the research is involved in supplying components to the automobile, industrial and civil engineering sectors throughout Europe and beyond. They are part of a multi-national organisation but have their own corporate structure and facilities within the overall Corporation, the headquarters of which are situated in the USA. They have about one thousand employees throughout Europe and their annual turnover is about £ 550m. They use only a few basic raw materials and from that make a considerable range of products. Thus they can be described as a "V" plant as described in Srikanth and Umble (1990). They have both manufacture and assembly operations, their own research and development resources and work directly with many of their customers, many of whom are very large organisations themselves. They have sites throughout Europe, and each site has manufacturing, customer support and sales resources.

The involvement with the company came about due to personal contact by the researcher to the Manufacturing Director for Europe who was keen to implement a process of on-going improvement throughout the

company starting in the production area. At the time the company was experiencing difficulties in meeting customer demand for their products, their lead time was too long set against the industry standard and their competitors, and their due date performance was below 30%. The flow of material through the company was not coherent, with many blockages and constraints. They were experiencing an inability to schedule the four main plants in Europe to meet customer schedules. Other consultants had been brought in to address these issues but had so far produced no measurable improvement.

As part of the implementation of TOC some of the senior management team, ten in all, attended a three-day production workshop. They used this to ascertain the applicability of the TOC approach to their environment and the best way of proceeding if it was applicable. The outcome of this programme was the setting up of the main programme, which introduces the TOC known as the Jonah Programme, with ten people, including six of the first group and adding key people from their European operations and the CEO for Europe. The tasks being addressed through the Jonah programme included the ability to schedule across all plants in Europe, the development of a coherent Quality policy throughout Europe, the development of a coherent Information Systems Policy throughout the Division, improving customer service. The full list is shown below with the subject matter they were responsible for as part of both their role within the company and the focus of their activities on the programme also identified: -

Bill (CEO) Subject Matter - How to improve the performance of the Top Team.

David (Manufacturing Director) Subject Matter - How to develop and implement a European Quality Strategy.

Helmut (German Plant Manager) Subject Matter - How to develop improved introduction of new products to manufacture.

John (Improvement Manager) Subject Matter - How to improve the process of introducing Improvement Groups within manufacturing.

Jean-Claude (European IT Manager) Subject Matter - The introduction of a European Inventory Control System.

Jonathon (European Master Scheduler) Subject Matter - The introduction of European Scheduling linked to the Inventory Control System.

The remaining members of the team supported those already allocated a subject matter in line with the above list.

The course proceeded as expected with each person completing a full analysis of his or her area of exploration and producing a solution to the problem. This was then prepared for implementation back in the company. Following this initial work a number of visits were undertaken by the researcher to check on progress and a number of production workshops were also held in order to lock the understanding and implementation of the TOC approach to production known as Drum - Buffer – Rope (DBR) to key people within the plants.

Throughout this time the CEO was trying to work on his subject matter and the issues it raised. Bill was in charge of the European Industrial Division with responsibility to improve the financial performance of the division, to ensure the highest possible customer satisfaction, to develop new markets particularly in the Far East and to improve the production facilities to meet "World Class" measures of performance. To achieve these goals he had recruited people from outside the company to bring new ideas and techniques with the aim of encouraging the existing members of staff and to drive the company forward.

Bill found that the tasks and objectives set were not going to be easily achieved. During the Jonah Programme he recognised that some of the people who had been brought in were not up to the tasks set for them. Others seemed to have a different agenda from that set, and one appeared

to have an agenda that did not include improving the performance of the business. Finally, others were not given the authority to do what they were supposed to do.

The first major complaint raised by Bill was that as a result of the debates that had been going on within the company, and the response to his repeated requests for action to be taken, there was a real lack of trust within the top team. They were each embarking on improvement plans for their areas without reference to each other, and often in conflict with each other. This led to the creation of the first cloud as outlined in figure 5.4.
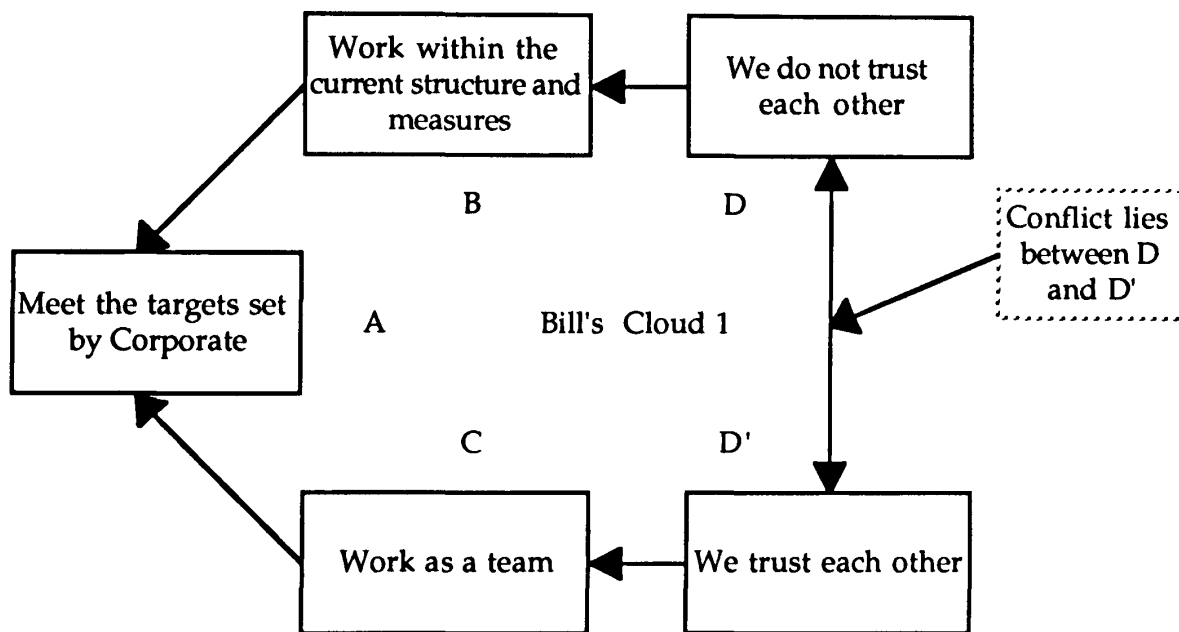
Figure 5.4 The First Cloud of the CEO

The cloud was constructed based on the recognition by Bill that there was this lack of trust within his top team, between each of the members and also with himself and from him to the team. The objective of the cloud was clear to all members of the team, and agreed. From the perspective of Bill, a clear requirement was that the only way to achieve these goals was through the senior management group working as a team, and if they were to work as a team then they must trust each other. However, at the same time, the goals had to be accomplished through the existing structure

and measure set by corporate and because of that there was a real lack of trust between the members of the senior management group, hence the conflict. The cloud was agreed by Bill as being a clear verbalisation of the conflict, the next step was to surface the assumptions. These are shown in figure 5.5.
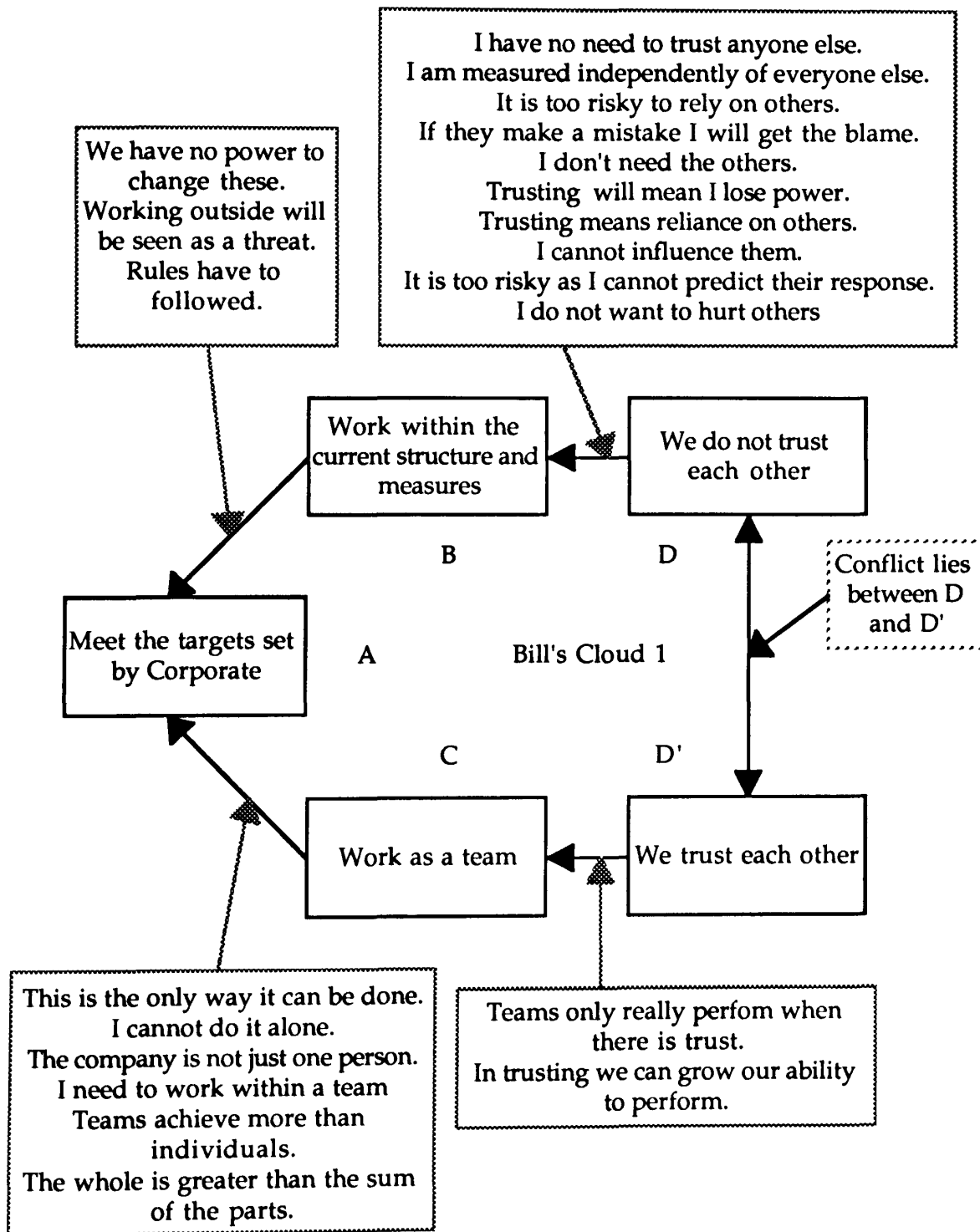
Figure 5.5 Assumptions of the first CEO cloud

Examination of these assumptions revealed much about the way in which Bill wanted to run his division but at the same time revealed how the people who had been around the company for some time wanted to work, and this was due in no small way to the measures that were being used to determine performance, and improvement. The surfacing of the assumptions did suggest a number of possible options open to Bill but these were not taken. He felt that there was only one way to move forward. Therefore as a result of being unable to break this conflict the response of Bill was to assume ever-larger control over the day to day operation of the business in addition to the more strategic nature of his responsibilities. At the same time he took full responsibility for the development of the Far East operation which removed him from the day to day management of his division. This led to the creation of the second cloud outlined below:
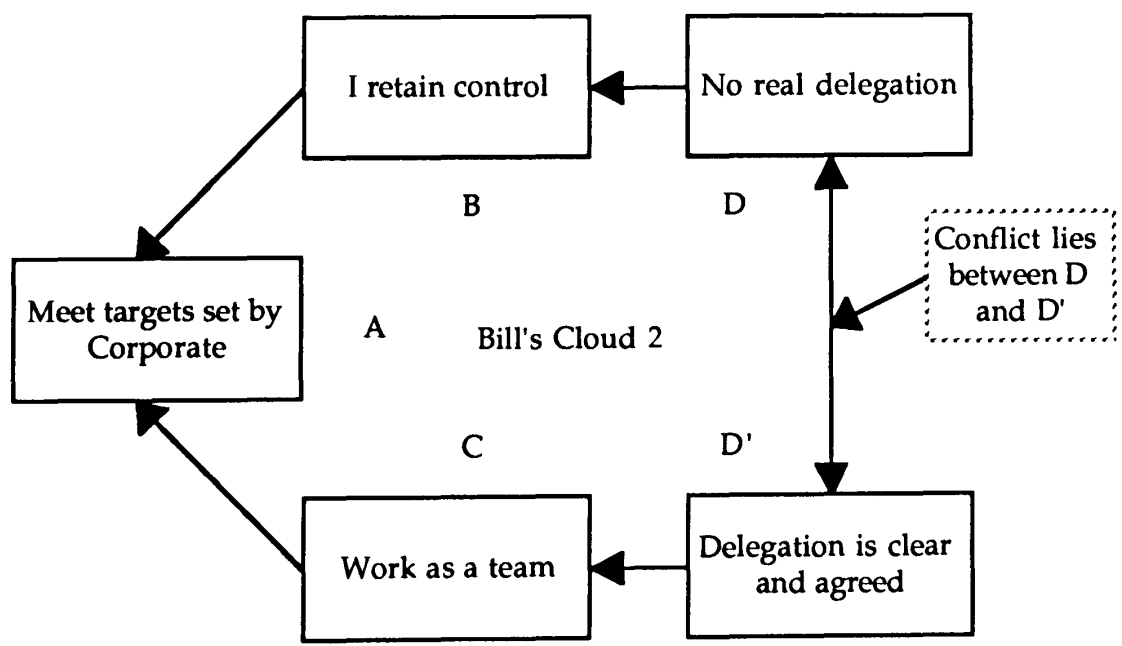
Figure 5.6 Second CEO Cloud

Now the conflict was between the giving of clear delegation or not. The reading of the cloud from the Objective to both D and D' was agreed as being clear and a fair description of the current situation. The main

difference between this cloud and the first one was that in B he wrote, "I retain control". Again the next step was to surface assumptions.
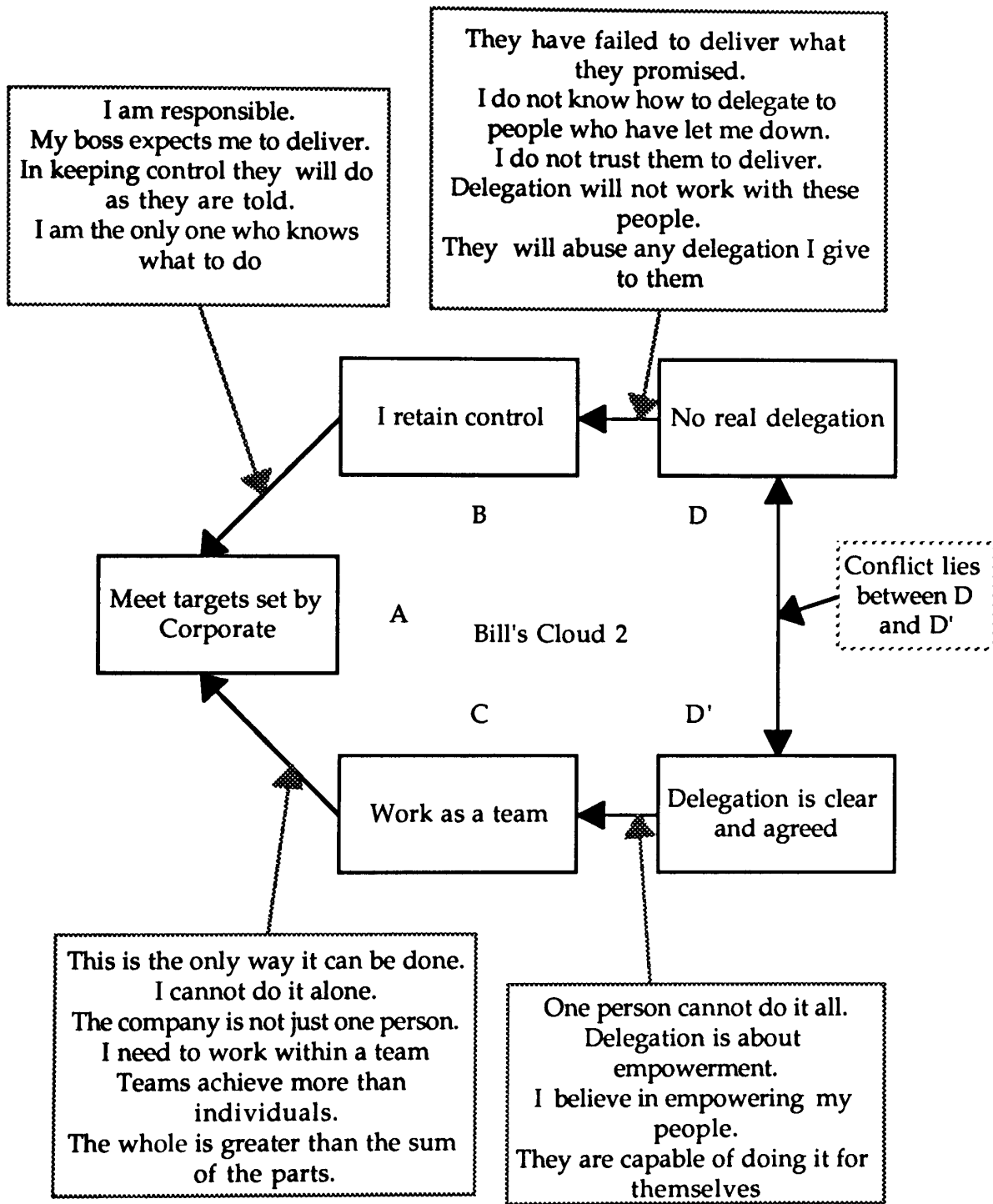
Figure 5.7 Second Cloud Assumptions

The assumptions surfaced here reflected the pain that Bill was now experiencing. In complying with the D in each of the two clouds so far he knew he was compromising and that the compromise was hurting him

greatly. The way in which he wanted to run the division was very much in line with the sequence from A through C to D'. For the moment however this approach lay in the future as there appeared to be no way in which to achieve what was required without going along the path from A through B to D, bearing in mind that D was a very undesirable effect to him personally.

What now became clear in this second cloud was the nature of what the researcher describes as paradigm lock. The statement in D' is a desirable effect that the CEO wanted and believed in very much. He also knew that without this clear delegation that he would not be able to develop the team method of working he felt was necessary to achieve the goals set by Corporate. However to move to that state would be to put in jeopardy the other requirement in B. Because there was no apparent way to achieve D' without risking B the only avenue open was to continue with the undesirable effect in D and accept the risks involved. This method of working with top teams was alien to the CEO but he felt he had no other choice. Even though the assumptions were examined and some were recognised as erroneous no action was taken. The reason being given was that the risk to B was too great to consider any other option at all. Recognising this state of affairs he then took time to construct an additional cloud in which he tried to verbalise his feelings towards the team in greater detail. This cloud is shown in figure 5.8.

```
                  ┌─────────────────────────────┐
                  │  Company evaluates individual│
                  │         performance.         │
                  │  Group agenda may be too broad.│
                  │  Ambitious individuals want to be│
                  │  recognised for their contribution.│
                  │  Low to no experience amongst the│
                  │  individuals of working in teams.│
                  └─────────────────────────────┘
```

My agenda is too flexible	Individuals have their own agenda

B   D

A team that is capable and confident of leading a growing healthy business	A

C   D'

We build a healthy growing business as a team	We have a shared vision for the business

Figure 5.8 The Personal Cloud of the CEO

This cloud allowed him to develop just what he was looking for in the top team. He considered that the objective as stated was important to him because he felt that a team is a more powerful and effective way of running a business rather than through a single individual, that more complex challenges can be addressed by a well functioning top team, that a team would allow the company to have a greater diversity of background and contributions than a hierarchical organisation, and finally that this environment would create a self-sustaining model that competitors would not be able to break. He was then asked to surface the assumptions under the arrows. Those that sat beneath A - C where that he felt that he could build a team in Europe even though the culture was not supportive, that his team wanted to work this way and there was a healthy growing

business available to them with the existing set of competencies. The assumptions that sat under the arrow from A to B were that people are self-regulating, that his people wanted to work in the teams, that the priorities and the group agenda were clear and agreed.

He was then asked to consider why D' was so important to him and gave the following reasons:
* That a shared vision creates a powerful force for success
* A shared vision creates commitment
* A shared vision enables quicker resolution of conflicts in priorities
* Creating vision will build top teams
* Our business will not grow without shared vision
* A shared vision helps define collective responsibility
* A shared vision requires individual/personal assessment of fit with the company

This led to a consideration of what needs made D' so important and these were listed as below:
* An aligned, committed team is the only way to create and sustain a growing healthy business
* The business at the time was not growing
* He doubted the future with the current technology base within the company
* People want to be part of a successful business
* People will feel more comfortable by being part of a successful team
* People are mature enough to work in a team
* We can create our own successful culture by building the business as a team
* We have the capability among the top team to create a healthy growing business

Once these had been identified the next stage was to consider why the cloud was in existence, in other words the assumptions that lay beneath B - D and why he allowed D to continue in existence. The reasons for D are shown in the cloud diagram above. The reasons for the continued existence of the B - D arrow where given as:

* People will see the big (group) picture and take initiative to align their agenda with the group agenda
* People will accept collective responsibility for the business
* People will work together to resolve cross-functional issues without his continued intervention
* People want to resolve their own problems
* He is willing to compromise his agenda if he sees a clear need from one of the staff members to spend time on theirs
* He can make up the time lost on his agenda after hours
* I assume their judgement is sound and that they are comfortable exercising it
* He shares with his people the same basic assumptions
* Flexibility creates room for taking new opportunities
* He has to allow time for frequent priority changes from Corporate
* There are too many priorities

Once these clouds had been developed and considered it was then possible to construct a cloud that might be more generic in application. Here the verbalisation has been changed to show the generic nature of the conflicts faced by the CEO and the following case studies will try to examine whether this is such a generic cloud or not. If so then the cloud should be capable of application beyond this research.
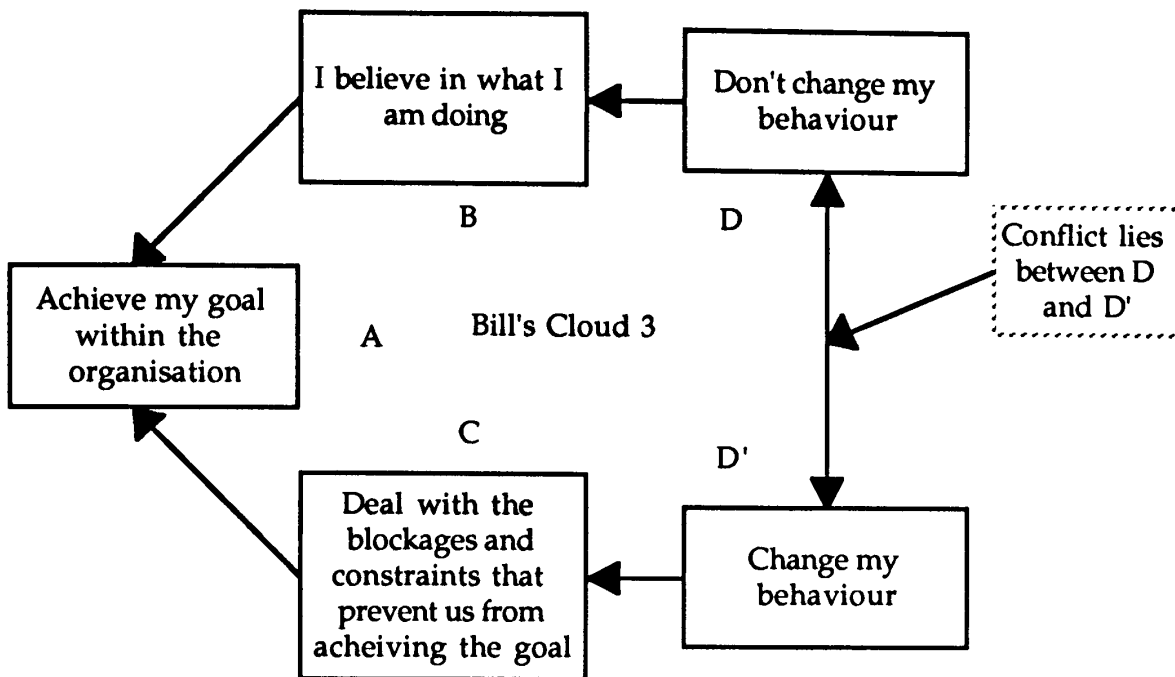
Figure 5.9 The Third CEO Cloud

The objective of the cloud is now verbalised as "Achieve my goal within the organisation". For the CEO the goal in question was still the original objective. The cloud can now be read as "In order to achieve that objective it is necessary to deal with the blockages and constraints that prevent such achievement, and in order to do that I must change my behaviour. On the other hand, in order to achieve my goal within the organisation I must believe in what I am doing, and in order to do that I must not change my behaviour". The next step was the surfacing of the assumptions that lie behind the arrows and these are shown in figure 5.10.

Figure 5.10 The assumptions related to the third CEO Cloud

This cloud, and the assumptions that were surfaced, was clearly defined as blocking the CEO from taking any action. The reason being that in order

to move to D', any injection that would achieve that desirable effect would put in jeopardy the entity B. This was seen as too threatening. The inability to see that both B and C could combine in any way was sufficient to block any progress towards the achievement of D'. Ther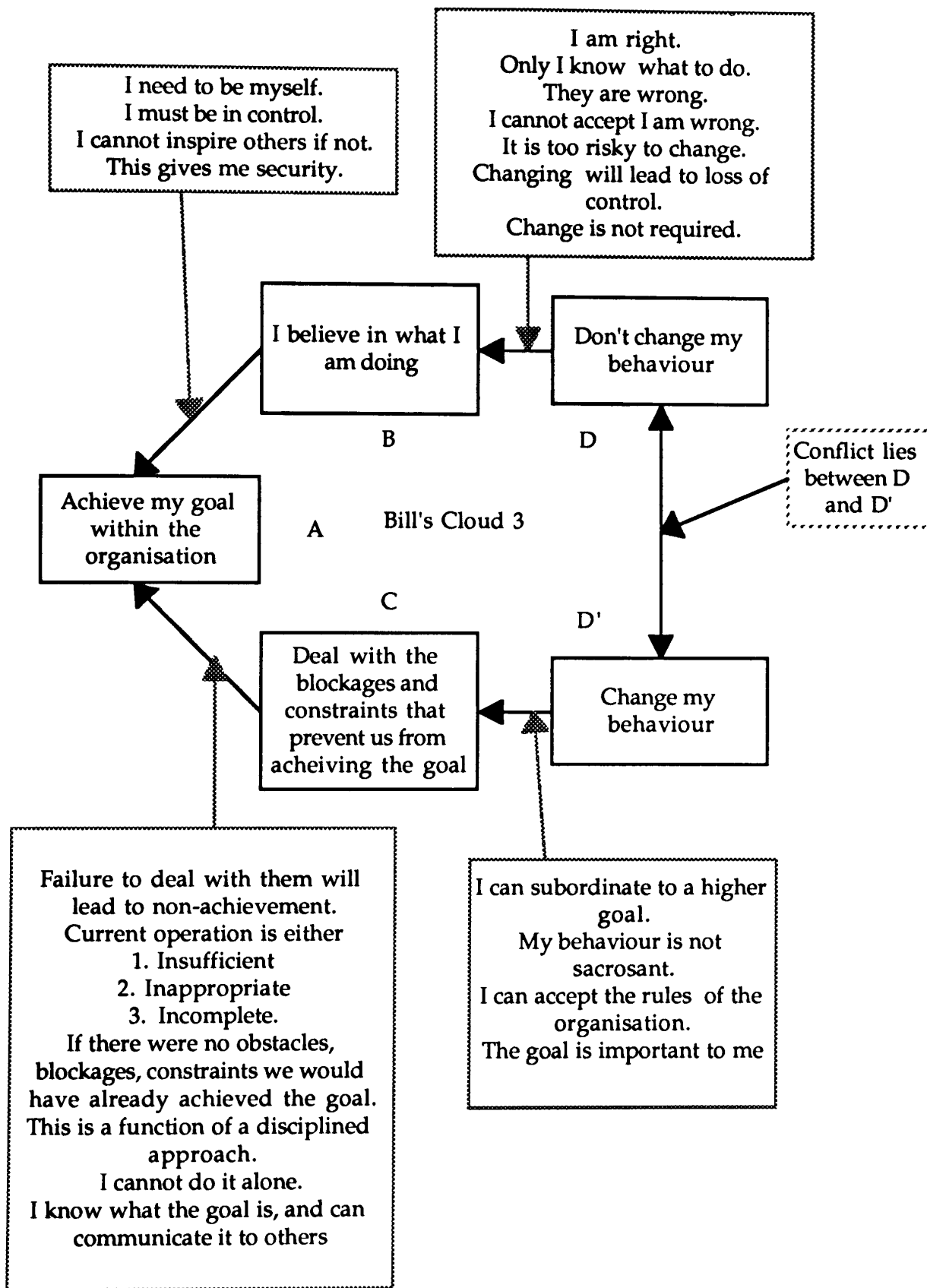e was no way in which B and C could co-exist; there was no perceived overlap of these two entities, and no process that could achieve such an overlap. Though B and C were not in conflict, the CEO saw no way to achieve both, and even if they could exist together, he saw no process capable of achieving such an impossible task. The implications for B should D' be accomplished were too great a risk to consider. The change itself was too threatening for B and therefore B became the goal of the CEO rather than that set by Corporate, or even by the group.

As a result of this inaction the CEO took actions which led to others leaving the company, including some whose purpose had been to implement exactly what the CEO wanted. This action led to the inability of the CEO to meet the targets set out by Corporate in the USA. This in turn brought about a change at the top of the organisation where the CEO was removed from his position and given the task of marketing new products to the Far East and a new CEO being appointed. Though the original CEO did not leave the company he now had a greatly reduced role within the company and greatly reduced power. This continued for a further twelve months and Bill has now left the company and is working as a consultant in the USA. Of the other members of the team that took part in the programme some are still in the company, others have left and in three cases have come back to the researcher for further work in their new organisations. The reasons given for coming back was that they thought the TOC/TP could deliver, but not with the CEO they had in the previous company. Now that that constraint had gone they felt able to put their new companies on a process of on-going improvement using the TOC/TP.

5.2.2 Case Study Two

The second case study comes from a company involved in the manufacture of automotive parts. The story centres on the Manufacturing Director and his attempts to put the company on a process of on-going improvement. Peter was brought in by the CEO to sort out the problems related to production throughout the Division, to recruit where appropriate and to implement the latest manufacturing approaches including Cell Manufacture, Kanban and Drum - Buffer - Rope. Many of the problems they faced were similar to those of the first case study.

Peter started with the Production Workshop with some of his people and then moved to the Jonah programme. As the programmes progressed the level of frustration and anger felt by Peter grew. This anger and frustration centred on the structure that the CEO had set up and the impact this had on the whole production area. Though the CEO had given the Peter the authority to recruit people, which he did, he also found that he was not able to influence appointments, which, though they were not strictly in the production area had considerable impact nevertheless. One example of this was in the area of purchasing. At the same time the CEO made it clear that no changes to the top team were envisaged and that they would have to work together. This led to the development of the first cloud as shown in figure 5.11.
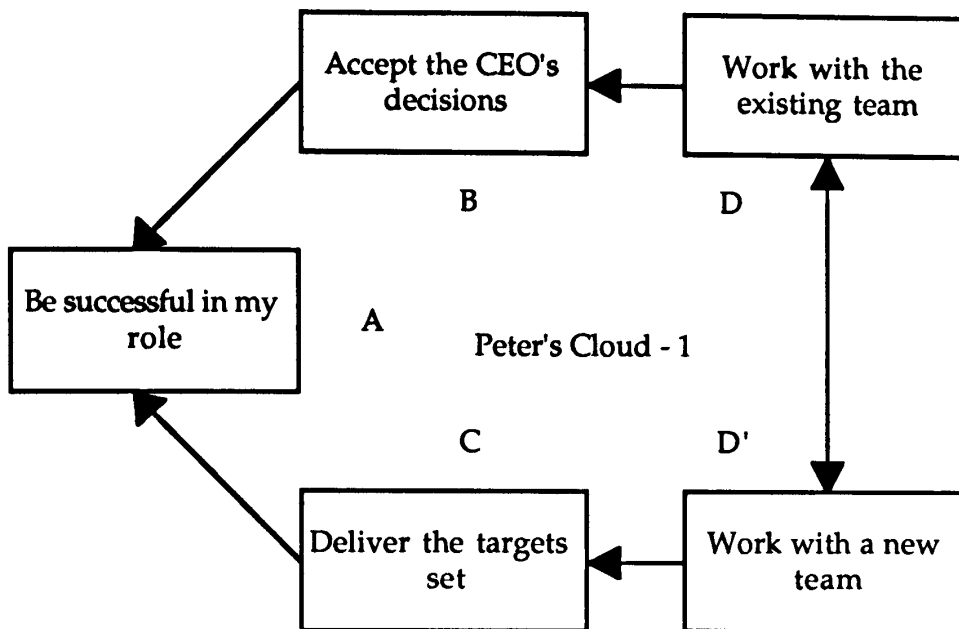
Figure 5.11 The first cloud of the Manufacturing Director

This was very much a conflict between what he wanted now and what he wanted to change to. His original intention was to change the team with the support of the CEO in order to alleviate the other cloud, which was affecting him. This is shown below:
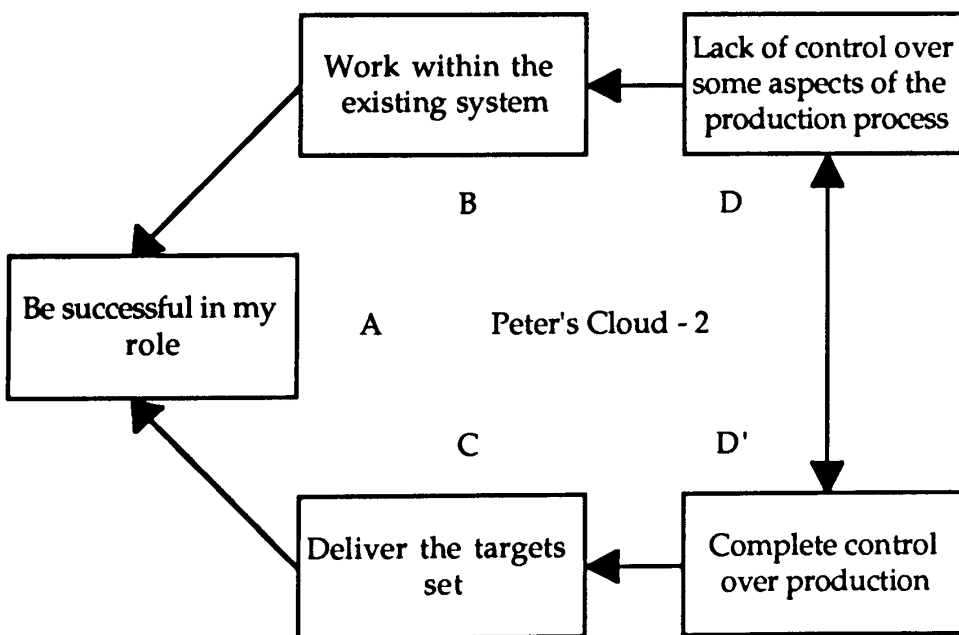
Figure 5.12 The second cloud of the Manufacturing Director

Once this cloud had been verbalised in discussion, he changed his original D to the one above, namely "lack of control over some aspects of the

production process". His main problem was that though he was responsible for production, he was not responsible for Purchasing or Distribution, both of which were controlled by another Director. These two clouds were therefore linked through the team he had to work with and the ability to achieve the targets set by both the CEO and the market. Once the clouds had been verbalised, the next step was to surface the assumptions.
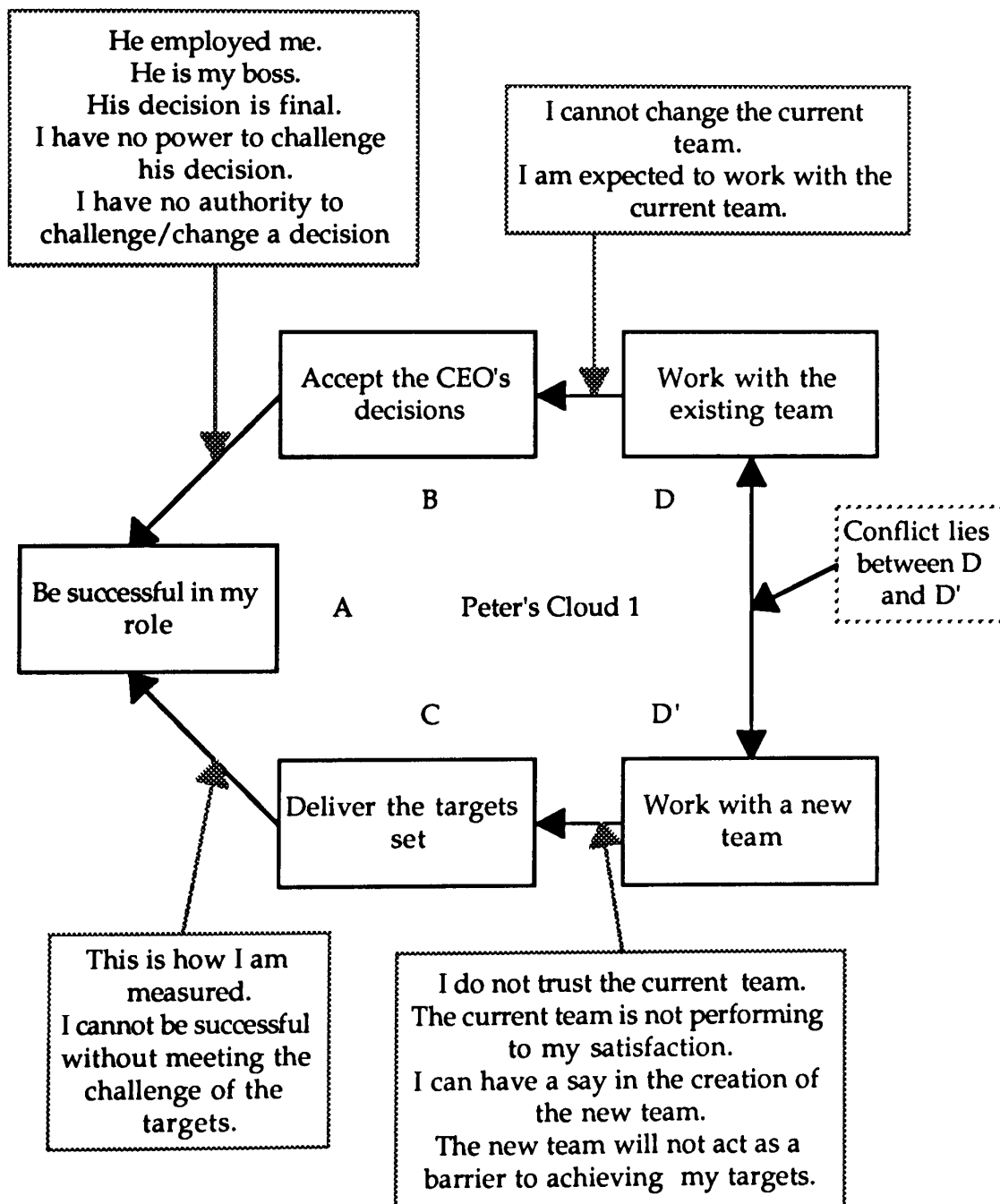
Figure 5.13 Assumptions related to the first cloud of the Manufacturing Director

This cloud was the first time in which the impact of D' on the continued existence of B was recognised. If a new team was to be formed within the company, then there was the possibility of a real challenge to the CEO's decisions, which, given the nature of the CEO's own clouds, was unlikely to happen. At the same time the second cloud was also examined through the surfacing of assumptions and is shown below.
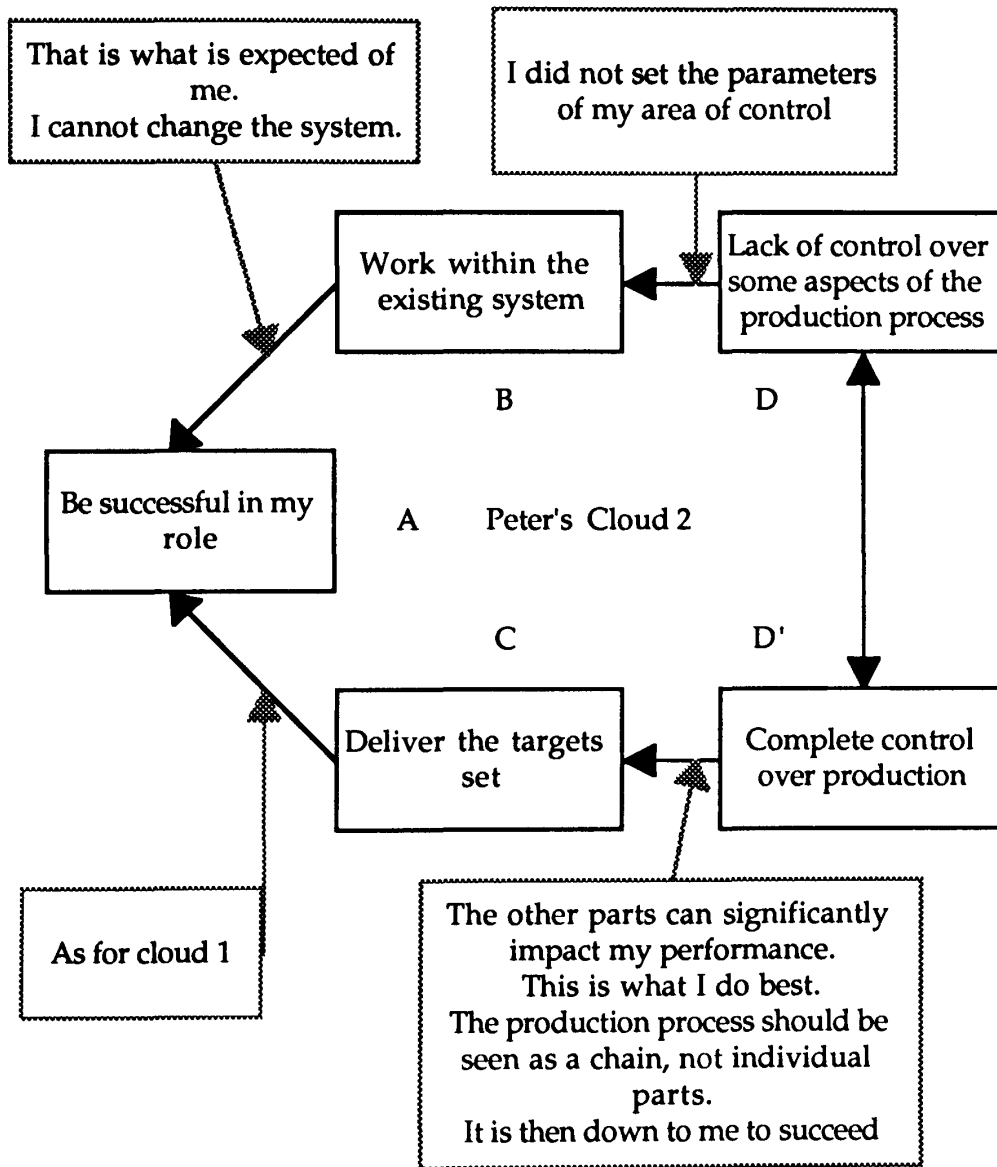
Figure 5.14 Assumptions related to the second cloud of the Manufacturing Director

The two clouds combined to give Peter a clear view of the predicament he was in. To his mind the lack of control over the whole of the production process was a major factor in his inability to meet the targets set by the

CEO. The other director, he felt, was playing a political game in which he did not want to participate. This struggle continued for some eight months during which time he decided that either the CEO would change the structure and the span of control or he would have to leave. This then led to the creation of the final cloud for this person which is shown below.
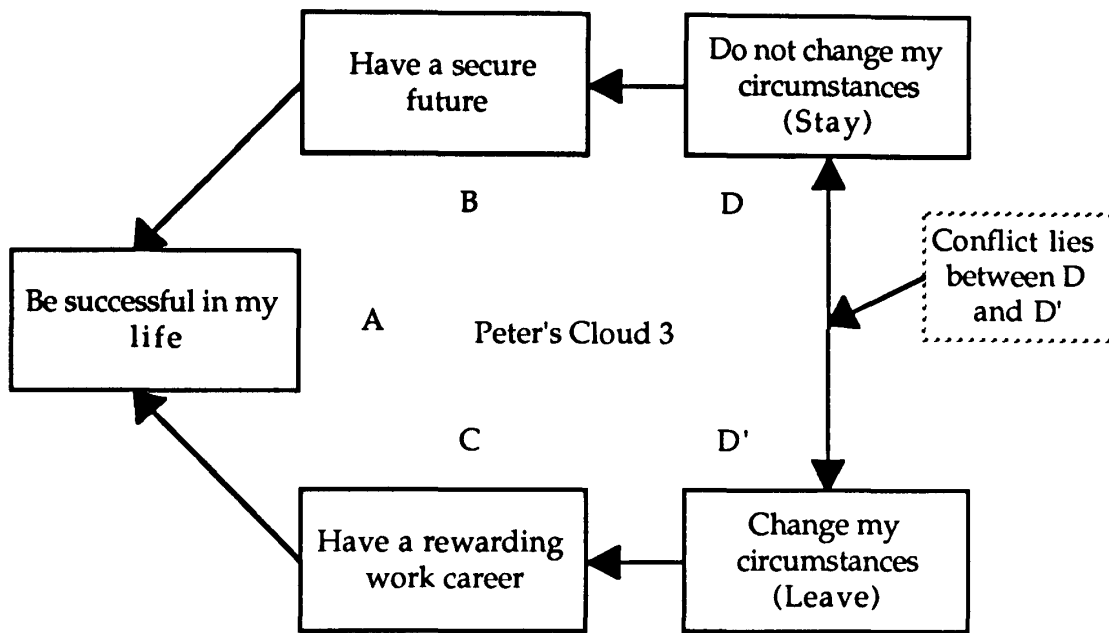
Figure 5.15 The third Cloud of the Manufacturing Director

This cloud was developed in the office of the researcher whilst considering what Peter should do. The assumptions were surfaced and centred on the need of the person to feel at home with what he was doing in his life, and even though leaving was a possible threat to his B, staying meant that both A and C could never be achieved. Though there was a potential threat from D' to B the bigger threat was from the continued existence of D and the threat that contained for C.

Within five months of verbalising this cloud the CEO and Peter argued over policy concerning production and the top team and Peter resigned with immediate effect. Within two weeks he had set himself up as an independent manufacturing consultant, drawing on his experience prior to joining this company, and was also successful in gaining a position

within a larger manufacturing consultancy, the combination of both giving him the security he needed. He continues to work in this position and uses the TOC/TP where he feels it is most appropriate.

5.2.3 Case Study Three

This case study involves a company, which was involved in the research and design, manufacture and on-going support of telecommunication equipment. The company was formed in two distinct divisions, each being a separate business unit. The first focused on the terminal equipment and the second on the base stations, which are sited throughout the country. They have about five hundred employees in the UK and their turnover is in the region of £ 100m. They are a high technology company using the latest technological developments in both communications and microprocessors to maintain a leading competitive edge in a difficult market with a high potential for increasing revenues to the company which can keep ahead of the competition, or develop a new dimension to the product. A great deal of resources is therefore given to the Engineering function, which includes research and development of new products. There is also a great deal of pressure to bring products to market as quickly as possible. This in turn places a great deal of pressure on both Engineering and Marketing. The company is owned jointly by two major companies in the field of telecommunications with no other shareholders.

The manufacturing environment is relatively simple, with the part of the business that manufactures the telephones, known as terminals, being a simple line with assembly operations throughout the whole procedure. This equates to the description of an "A" plant whilst the base stations area, called infrastructure, is different in that it conforms to the description of a "T" plant. Both of these types are fully described in Srikanth and

Umble (1990). Both of these manufacturing areas are managed separately, and submit accounts and all other management information as two separate organisations under the same umbrella.

The approach to the researcher came after the Business Development manager attended a seminar run by Dr. Goldratt and a follow-up meeting with the researcher. This led to the commencement of a detailed and comprehensive programme, which included Production Workshops, and the Jonah Programme. They were experiencing a number of problems such as delay in getting new products to market, being unable to meet customer due dates, ever growing lead times for manufacturing, this in both areas. The programmes were spread over a twelve month period and involved some fifty people, with ten attending the Jonah Programme. The production workshops were designed to introduce the Drum - Buffer - Rope solution to both manufacturing areas.

The Jonah Programme included people from both of the business units and was drawn from manufacturing, engineering, sales and marketing and business development. The key areas to address were agreed upon prior to the commencement and included the time taken to bring new products to market, the delays in manufacturing which were leading to missed due dates and quite severe problems within the manufacturing area and in particular the question of problems related to suppliers. As part of the programmes adopted by the company the two prime movers were the Business Development Manager, Sean, and the Sales and Marketing Manager, Mike. These two people were responsible for attacking the current problems within the company and for selecting the people they thought would best be able to deliver the necessary solutions. Sean had followed the Managing Director (M.D.) from a previous company where they had worked together successfully. The M.D. relied on Sean to identify areas of concern and come up with solutions to address

these problems, often including their implementation. For the Jonah Programme each person attending was asked to consider the area under their control and responsibility and to then determine what they wanted to address through the programme. The response of the group is shown below: -

Team 1: Andy - Engineering Manager, subject matter - To implement a process of continuous concept to product Lead-time improvement.

The efficient process of meeting market demand needs cost effective implementation in the form of manufacturable products, which will directly impact the company's competitive ability in the market. This will lead to a larger product portfolio, a reduction in cycle times, a reduction in costs and an increase in the company profits. The current problems associated with this are: -

1. Product Developments are late
2. Development costs are over budget
3. Full-scale developments are slow in starting
4. Some market needs are not satisfied by our products
5. Unit Costs are high
6. Manufacture starts slowly
7. There are insufficient development funds to meet the business objectives
8. Some staff morale is low
9. Some senior managers are not trusted.

Team 1: Bob - Production Manager, Subject Matter - To reduce the Manufacturing Cycle Time (MCT) of the production process. The problems is this area being:

1. There is a shortage of some parts
2. We are failing to deliver some customer orders on time

3. There is too much rework

4. Some test equipment is unreliable

5. Some supplied parts do not meet the spec

6. The shop floor data collection system does not locate the products

7. Parts not arriving from stores when required

8. The cost of rework is not known

9. RF board has to double back to fit gasket after test

10. The telephone top cover has to be cut by hand

11. The heatbonding machine is not reliable

12. Production layout does not complement the product flow.

Team 2: Chris - Marketing Manager, Subject Matter - To improve the turn-around time for the preparation of quotations to customers typically from around five days to 2 days, (working days). Typical problems being the following: -

1. Some people delay their decision on approving the pricing Approval (PA)

2. Pricing data takes too long to obtain

3. People look for reasons to reject PAs

4. It is difficult to get agreement on prices

5. It is difficult to get agreement on timescales

6. Too many people are required as signatories

7. Engineering cannot guarantee costs

8. There are inaccurate requirements

9. There are customer misunderstandings

10. There are unrealistic internal timescales

11. There is a long waiting time for quotations from subcontractors

12. There are manipulative politics

13. Some people fail to deliver what they promised

Team 2: Frank - Engineering Manager, **Subject** Matter - To improve the quality and speed of design into manufacture by introducing more process engineering into core product design, and the introduction of structured methods of product introduction e.g. increased design involvement in factory test equipment development/auditing.

Benefits include a reduction in development time and costs, the avoidance of costly mistakes by analysis of core product introduction in advance of development, the reduction in overlap of effort/repeat of effort and thus a reduction in firefighting, allow for more products to be developed, and allow for better control of suppliers by a clearer understanding of the roles of engineering design, production engineering and materials management. The key problems were identified as the following: -

1. Development costs are over budget
2. Some Unit costs are over budget
3. There are additional processes in manufacturing not known at this early stage
4. There is late detection of manufacturing problems
5. There is a lack of initiative in solving problems
6. There is rework
7. There is duplication of effort
8. There is protracted production handover
9. There are unplanned corrective actions
10. Some products are difficult to rework
11. Some components get damaged during assembly
12. Some planning is inaccurate
13. Some suppliers do not meet our requirements
14. Some products are difficult to manufacture

Team 1: John - Senior Production Manager, Subject Matter - To improve the process of design into manufacture by improving planning, reducing timescales, reducing re-engineering and increasing the ability to meet production ramp up demand within the Business Unit. The problems identified were as listed below:

1. There is a failure to achieve design performance
2. Products are difficult to manufacture
3. There is often rework of manufacturing systems
4. Manufacturing Engineering time is lost
5. There are product design changes
6. Changes take too long
7. Communication is difficult between design and manufacture
8. There is a mismatch between milestones and key dates
10. Sometime performance deviates from the plan.

Team 2: Mark - Production Manager, Subject Matter - To give our customers confidence in our delivery promises so they will place further orders. This is to be achieved by identifying the constraints, which restrict our performance and take action to diminish or remove them. The initial problems being: -

1. Customer's delivery dates are sometimes missed
2. Manufacture sometimes fails to meet production targets
3. Production constraints are not fully understood
4. Some of the production process times are inaccurate
5. There are material shortages
6. Some suppliers do not meet our requirements
7. Stock records are not accurate
8. The release of BOMs for new products is often late
9. Some sales forecasts are often inaccurate
10. There is rework
11. The production layout does not complement production flow

12. The parts are not arriving from stores when required

Team 1/2: Mike - Senior Sales Manager, Subject Matter - To make Business Unit Marketing function operate more effectively. The effectiveness of my group will have a direct impact on the profitability of the terminals business. The objectives are to exceed the Business Unit contribution in the 1994/95 by 10% while reducing the marketing budget by 20%. The problems centred on the list below:

1. Company is not perceived as a good supplier by customers
2. Company has no consumer image
3. Sales are low
4. Engineering do not support the new Product Plan
5. Margins are continually being eroded
6. Confidence in shipment dates is low
7. The Distribution base is low
8. The department is always firefighting
9. Distributors do not have confidence in our product reliability
10. New products and accessories are always late to the market

Team 2: Neil, Senior Production Manager, Subject Matter to consistently improve the overall performance of the production facility and to increase the volume through the plant by at least 20%. The main problems were considered to be the following: -

1. There is limited capital budget to invest in all production processes
2. There is scrap
3. There are rejects
4. There are customer complaints
5. There are returns from customers
6. There is a lack of resource flexibility
7. The capital depreciation is high

Team 2: Richard, Sales and Marketing Support Manager, Subject Matter - To reduce timescales for projects from Concept to Production and at the same time improve the product introduction to the factory. The problems identified in this area were as follows: -

1. Agreed project milestones are not met
2. Project requirements are not clear
3. Unplanned customer changes occur
4. There is a lack of some resources
5. Unforeseen technical problems occur
6. We are always firefighting
7. Some people lack motivation
8. There is a mismatch of skills to the workload
9. There is protracted production handover
10. Some managers are not prepared to commit themselves
11. There is poor communication with marketing.

Team 1/2: Sean - Business Development Manager, Subject Matter - The objective is to examine how to function as a catalyst in order to initiate and co-ordinate improvements to the business process. The problems that lie in this area are as listed below: -

1. Some people are resistant to changes, which affect them
2. Some people feel too busy to take on change
3. Some people believe that they do not need to improve
4. Some people believe everybody else needs to improve
5. Some people will agree to improvements but do not implement them
6. Some people are unable to overcome historic conflicts
7. There is a lack of necessary skills
8. There is insufficient imagination
9. Some links in the business process are not being improved

10. There is inaccurate measurement of the contribution of improvement initiatives

11. Some suppliers do not match our requirements.

The programmes were completed with the normal outcome of each person working with their own implementation plan for the resolution of the problem they started with. Each team followed up the Jonah programme with four production workshops for a total of thirty-two people from the production area with the aim of securing the implementation of Drum - Buffer - Rope. As a result of this both teams knew what had to be done in the implementation plan.

In one half of the company, team 2, these solutions were implemented fully. They were able to obtain the improvements they were seeking. The volume went up from 600 units in a 20-day lead-time to 2500 units in 4 days. The due date performance was held at 100% for most of that time, only slipping below when suppliers were late or some other unforeseen problem occurred. Neil, the senior production manager, left at the start of this process and was replaced by Mark who had been his understudy. Neil continues to keep in touch though has had no other opportunity to apply TOC/TP to any of his subsequent companies. The base station side of the business has grown from strength to strength. Richard has taken over as the Division chief and Mark has taken on the role of Quality Manager in addition to his production duties.

However in the other half, team 1, where Mike and Sean were most involved very little happened. Though the plans were sound, they were given little opportunity to come to fruition as the M.D. made a decision to change the senior management structure. This involved moving move Sean to become head of engineering and forcing Mike to take actions in which he did not believe. This shift was driven by the lack of results

coming from team 1 and the fact that Andy and Frank left shortly after completion of the Jonah programme. The remaining team members felt they did not have the necessary skills to continue and so stopped altogether.

With these changes, over the next few months both Mike and Sean grew in frustration as the plans that had been so carefully developed were put completely to one side, a new Director was brought in by the M.D. over the heads of both men and this new person wanted to do things his own way without reference to any work that had gone on before. After six months this was recognised by the M.D. as having been a mistake and he then lay the blame for this at the feet of both Sean and Mike. It was at this point that both clouds were developed as the two men entered a phase of combined frustration and depression.

The first cloud is that of Sean and the second, that of the Mike. The conflict in both cases was the same, stay against leaving. The need that staying was required for was different for both men, equally the need that leaving was trying to support was also different, but in debate both could agree that the B for one was equally appropriate to the other and the same for C and indeed for A. Once the initial clouds had been verbalised the next step was to surface the assumptions that led to the creation of the cloud in the first place. It is also important to recognise that the conflict was verbalised as internal to each of them, the M.D. though a player, was not the key figure. It was their own personal conflict that was deemed to be of greatest importance.
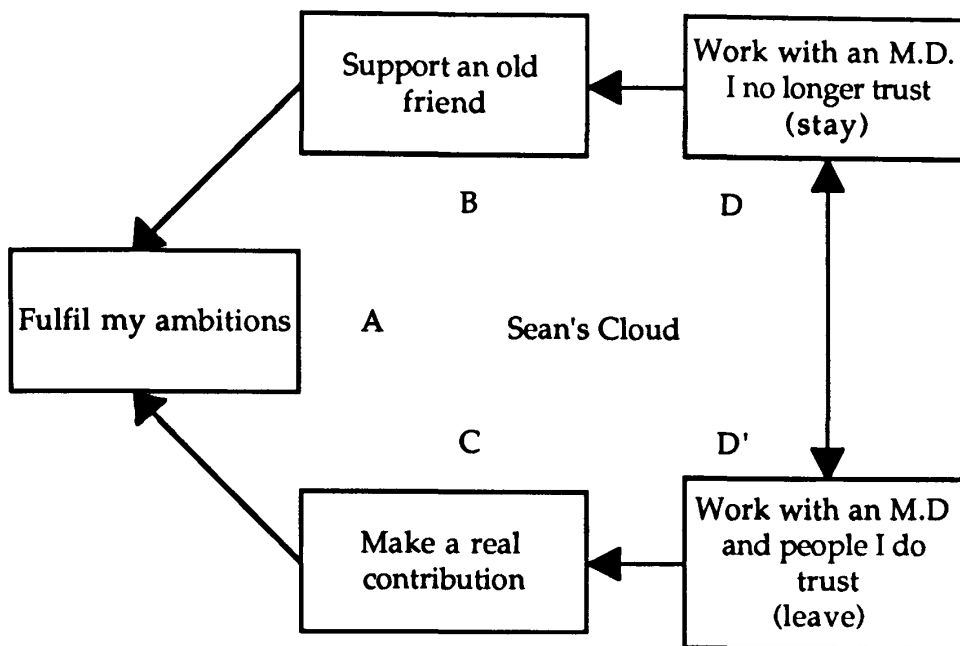
Figure 5.16 The first cloud of the Business Development Manager

Though the first verbalisation was about the conflict related to trust in first the M.D. and then others within the company the real conflict that emerged was between staying or leaving, and this became the same for both of them. Being able to verbalise the cloud to this level of detail was not an easy task as it required each of them to look inside themselves and ask questions of themselves which they admitted afterwards they did not like to do, though they also accepted that without such inward examination any resulting analysis would have been of little value. At this point, using the interaction of D' on the existence of B, in both cases D' was seen as a threat to the continued existence of B.

In the case of the BDM the friendship with the M.D. went back some time and was not easy to give up, even though staying involved an increasing amount of personal pain. The only reason he had agreed to switch to the head of engineering was to comply with a request from the M.D.; he being of the opinion that he was not qualified to be head of engineering. The fact that he was subsequently successful in the post for some twelve months and in that time brought a major new product to the market was

not seen as particularly relevant, simply engineering was not where he saw his career going.

```
┌─────────────┐                      ┌─────────────┐
│ I don't want to │                  │  I have no   │
│ leave him in │                     │ alternative  │
│  difficulty  │                     └─────────────┘
└─────────────┘                            │
          │        ┌─────────────┐         ▼
          │        │Support an old│  ┌──────────────┐
          │        │   friend     │◄─│Work with an M.D.│
          ▼        └─────────────┘  │ I no longer trust│
  ┌─────────────┐        B          │    (stay)     │
  │             │                   └──────────────┘
  │             │                          D
  │Fulfil my ambitions│  A      Sean's Cloud           ▲
  │             │                                      │
  └─────────────┘        C            D'               │
          ▲        ┌─────────────┐  ┌──────────────┐
          │        │  Make a real │◄─│Work with an M.D│
          │        │ contribution │  │and people I do │
          │        └─────────────┘  │     trust      │
  ┌─────────────┐                   │    (leave)     │
  │ This is how I│                  └──────────────┘
  │value my work.│
  └─────────────┘       ┌─────────────┐
                        │This is part of│
                        │my value set  │
                        │This is a real│
                        │  win-win     │
                        └─────────────┘
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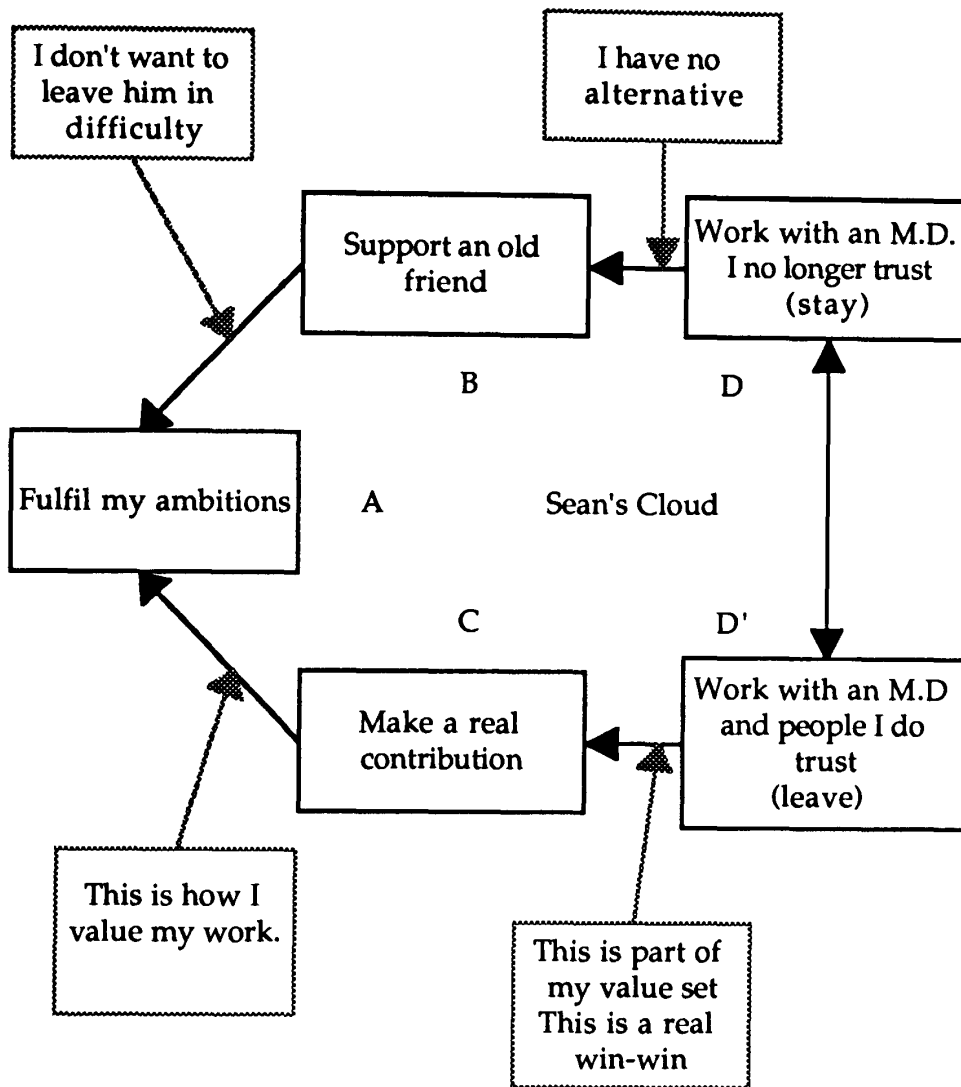
Figure 5.17 Assumptions related to the first cloud of the Business Development Manager

The surfacing of the assumptions only served to reinforce the nature of the conflict and give added impetus to the need to break it. It soon became obvious that Sean would have to seriously consider where he was going in his career and that it would inevitably mean a break with the past. Sean eventually left and joined a new company, first as head of engineering and more recently as Director of Manufacture. He is still using TOC/TP and is currently waiting to put this new company on the relevant TOC/TP programmes.

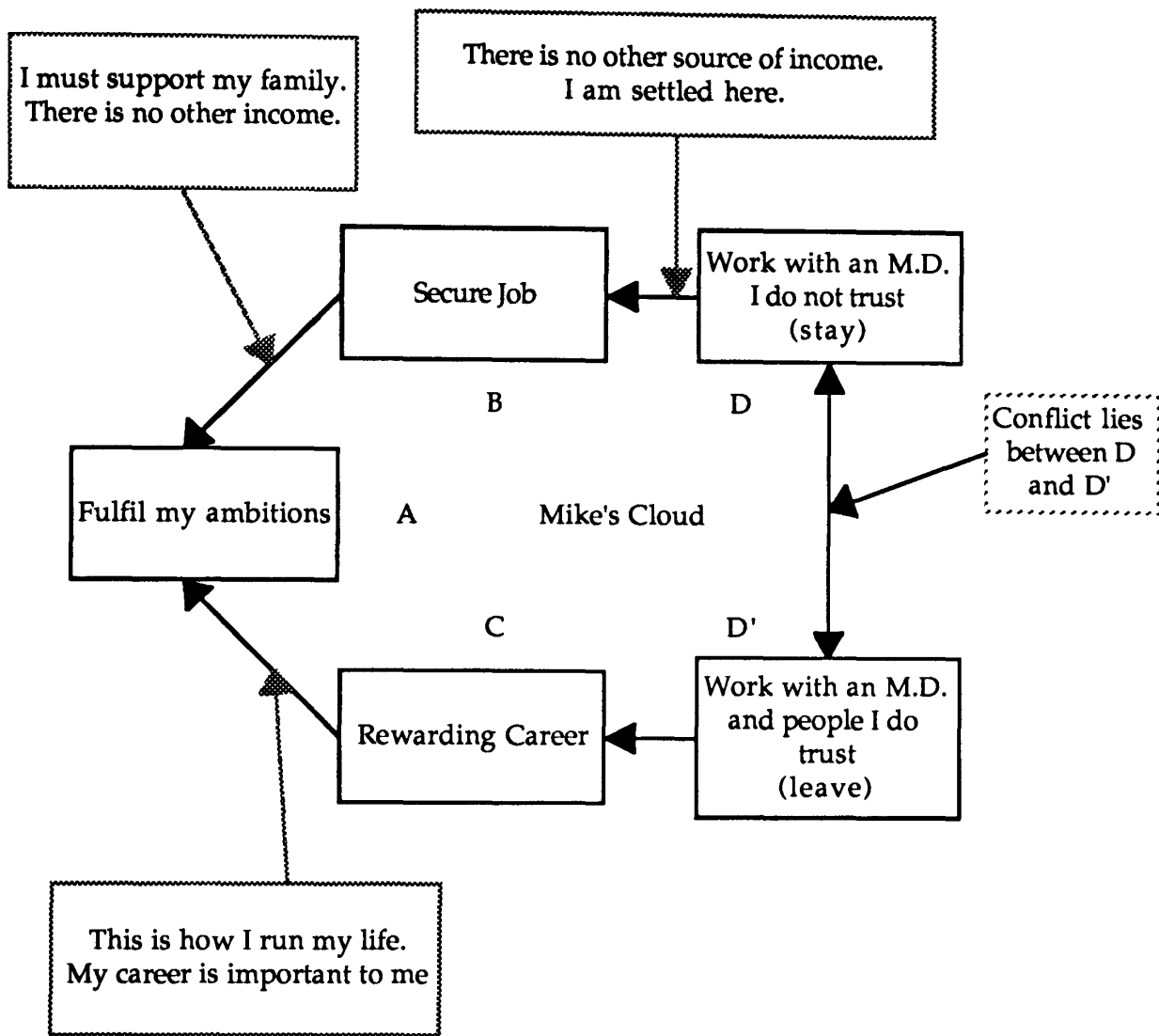The cloud developed by Mike was similar though there was no previous working relationship with the M.D.

Figure 5.18 The first cloud of the Sales and Marketing Manager

Again with this cloud, once it had been verbalised the cross impact of D' on B was examined. Mike saw leaving the company as a major threat to his family, they being young and relying totally on him for income. The outcome was that he telephoned the researcher after about six months informing him that he was leaving the company with no job to go to and could he meet. The meeting took place close to where Mike lives and confirmed that the reasons for leaving were the conditions that now existed within that division and that they were now intolerable as far as Mike was concerned. He is now with a new company and enjoying life again, and using TOC/TP within that new organisation.

5.3 An overview of three further case studies

These remaining case studies are in all cases similar to those already described. What is covered in the case studies are the clouds that were developed during or just after the programmes with respect to the management of the programmes and the implementations, and the relationships between the people in the organisations. Though not developed to the same degree as the preceding three case studies, the circumstances are the same. Each company was involved in the implementation of the TOC/TP and the individuals concerned had come up against a conflict of the same type as before.

5.3.1 Case Study Four

This next example is drawn from a Jonah Programme in 1993. The company was a small manufacturing company. Jim was the owner of the company and he brought his top team to the programme with the aim of ensuring that they were able to run the business after he retired. His first concern was about whether the TOC/TP was of value to him and his company, which led to the creation of the first cloud shown in figure 5.19.
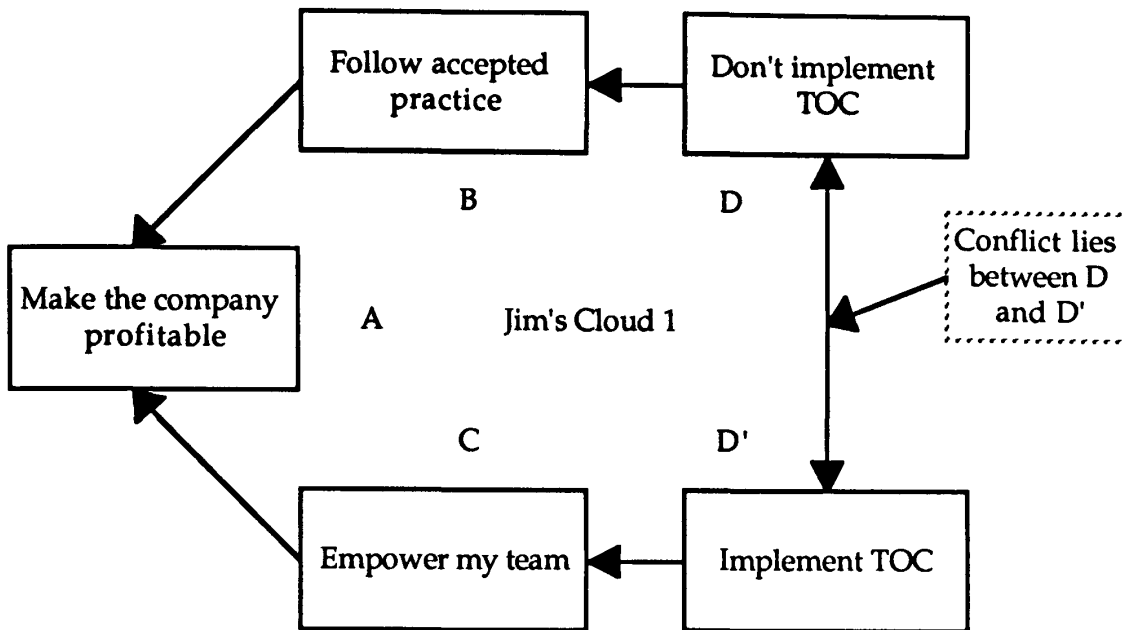
Figure 5.19 The first cloud of the Chairman

Jim invested in the TOC/TP through two Jonah Programmes and three production workshops. In all some 20 people attended TOC/TP programmes. The Operations Director was given the task of implementing the Drum - Buffer - Rope. However the timescale started to slip, as it became obvious that the way in which the improvements were being handled was creating problems between the members of the top team. Jim started to feel that his investment in the people at the top was not being returned in the form of better performance. He was also keen to sell as soon as he could and was afraid that any delay would lead to a reduction in the price the company would attract. Hence the second cloud was constructed.
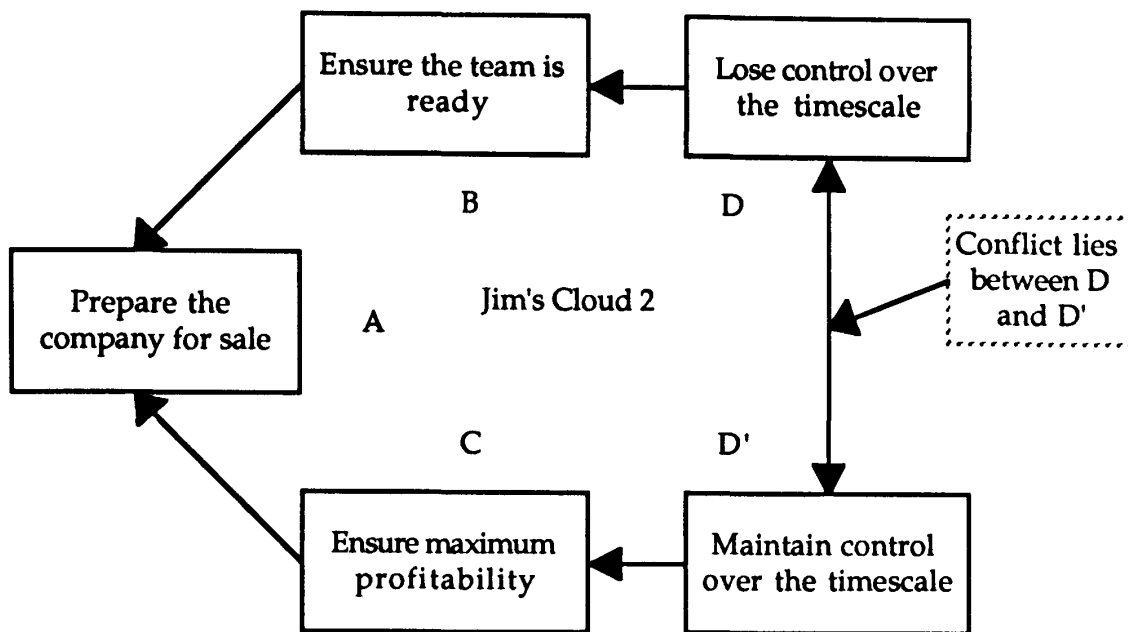
Figure 5.20 The second cloud of the Chairman

As time went by and the performance only improved in short bursts, Jim began to push the team hard. They were continually fighting over strategy in the market, the sales and marketing team were pushing ahead with new product launches, but production could not keep up. This was even after significant improvement in lead-time and capacity through the DBR implementation. Every time that production was able to create some spare capacity, which in turn gave protection to the plant and to the customers, the sales people would sell that capacity and therefore remove the protection. This in turn meant that production was never able to really get to grips with their problems. This is not a new phenomenon and had been pointed out to them by the researcher, but they ignored the advice and continued to try and sell more every time capacity became available. As this continued the level of fighting between the top team grew ever more difficult to control. The result was that Jim finally took more and more control and in the end sold the company without much reference to the rest of the team. His patience had given out. The cloud is shown in figure 5.21.
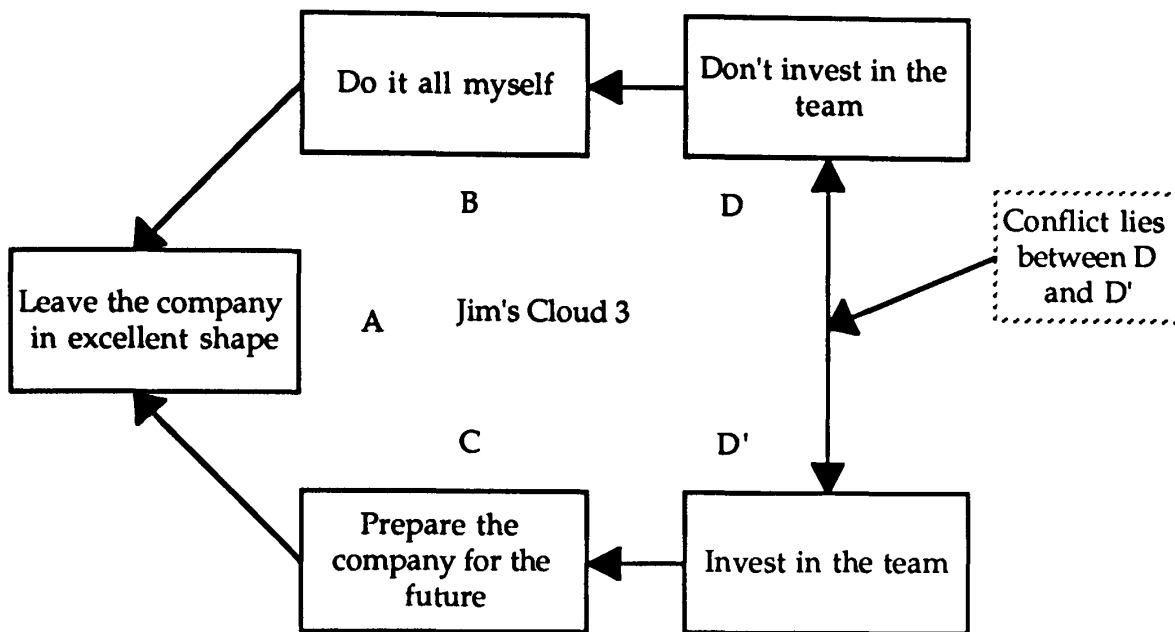
Figure 5.21 The third cloud of the Chairman

Jim felt that D' was no longer a viable option and took the risk that not investing in the team might have a negative impact on the sale of the company. In the end he left the company having sold it for a reasonable price. Of the top team only two remain. The Operations Director left shortly after and is now running a new company using TOC/TP in both production and sales.

At the time the Operations Director was taking a lot of criticism for the performance of his area. At every meeting with the top team however, he always took the blame on himself, never his people. In discussions with the researcher he produced the cloud in figure 5.22.

Figure 5.22 The first cloud of the Operations Director

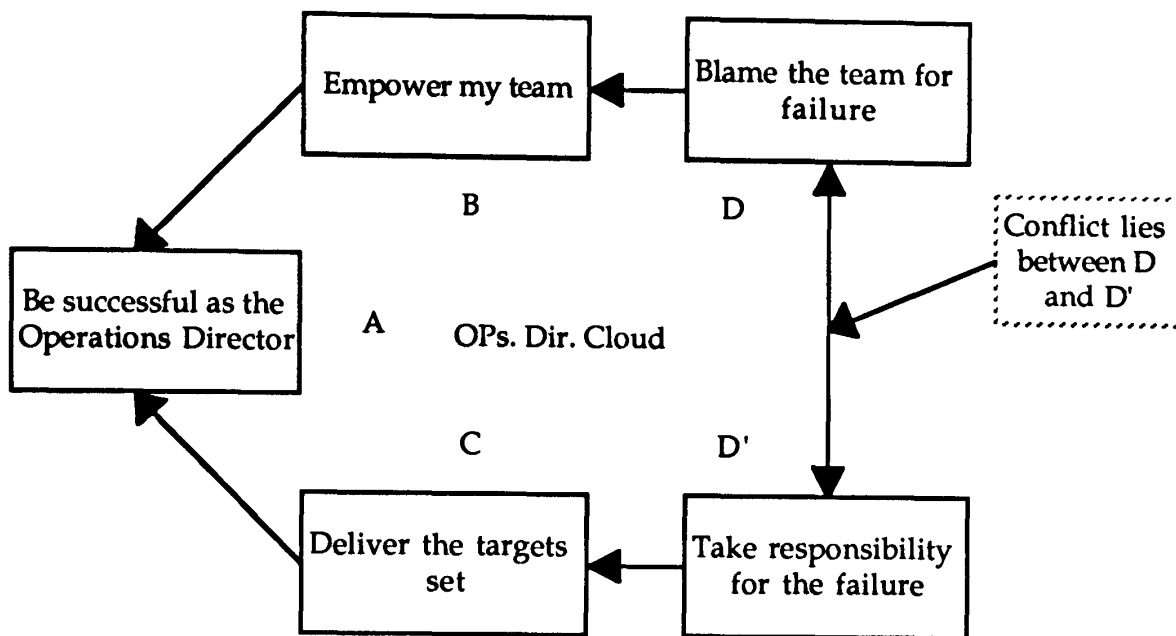He felt that the only way to produce the results that he and Jim wanted was to push his people gently, encouraging them to grow in knowledge and contribution. In the end however the non-performance of his people led to his leaving the company.

5.3.2 Case Study Five

The next company was based in Germany and was involved in making household and bathroom fittings and furniture. They attended four programmes, the Management Skills Workshop (MSW) and three production workshops. The total number of people attending programmes being 11 on the MSW and senior management production workshops and 20 people attending the 5 day production workshops.

Their primary aim was to introduce Drum - Buffer - Rope into the company and then to move to the Jonah programme in order to develop new markets and new sales opportunities. They were successful in reducing the lead time of their manufacturing process and were starting to achieve much better due date performance when a particular problem arose. The owner of the company had expected to have a considerable

amount of money paid to him at the end of the financial year. However due to the market downturn this was not possible. However as a result of our activities with Drum - Buffer - Rope excess capacity had been revealed. The owner took this opportunity to convert the spare capacity into money by making 35 people redundant. These people were from the areas that had improved and from which it was hoped more sales could be generated. With the action the owner lost the opportunity to develop the markets he was already in and any chance of developing new ones. At this point the researcher pulled out of the company. The M.D. of the company, Hans, constructed the cloud shown below: -
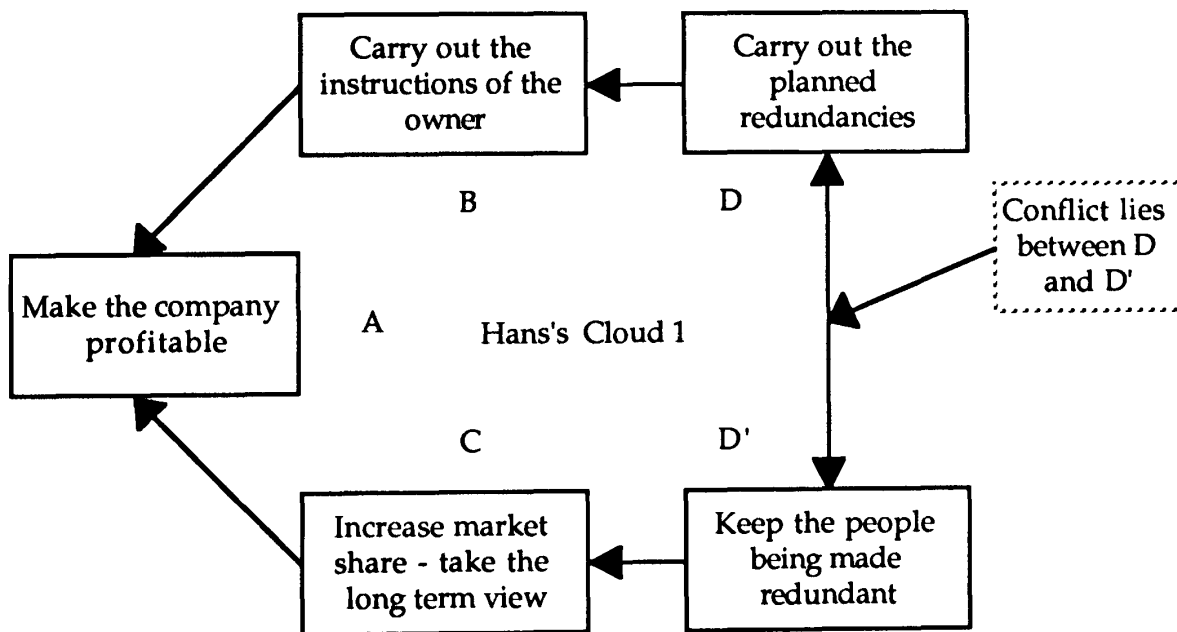
Figure 5.23 The first cloud of the Managing Director

The decision to make so many people redundant was not something that Hans wanted to contemplate. For him it was against all that he believed in when it comes to running a successful manufacturing company. However the second cloud was also applicable and made life very difficult.
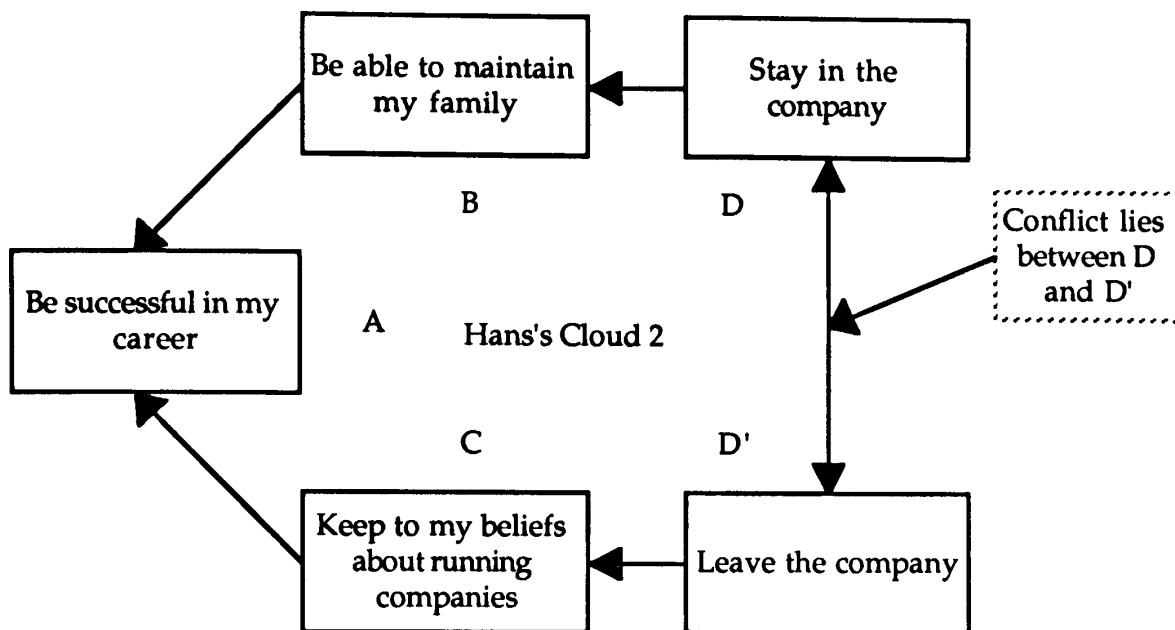
Figure 5.24 The second cloud of the Managing Director

The result was that Hans waited for a few weeks and then left the company. At the same time the Technical Director also left the company feeling that the owner had destroyed his work and did not run the plant the way it should be. The Technical Director was a Jonah from a previous company the researcher had been involved with. Both are still in touch with the researcher and are keen to develop more understanding of the TOC/TP and the way it applies to their companies.

5.3.3 Case Study Six

The final company to be examined was a small consultancy practice. They were using TOC/TP as the basis for their operations. The researcher came to work with them as he was developing his own understanding of TOC/TP. Stacey was one of the original members of the group, which had come together in 1991. She had been exposed to the work of Dr Goldratt in 1987 and continued to develop understanding throughout that period. The first cloud refers to the way in which she felt about working with some of the people in the practice. This was a real issue for her as the code

of practice was clear but at the same time she could not come to terms with the non-performance of other members of the team.

This led to a real breakdown in communication between Stacey and the rest of the team. Once more the cross connection of the cloud, the impact of D' on B and that of D on C was fierce. Stacey felt trapped.
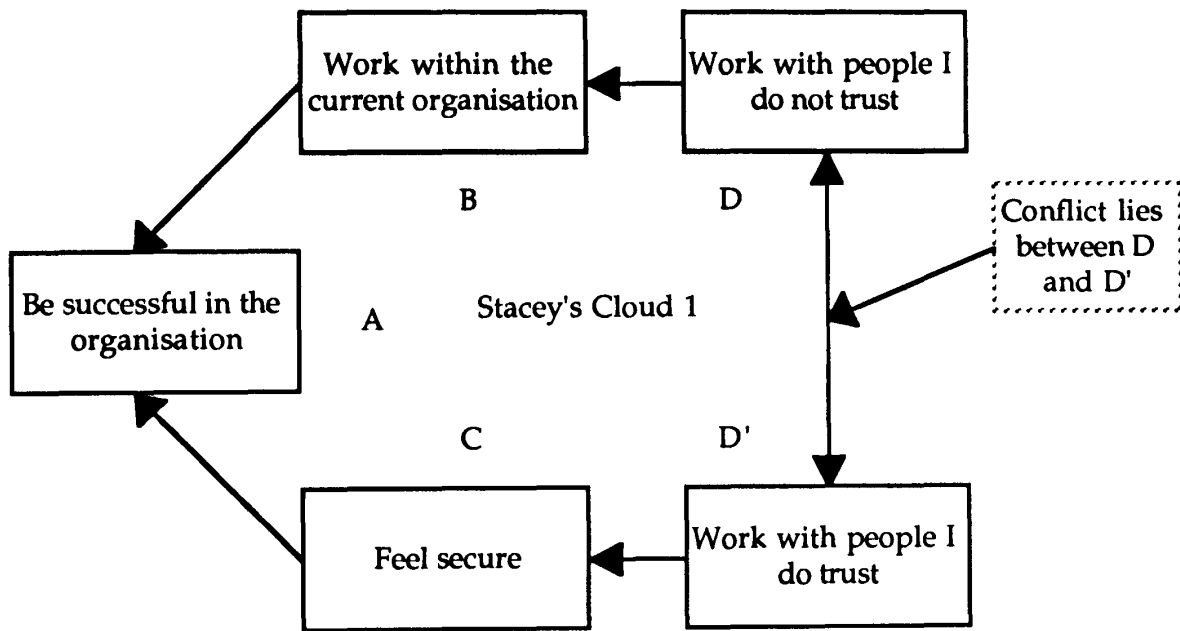

Figure 5.25 The first cloud of the consultant

This level of feeling trapped was not helped when the head of the practice made it clear that the finger-pointing and the blame culture that had developed was not to be tolerated and that he expected them to sort it out using the TOC/TP tools. At this point the second cloud became very real to Stacey.
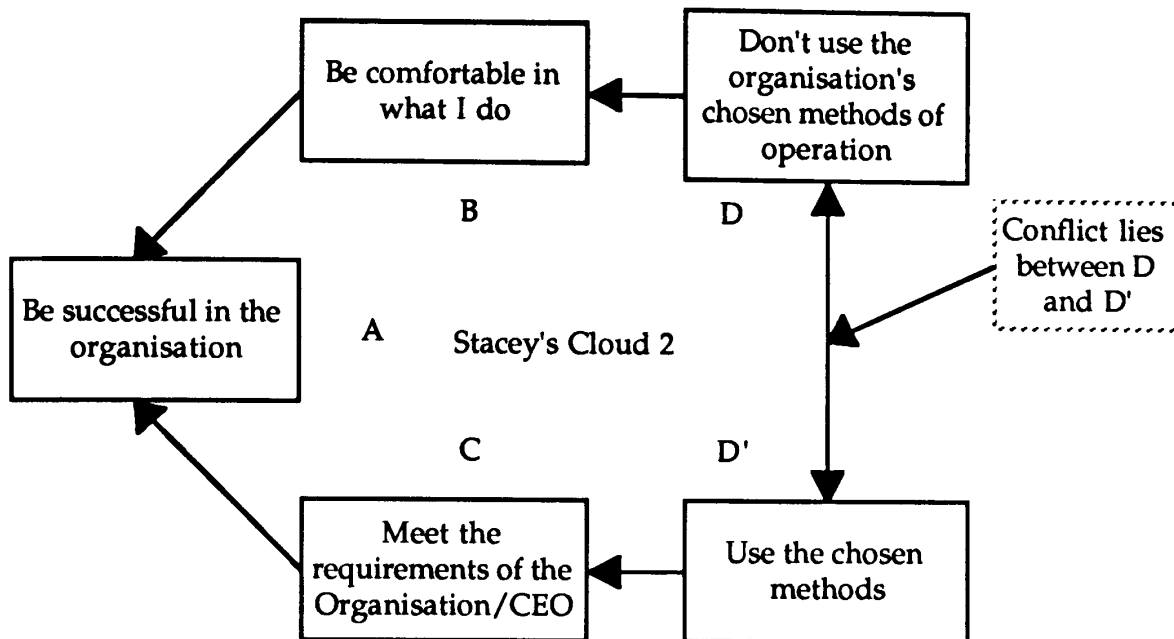
Figure 5.26 The second cloud of the consultant

Stacey found that she had to ask very searching questions of herself and where she was going in her life. This was not a comfortable period for her and the pain of staying in the organisation was matched by the thought of leaving. At the time of writing Stacey is still in the organisation but is very much a peripheral figure with no real input on both day to day operations and long term strategy.

Review of Chapter Five

This chapter has been concerned with an examination of the data collected as part of this research. In most cases the clouds were developed at the time. Some were developed over time during which the individual was able to verbalise better the issues faced. It was observed that when the impact of cloud was felt the level of emotion was high. Each of the clouds presented as part of the case studies were only a small fraction of the total number encountered during the time of the study. The conflicts depicted within each cloud are always a function of strong emotion on the part of the owner of the cloud. The time taken to verbalise each cloud is both a function of this emotion and the skill of the researcher in developing

them. The latter improved over the time of the research considerably. At the same time the ability to surface the assumptions also grew in both competence and confidence. As a result of this, it is now relatively straightforward to teach the cloud process in this way and for the individual to resolve these types of conflict without recourse to any outside party.

The point of breakdown in the implementation process was found to be the point at which unresolvable conflict appeared. The clouds represent the level and types of conflict, which prevented the successful completion of the improvement project. The TOC/TP approach had been instrumental in bringing the individual to the point of recognition that there was a conflict and that the success or otherwise of the improvement now depended on the removal of that conflict. This concludes the descriptions of the case studies.

The next stage is to examine the clouds in more detail to seek a common thread that might exist through them and which points the way to a generic cloud, which can encompass all or most of the individual clouds, contained within this chapter.

Chapter Six

6.0 Introduction to the analysis of, and the conclusions drawn from, the Case Studies.

This chapter is concerned with a deeper analysis of the case studies described in chapter five. This begins with the creation of a composite cloud derived from those discussed in the previous chapter. This chapter then discusses the iteration that took place and presents a composite cloud which, it is argued, is a generic cloud acting as an obstacle to the implementation of change. The chapter then returns to the change models first presented in chapter two and revises them in the light of this generic cloud. The chapter then presents a theory for one aspect of non-performance in implementing change and links this into the literature first described in chapter two.

6.1 The development of the composite cloud.

The step from having a set of clouds drawn from a range of differing situations, people and environments to one single cloud that encompasses the set is relatively straightforward and was described in chapter five. Examining each box in the cloud in turn, and bearing in mind the questions which each box contains, what is being sought is a single statement which captures the statements in each individual corresponding box in the various clouds. In each of the clouds of chapter five the people involved highlighted both their frustration and their desire to achieve something significant. Examination of the clouds of chapter five revealed that in almost all cases they had a clear goal in mind, either related to the organisation or to their own personal development in either careers or organisational terms. This can then be placed in the A box of the composite cloud. This is shown in figure 6.1.
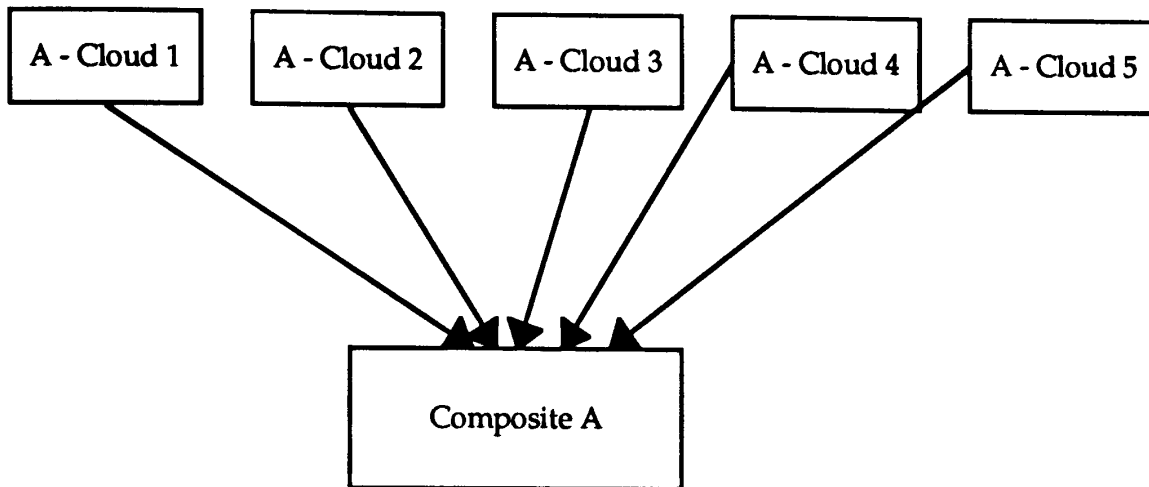
Figure 6.1 The construction of the composite cloud

The next step is to repeat this for each box in the individual clouds. It is important to try to identify the threads that may pass through most or all of the clouds collected rather than to try and examine each one in turn. This follows the procedure outlined at the start of chapter five. In this way the C box concentrated on attempting to deal with organisational blockages and problems in order to achieve the goal as written in the A box. For example the cloud in figure 5.4 suggests working as a team, the one in figure 5.13 expresses the need for delivering the targets set as the requirement for achieving the goal. The entries in the D box and the D'; box were all driven by the conflicts felt by each of those participating in the research and the common thread was initially suggested as being the conflict between not changing in D and changing in D'

The problem lay in what to place in the B box. This proved to be the most difficult as those participating found it very hard to say what was preventing them from implementing the proposed solution. The researcher took the opportunity to share this cloud at this stage with a number of people working in the same field. This was the first instance of involving other people in the analytical phase of the research. As discussed in chapter five, an early decision of the research process was not

to involve other practitioners in the same field at an early stage; rather to wait until there was a single composite cloud in existence, one which was not yet complete but sufficiently developed for valuable discussion to take place. The difficulties surrounding the phrasing of the content of the B box was considered to be an appropriate point for such widening of the involvement. The people invited to participate at this step complied with the assumptions outlined in chapter five. They had previous knowledge and skill in the use of the cloud technique. They were familiar with the subject area of the people from whom the data was collected. They were also the people chosen to assist with the validation of the generic cloud, which will be discussed later in this chapter. The people chosen were Dr Goldratt and Oded Cohen of the Avraham Y. Goldratt Institute, Prof. Alan Leader of Southern Connecticut State University, Prof. David Bergland of Iowa State University and Dr Jack DeGoia of Georgetown University, Washington DC. They were each invited to comment on the various suggestions for the content of the B box and to compare it to their own experience. The debate surrounded the need for the individual to be safe and to feel secure in their work environment. This was derived from statements such as those in figures 5.10, 5.11 and 5.12. This led to the first statement in the B box in figure 6.2.

Once the process of determining the entry for each box in the composite cloud was completed, the cloud was then checked by reading the logic in the manner described in chapter five. The strength of the cloud was also checked through the nature of the cross-connections. The first iteration of the cloud is shown overleaf in figure 6.2.
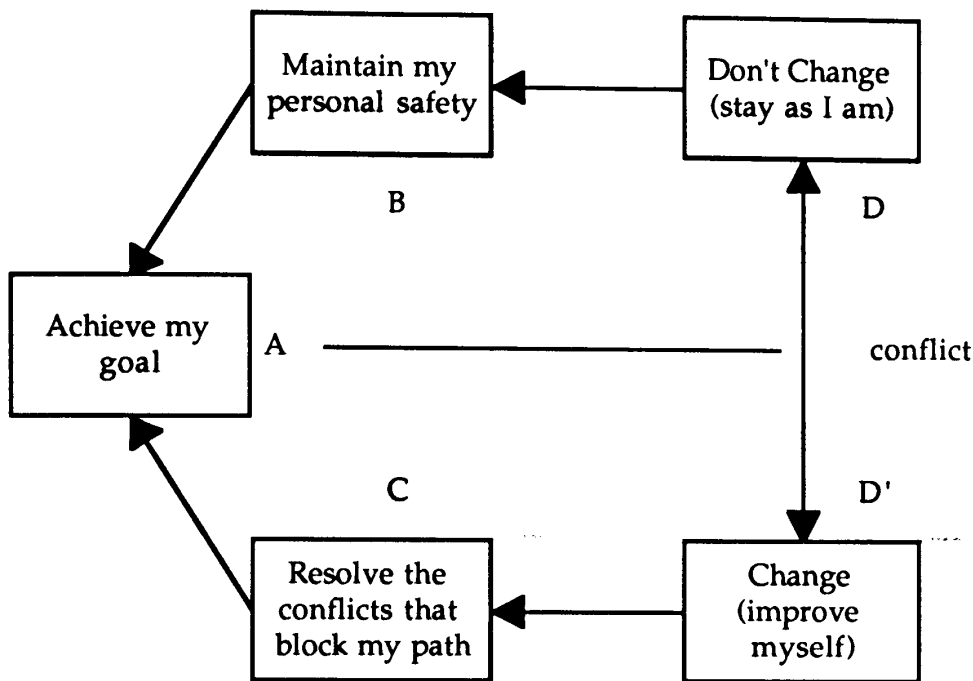
Figure 6.2 The composite cloud (first attempt)

The second step is the surfacing of the assumptions that lie beneath each arrow. This in turn checks the logic of the cloud once more and when the statements as written in each box fails to capture the entities in the individual boxes, the composite cloud is re-written and thus upgraded. In this case the entities did not quite capture the essence of what concerned the individuals. The next figure, 6.3, shows the second iteration of the composite cloud.
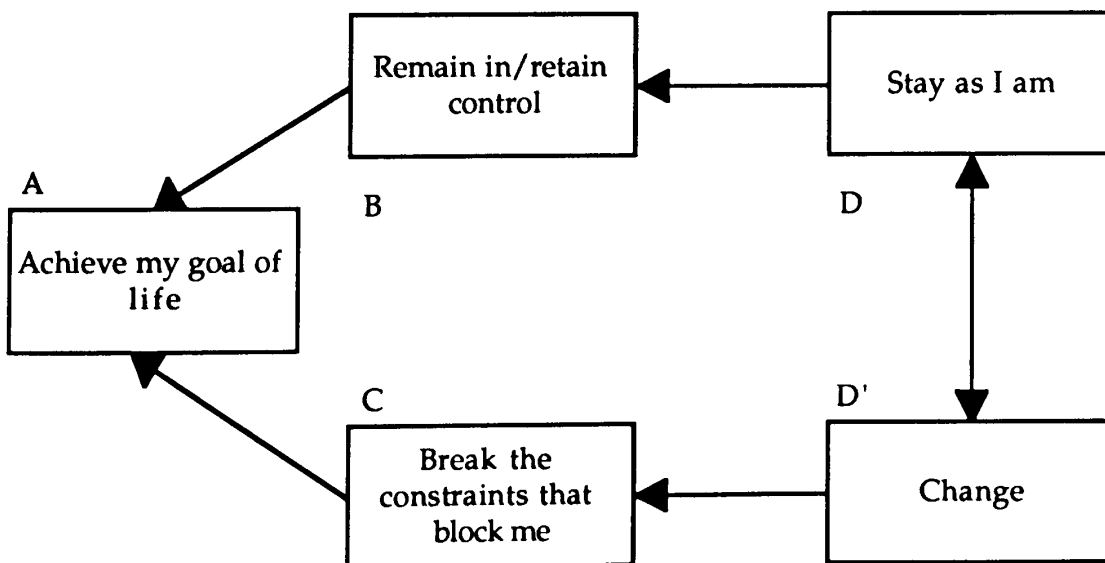
Figure 6.3 The composite cloud (second attempt)

The cloud reads as follows: "In order to achieve my goal in life I must break the constraints that block me", and then, "in order to break the constraints that block me, I must change" However, "In order to achieve my goal I must remain in/retain control" and then' "in order to remain/retain control I must stay as I am".

The logic of the cloud is as follows. The individual knows that there is a goal to be achieved. One necessary condition for the achievement of that goal is the need to break the constraints that block the way forward. In certain cases this will involve personal change. The change may be in what is done, the responsibilities assumed, the actions that are necessary and so on. However the change is seen by the individual as a threat to the other necessary condition, that written in the box B of the cloud. The logic is that if the individual has to change then control is lost. That cannot be countenanced and therefore the change does not take place. The next step of surfacing assumptions was carried out focusing in particular on the arrow B - D, as this is the arrow that should be focused on, with the result as shown overleaf in figure 6.4.

1. It's my goal.
2. This is my job.
3. This is what I am supposed to do.
4. I am responsible for the goal.

1. This is a function of safety/security.
2. Change is a threat to my security/safety.
3. I do not know how to effect change without puttng myself at risk.
4. I am not in full control of the change process.
5. It's not my problem - its lies outside my span of control
6. The proposed change is not my idea - it is a function of my own failure.

A
Achieve my goal of life

B
Remain in/retain control

C
Break the constraints that block me

D
Stay as I am

D'
Change

Figure 6.4 Assumptions related to the composite cloud

The key issue that arose out of this analysis was that the current paradigms of the individual, what Argyris (1992) calls the 'governing variables' and what Checkland (1981) calls 'W', were key factors in governing the decision-making process of the individual, especially when considering change which affected them personally. In each of the clouds of chapter five, the current, paradigms of the individuals were effectively locking them into the status quo thus preventing the proposed change from taking place.

What the composite cloud was demonstrating was the ability to verbalise this locking of the individual into their current paradigm. This led to the description of the composite cloud as the Paradigm Lock Cloud. Once the cloud had been verbalised in this way, it was possible to return to both the

data collected and some of the people involved checking whether this cloud captured their predicament. This led to the final step, which was to examine whether the apparent dysfunctional, irrational behaviour on the part of the individual, which was giving rise to the inactivity and defensive behaviours could be explained by the Paradigm Lock Cloud (PLC). This analysis led to the final iteration of the cloud as shown below:
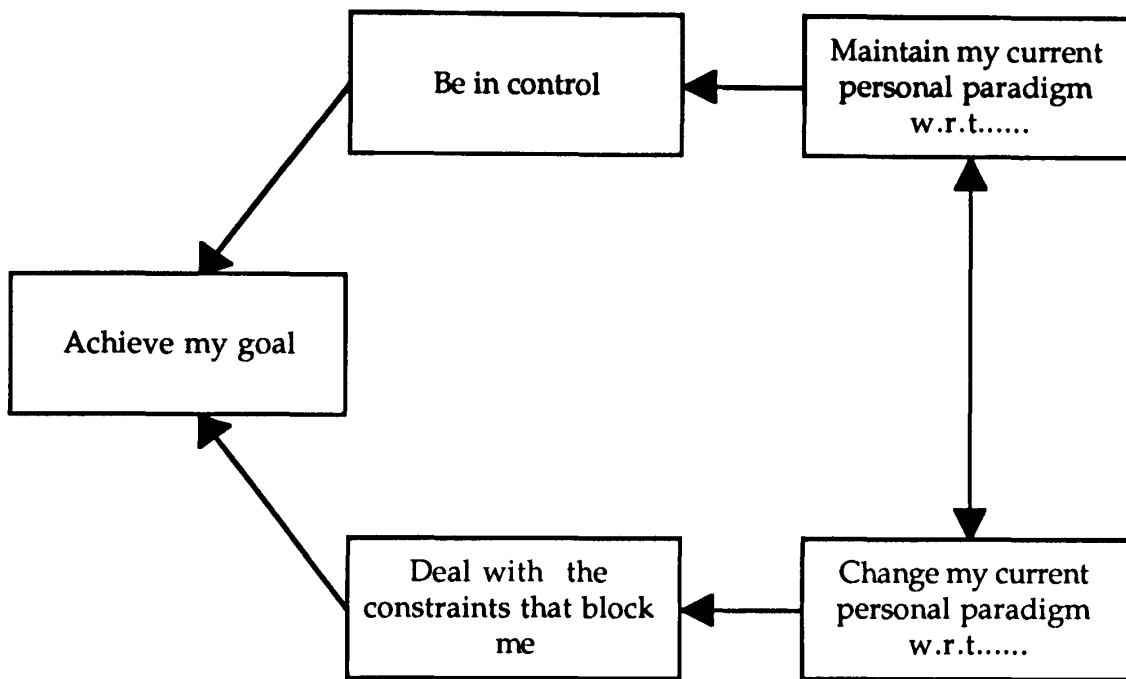
Figure 6.5 The Paradigm Lock Cloud

The personal paradigm is simply defined as the set of values or beliefs that the individual holds about a particular subject hence w.r.t. contained within the boxes D and D'. It might be about cost accounting, it might be about production scheduling, it might be about any area where some change is required. The key element is that the individual holds this set of values and is not minded to change them. For each of the people in chapter five there were many areas of their lives where change was not an issue or a blockage. However when the proposed change was seen by the individual to significantly threaten a personal paradigm then the lock came into play. They often knew that change has to take place. They had, in this research, been involved in both the analysis of the original

problem and the development of the solution. However, come the moment of implementation, when no other avenue was open to them, the full power of the lock was activated.

6.2 Linking the Paradigm Lock Cloud (PLC) to the Case Studies

Given that the PLC had been derived from the data collected as part of the case studies, this next stage required that the new cloud be checked against those who had taken part. Also, as an extension of this validation process, the cloud and the process of construction should be exposed to other practitioners active in the same field. Therefore validation followed two distinct avenues. The first was returning to many who had taken part in the original data collection and invite them to consider what had been developed and to relate it to their own environment. The clouds were presented to them and observations invited. This process proved to be reasonably successful in that though not all were able to return to the review and validation process, those who did participated without hesitation. The communication of each cloud followed the same path. First they were invited to comment on the conflict they had themselves experienced. Once this was confirmed, they were asked to examine the composite cloud and the resulting generic cloud. They were asked first whether the new cloud was clear to them. Secondly whether it was relevant to them personally. Of the seven people that took part in this part of validation all supported both the generic cloud and the impact it had on them personally.

Of course not all that took part in the research were able to complete this activity and for subsequent research it may be more appropriate to ensure that all those people whose clouds are used for the construction of the composite cloud are able to validate the outcome of the analysis. However, based on those who did take part, this validation exercise led to

confirmation that the PLC was a clear verbalisation of the internal conflict they had felt at the time. For further research more time could be given to assessing the generic cloud in conjunction with all those who had taken part. This could be done through electronic media such as the Internet. Any method that reduces the time involvement of the researcher will add to this element of validation.

Gaining a level of confidence in the applicability of the cloud to the original data set is one thing, checking whether it applies to a new, wider set is another. The second element of validation involved the use of other practitioners in the field. The importance of peer review is vital in this type of research. Once more the opportunity to show the cloud to others was taken, the initial group being those involved in the earlier stage of determining the content of Box B. They were chosen first because of their skill and knowledge of TOC and the use of clouds in particular. Second they were chosen as they had access through their own university departments to more potential candidates for the research. In other words they had their own group of people who could test both the cloud and the process of obtaining the data. As they were experienced in the use of clouds it was expected that they would have similar skills in pattern recognition, a role which is vital if the creation of the composite cloud is to be readily achieved. Finally, it was thought that they would have the necessary time to devote themselves to this activity.

They were each asked three questions. First, could they, from a group of people, to which they have access, determine first that there is this blockage, this obstacle to successful change, which lies at the heart of this research? Second could they build the individual clouds of each person that meets this criteria and then build a composite cloud? Third, having built their own composite cloud, could they compare it to the one proposed within this research and respond with their results.

There are problems associated with the approach adopted for validation. First there is the question of whether those asked would have the necessary time to carry out the validation. The second is whether they have, at the time of asking, a group they can use as a potential source of data. The people chosen all met the criteria set in chapter five and it is clear that without the required level of skill in the use of the cloud technique, it would be very difficult to replicate the original study. Indeed time itself is a problem as to date only one of those asked has been able to respond, which is dealt with in chapter seven. Some have given feedback in private which suggests that they have found similar instances of conflict leading to implementations being stopped, or not started at all. They suggest that the PLC is operating within the environments they are investigating but it is too early to accept this data as validation. What cannot be avoided is that there is a requirement for anyone seeking to validate this research to have a good working knowledge of TOC and Clouds.

6.3 Linking the Paradigm Lock Cloud to models of change.

In chapter two a simple model of change was described. Given the determination of a clearly verbalised obstacle in the form of the PLC the next step was to review the model in the light of the cloud. The original model consisted of four stages, which were now seen as insufficient to describe the processes taking place. This led to the first extension of the original model to that shown overleaf in figure 6.6
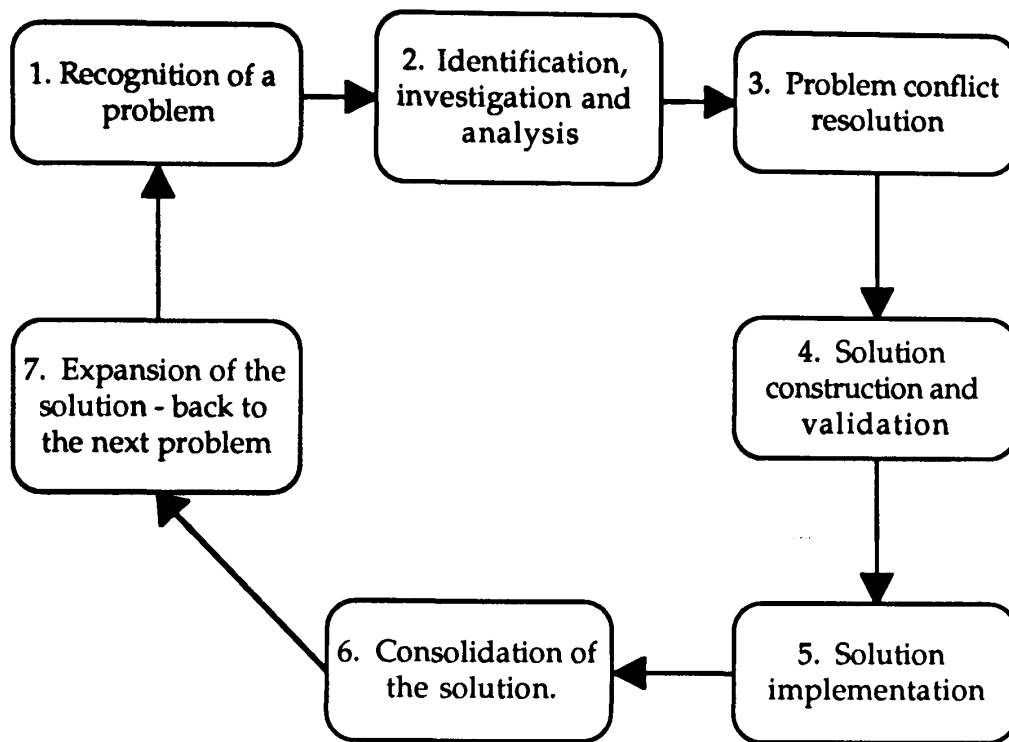
Figure 6.6 First review of the change model

Through this expansion, the increased level of detail highlighted, with greater clarity, the stages of problem-solving. One element was still missing, namely, that in many cases the model did not proceed past stage 5, solution implementation. Indeed often no implementation took place at all. It was this factor that had led to the description of the PLC as one source of non-completion. Noting this omission led to the next enhancement of the change model as shown in figure 6.7. This shows the change process surrounding the implementation stage in more detail and in particular the arrow under which the PLC acts.

It should be noted that there were occasions when problems did occur, but they fell into the category of a rational or functional explanation for the non-performance. In those cases the people involved simply returned to the part of the process that required further work and carried it out and then moved to a successful conclusion. Examples of these included times when the original analysis was found to be wanting in some respect, perhaps inadequate analysis of the market, or poor product development.

In other cases it was the recognition that the problems being addressed were in fact not the correct or the most urgent ones and this forced those involved to return to an earlier stage on the model and re-evaluate their work and possibly change tack altogether. These reasons for not progressing with the implementation were seen as rational. However this research has shown that there is also an irrational, dysfunctional force operating that prevents the implementations taking place. This led to the revision of the change model to include that factor. For this research the key area of analysis was that shown by the thick line in figure 6.7
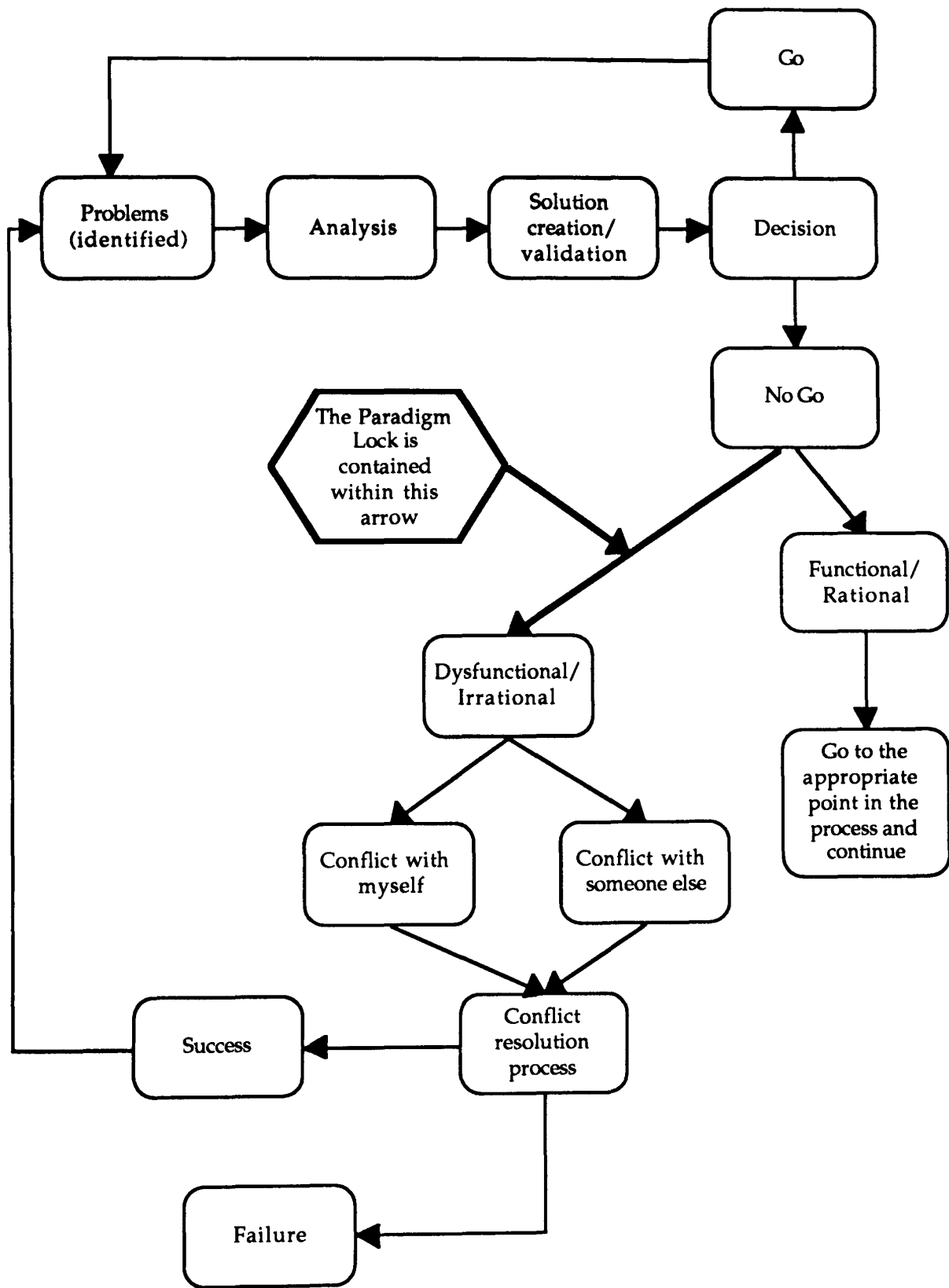
Figure 6.7 The Change Model incorporating the PLC.

The obstacle to change first considered in chapter one and developed in
the research questions of chapter three is the Paradigm Lock Cloud acting
at the point shown in a change process.

6.4 The Impact of the Paradigm Lock Cloud on the individual

People for whom this acts as an obstacle feel that there is no way out of their situation. The logical effects in terms of outcomes of their situation are very clear; often the causal relationships behind the logic are not.

If they are involved in attacking a problem it is reasonable to assume that some form of change will have to take place. Where the change does not affect a personal paradigm the individual has no difficulty in accepting the proposed change, it simply takes place. Where the proposed change violates a personal paradigm then the PLC begins to take effect. Decisions, which can be made in line with the personal paradigm, are relatively simple to make, those, which undermine the personal paradigm become extremely difficult. If it is possible, then the decision to go ahead with the change is postponed. If this is not possible, then other delaying tactics are brought into play. Hence the personal paradigm becomes a barrier to change which leaves the individual unable to deal with the original problem or constraint. This in turn means that the original goal, written in box A, cannot be achieved, because dealing with the problem/constraint is a necessary condition. This leaves only what is written in Box B as the goal of the individual. Within the case studies many involved found that their primary purpose at work was to protect their personal paradigm.

6.5 Conclusions of the chapter.

This chapter set out to develop the composite cloud from those collected during the research. Just using those described in chapter five produced a composite cloud which was then developed into a generic cloud known as the Paradigm Lock Cloud. The impact of the cloud on the change process was identified by examining a change model first described in chapter two and further developed here. This led to the primary finding of this

research that the cloud known as Paradigm Lock Cloud lies behind the behaviour pattern of those tasked with change but who fail to do so in a dysfunctional, irrational manner. They were trapped in a W of such power, a governing variable of such importance to them personally, that any other option was not allowed. The obstacle to change which started this research, and which forms the core of the research questions is this cloud.

The final chapter of the research considers how to approach dealing with this cloud, discusses further analysis of the method on three new clouds and raises suggestions for further research.

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Chapter Seven

7.0 Introduction to the conclusions.

This research set out to determine why implementation projects, mainly in manufacturing companies, fail even when the analysis of the problem and the development of the solution and the implementation plan seem to have been properly dealt with. Access to a group of people tasked with such projects was negotiated at the outset of the research phase and led to the collection of data in the form of clouds. This was shown in chapter five.

In chapter three the research problem was defined in the form of three research questions (see page 55). The first was, "Can the block to improvement which is by definition dysfunctional, be identified?" The second was, "Can the block be verbalised in a clear and logical fashion in such a way that allows for proper analysis of the block?" Finally, the third question asked, 'Is it possible to verbalise the block in such a way that it is possible to determine the necessary actions that must be taken in order to remove the block?"

The data collection focused on the first two questions initially and led to the creation of the Paradigm Lock Cloud (PLC). This is the block as suggested in the first two questions, and through the use of the cloud technique allows for a proper analysis of the block.

Following the ability to develop the PLC, the relationship of that cloud to the current, ruling paradigm of the individual was clear. The framework outlined on page 58 was found to be the case in those examples cited in chapter five. Further studies carried out in the UK and described later in this chapter, also support the nature of the framework and the impact of

the PLC. Therefore the area of dysfunctional, irrational behaviour highlighted by the arrow in figure 6.7 of chapter six is the area where the PLC is most active and acts as a barrier to change.

As the PLC identified in chapter six is considered to be a sound articulation of the barrier to change which was first raised in chapter one and discussed in more detail in chapter three, then it follows that it should be overcome. If this obstacle exists then it can be safely assumed that no real improvement can take place until it has been overcome.

This chapter then is concerned with a number of critical issues. The first is a return to the question of validity first raised in sections 6.2 and 6.3. This is primarily a question of the internal validity of the research process. The second element of validity is the question of replacability. Can the process described be used by others? What are the parameters of such use and what results have been obtained to date, if any? This chapter also contains a clear statement of the contribution to knowledge as a result of this study. Other discussion points contained in this chapter discuss the possible approaches to deal with the removal of the paradigm lock and a discussion on further areas of research. In particular the setting of the paradigm lock cloud into a sequence of clouds that affect change programmes and a structured approach to implementing change.

7.1   Validation of the research process

There are two key areas of validity. This first is the level of validity that can be accorded to the process used by the researcher. This entails an analysis of the process used and a consideration given to the question as to why the process seems to work in producing the results gained. The types of questions include the ability to set boundaries for the research, checking the appropriateness of the chosen approach and the lessons learned. The

second area of validity is external. Can someone else replicate the study and the results of the research described here. This is an important dimension in terms of the replication of results but also the confidence that can be gained in the research process itself.

7.1.1   Discussion concerning the validity of the research

When it comes to determining the method for research the criteria set by Bouchard (1976) was "...asking the right question and picking the most powerful method for answering that particular question" (p402). The questions for this research were set out in chapter three. The choice of method was determined by the specific nature of that set of questions. As they concerned an hypothesis that had at its core a series of elements that were hidden from view, the method had to be capable of questioning and checking causality. This need to check behind initial responses led to the requirement of active participation of the researcher.

Equally there was a recognition that the approach must deliver verifiable results, capable of test and replicability. This was very much in line with Kerlinger (1973) and his argument that science sets out to explain what is happening, the explanation being termed a theory. Thus the research focused on a qualitative study due in large part to the need to determine the causal factors that exist within the lives of the people participating, how they function within the organisation, and how they interact. It was felt that quantitative methods would not be able to produce the richness of data, or the explicit causal connections sought after as part of the research questions.

Thus the process led naturally to qualitative methods developing a series of case studies. It also meant that the case studies would be developed in real-time in the field. This allowed the researcher to check progress and to

change the way in which the involvement of the individuals was achieved. The intention of this was to discover the significant variables pertaining to the research and to discover relationships between them. This active participation by the researcher clearly in the role of a participant observer, and the research itself, took the study into the field of action research.

As a result of this it was clear that there is a necessity for the role of the researcher to be clear. At what point is the research the prime activity and when is it not. Confusion in the mind of the respondent is a clear danger without such clarification of roles. The need to have such clarification was clear from the outset. The negotiation with the respondent was undertaken at the earliest point. Every stage of data collection was clearly identified with the respondents in advance.

The data collection also involved the use of a specific tool – the cloud. Were the respondents not to understand what was required of both them and the technique there could well be a danger of dissonance, of detachment from the study. The active participation of the respondents was fundamental, as is their need to be honest to both themselves and the researcher. Therefore the use of the tool had to be demonstrated to the respondents. They had to recognise what the tool was trying to achieve. Here the role of the researcher is vital. His knowledge of the tool, and the ability to create empathy is a core element of this aspect of data collection. Creating the right environment where people feel they can open up and be candid about is what had to be achieved from the outset. This requires the researcher to have that ability to put people at ease and allow them time to discuss difficult issues without pressure. Often the time to collect one cloud would be spread over a number of sessions with each individual.

Once the data had been collected it was checked by inviting the respondents to verify what they have said by examining the clouds as written. The fact that each cloud was written down significantly aided understanding and verification. They were able to correct any statements they felt did not capture the true nature of the conflict they were experiencing. This ability to correct what was written gave them confidence in both what they were saying and in the researcher. It was clearly accepted that the researcher was faithfully recording the clouds. This proved to be a major element in the robustness of the clouds collected. It is also very much in line with Hartley's (1996) observation that the key feature of such case studies is "..the emphasis on understanding processes as they occur in their context". (p227)

The study followed the format developed by Grant (1996) which was, first diagnosis, second action plan, third action taken and then evaluation followed by learning. The diagnosis was the hypothesis stage and the development of the research question and data collection method. The second and third were the actual phases of data collection and analysis.

The final two stages, evaluation and learning, are on going. The evaluation stage led to the creation of the PLC and subsequent external validation of the hypothesis. The key elements here include the skill of the researcher already described above. It also includes the ability to develop pattern recognition when moving to the creation of the composite cloud.

Learning is what this chapter is about but also other areas of further research outlined later in this chapter. Above all, learning is about the contribution to knowledge. As with action research a key element of this study was to determine working solutions to a problem identified. This is covered in section 7.3.

This research set out to determine the nature of the obstacles to change. In figure 6.7 a model was produced as a result of the data collected. For this research to have validity the test lies in the ability to challenge the model through rigorous analysis and replicability. This being a human activity system as defined by Checkland (1981) there are many facets of the people and the circumstances that were not captured. The question is whether what was captured is sufficient to sustain the results. Checkland reminds us that what is collected are "mental constructs, not would-be accounts of reality" (p249). People felt that they faced a major obstacle in their implementation. This obstacle is a function of many aspects not all collected as part of the research. This raises the question of "good enough"? Is the data collected and the subsequent analysis leading to the creation of the generic cloud good enough? Given the time allocated to data collection and the spread of people taking part there is certainly a reasonable size to the data group. The number of people taking part meant that there were a considerable number of clouds to form the core data set. That these clouds were also drawn from a wide section of companies, and levels within those companies adds to the credibility that can be attached to the data set. The research therefore included a significant number of people, with a number of clouds from each of them. Though more clouds could have been added it was found that further clouds did not change the nature of the core cloud at this point. Of course further data acquisition could add clarity to this statement but this is currently beyond the scope and timescale of this research.

7.1.2 External validation of the research

During the time given to writing this thesis, Oded Cohen of the Avraham Y. Goldratt Institute was pursuing analysis into the PLC and to determine whether he could replicate the work already described here. He was one of

the people chosen to both scrutinise the composite cloud construction and to validate the research itself. He is a skilled practitioner with TOC and clouds. He submitted, following a lengthy discussion with the researcher, the following four clouds. The background to the clouds is that Cohen is one of a group of people within the UK responsible for the introduction of the TOC to UK organisations and therefore has access to people who meet the criteria outlined earlier. In this case Cohen derived the clouds from a group of people seeking to teach the TOC. There is a requirement that such teaching takes both the student and the tutor towards their respective goals. The goal of the Institute is "To generate and disseminate knowledge, which brings results" and knowledge is defined as that which brings benefit to the user. In examining the performance of tutors, Cohen developed the three clouds and then developed them using the process contained within this research to develop a composite cloud. He then compared his composite cloud to that developed within chapter six and the PLC itself. The first cloud is shown below: -
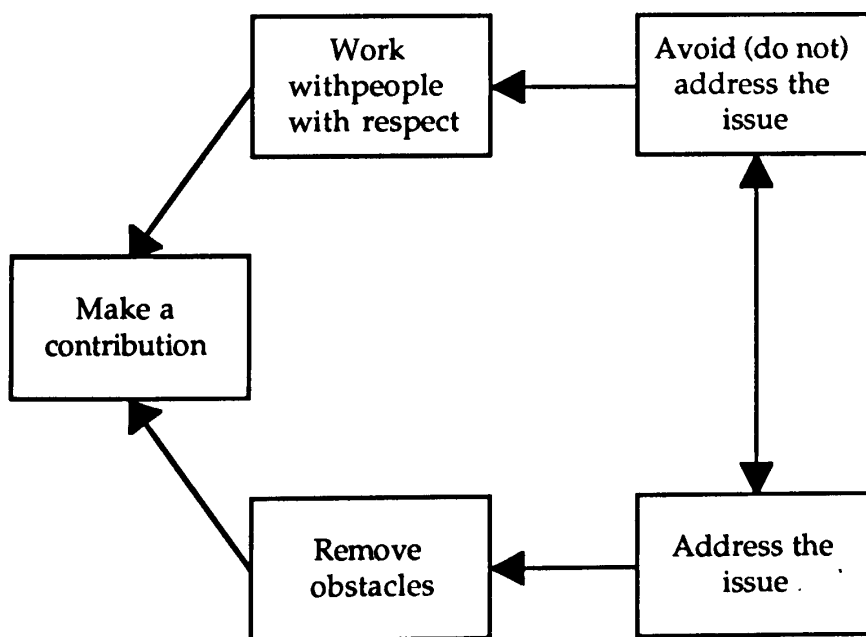

Figure 7.1 Cohen's first cloud

This cloud centred on the perceived need to avoid upsetting or giving offence to students when validating their work and giving feedback. It is

the cloud of the tutors Cohen was working with at the time. The cloud was proving to be a significant obstacle for the tutor trying to make a contribution to the knowledge acquisition of their students. The tutors felt that if they gave feedback they may do so in a manner likely to cause more problems. They felt that they did not have the confidence to use the process expected of them, the TOC/TP, and that therefore they were compromised in their role as tutors.
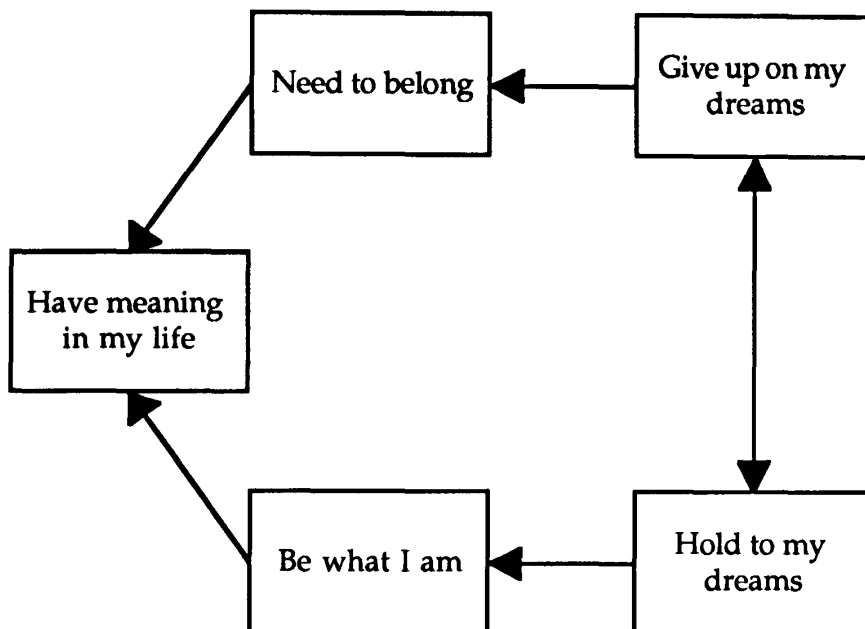
Figure 7.2 Cohen's second cloud

This cloud was also derived from the same group of people as the previous cloud. This was seen as a function of the conflict they felt between, on the one hand trying to achieve what they had set out to achieve and at the same time trying to accept the reality of their current position. The conflict arose primarily because they did not set out the necessary conditions to achieve their goals. The need to belong, in this case to a specific network of colleagues, often led them to give up what they really wanted to do in their lives.
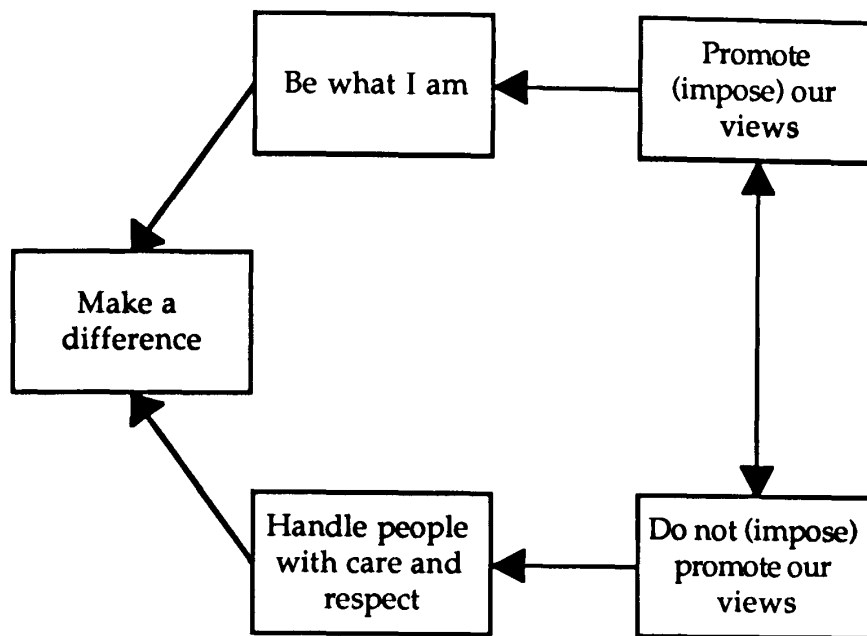
Figure 7.3 Cohen's third cloud

This cloud, the final one of the set of three from the tutors is about the methods used in teaching TOC/TP through a Socratic approach. Many of the people coming to learn about the TOC/TP, the focal point of the work Cohen and the tutors were involved centres on the need to use the terminology of the students rather than that of the TOC/TP. The intention is to use the Socratic approach, which starts with the use of questions where the assumption is that the person being questioned already knows the answer. Then follows the need to time the questions and ensure that the language used in the question is that of the person being asked to give the answer. Cohen found that in some cases this requirement of the Socratic approach was creating a conflict between demonstrating confidence in the use of TOC/TP and the application being considered, and showing a grasp of the students own environment. Teaching through the use of the Socratic approach involves avoiding quite clearly the imposition of views from the tutor. The student must learn by having the knowledge developed from within themselves. Being unable to deal with this properly led to the creation of the third cloud in figure 7.3 above.

Given these three clouds, and following the same path as the researcher, Cohen produced the composite cloud in figure 7.4.
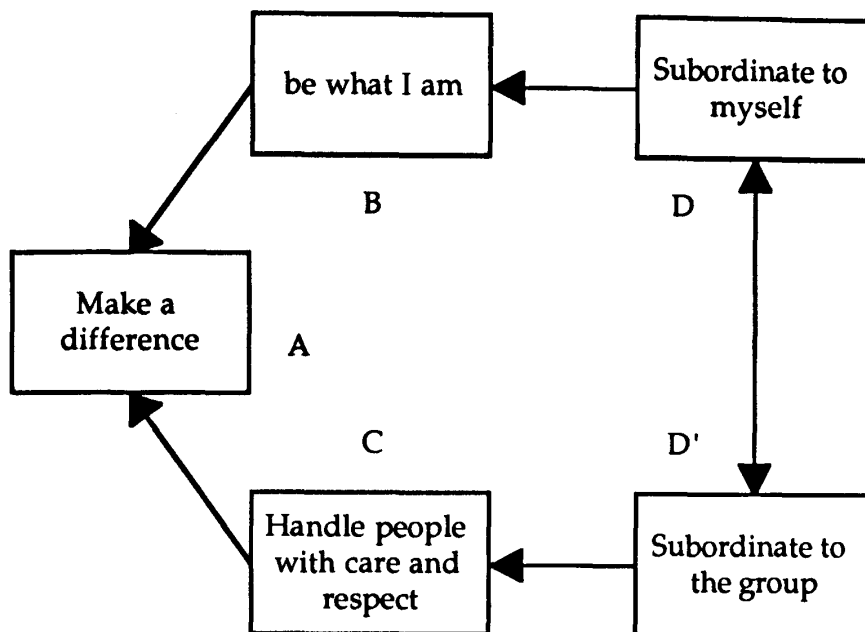
Figure 7.4 Cohen's composite cloud

This cloud captures many of the same issues that are determined in the PLC of chapter six. Once more the lock is in evidence in that by holding to D and not moving to D' that are unable to deal with C – "Handle people with care and respect". This leads to the recognition that they are unable to achieve the goal, "Make a difference". This leaves them with staying as they are, in other words "Being what I am" with no obvious opportunity to change. The importance of subordinating themselves and what they want to do is in line with the statement in the D box of the PLC, which is "Maintain my personal paradigm w.r.t...". If they shift to the subordination to the group they will consider that they are likely to lose control, the requirement written in the B box of the PLC. In this way Cohen has identified the same obstacle as that proposed, and verbalised, within this research.

7.2   Contribution to knowledge

This research set out to answer the questions first raised in chapter three. These questions focused on the reasons why the change process in manufacturing organisations stalled. In particular the causality that exists under the arrow of figure 6.7 under which the paradigm lock is deemed to exist. The study identified a number of conflicts which a group of people from manufacturing companies experienced whilst trying to implement change. It is not the nature or the existence of the conflicts that constitutes the primary contribution to knowledge.

The primary contribution to knowledge is the use of the evaporating cloud technique to both verbalise these conflicts and to use the technique to develop understanding about the nature of the conflict. It also created a picture of the environment in which it exists, and set out to gain the consensus of the person with the individual conflict that it represents a clear obstacle to the change process they are attempting to implement.

Using the technique known an 'evaporating clouds', part of the process tools of the TOC/TP, a number of these conflicts were captured. The technique attempts to verbalise the conflict the individual is experiencing in a clear and understandable way. These clouds, individually, captured a specific conflict that the individual was experiencing at the time. Using the questions contained within each of the five boxes of the cloud structure, covered in chapter four, the full cloud was obtained. Through the use of this process, based on the logic of necessity, the conflict so defined allows the individual to understand the impact of the conflict on themselves and on what they are trying to achieve.

The collection of this data involved the active participation of the researcher. Asking the questions contained in each box and seeking clarity

of the answers given in order to fully understand the true nature of the conflict was an important step in the process. The clarity was gained by asking questions concerning the statements offered by the individuals and ensuring a clear verbalisation of their answers. Having accomplished the task of verbalising the conflicts it was then found possible to understand the causality of the conflict through the surfacing of the assumptions that lies beneath each arrow of the cloud. This made the conflict very visible to the individual and its impact. They could challenge the logic of the cloud, a process that enhanced the understanding in each case.

A process of integration, carried out by the researcher followed this, in order to produce one composite cloud which encapsulated the individual clouds collected. This process centred on the ability of the researcher to recognise patterns of behaviour in each of the clouds and to then build that pattern into a single statement.

Once the composite cloud was developed the researcher then returned to some of the individuals and asked them to check the wording of this new cloud and to compare it to their own circumstance. This active participation of both the researcher and the respondents provided the necessary confidence in the robustness of the composite cloud. At this point the cloud was considered to be a generic cloud on conflict associated with the implementation of change. Going to new respondents to determine whether they have experienced the same generic conflict further validated the existence of this cloud. This too proved successful, though the results are not included within this study.

7.3   Discussion concerning overcoming the paradigm lock

One of the basic assumptions of this research is that the people taking part were keen to improve the performance of their organisation. Indeed in

many cases they were the driving forces for the improvement project. This was nearly always reflected in the way they suggested what was written in box A of their various clouds. It was also accepted that change would be a part of the solution. They accepted, and understood that they could not achieve what they wanted without change. That dealing with constraints to improve performance carried with it a requirement for change. It also became clear that many of those taking part wanted to work in a safety zone where they felt confident of what they were doing and did not feel threatened in any way. This is a measure of their self-perception, and was reflected in what they wrote in the B box. This is very much in line with what Argyris (1996) calls the "governing variables" and what Checkland (1981) calls "W". The main difference here is that whilst both Argyris and Checkland identified that there were forces at play in the decision-making process used by people, and that in some cases these forces worked in favour and in some cases against what was being proposed, they did not clearly verbalise the force which prevented successful change.

This research develops their work and takes it to the stage of identification of that force which leads to an understanding of the obstacle, which leads to the dysfunctional/irrational failure to implement. They did not capture the real nature of this obstacle. Whatever is written in the B box is seen as a function of the control the individual needs within his or her life. The ability to stay in control is seen as central by those taking part in the research. The importance of this is made highly significant when a proposed change is seen to threaten that level of control. The proposed change may be rooted in powerful, compelling, logic but the threat to the individual, real or imaginary, is even greater. This is the nub of the paradigm lock. The individual feels trapped with no possibility of escape. It follows that if improvement is to take place then this obstacle must be overcome. It must be done in a way that allows for the constraint to be

fully and properly dealt with, and at the same time allows the individual to retain control.

As the technique to verbalise this conflict is a cloud, then it follows that the process of surfacing assumptions will enable those, which are erroneous to be identified and dealt with. The primary area to focus attention would be the arrow B – D of the PLC. Recognising that this is a generic cloud leads to the conclusion that any erroneous assumptions surfaced here will probably be generic in nature. For each individual there will also be assumptions unique to that person and therefore any analysis undertaken to determine the way forward will have to take note of both generic assumptions and specific ones related to that individual. For the purposes of this research no attempt has been made to surface generic assumptions from each person. However before the process of surfacing assumptions can be considered one factor stood out from the research.

As noted in chapter five and also shown on figure 6.7 there were people for whom this cloud did not exist. They were able to implement change even when they themselves had to change what they were doing. In examining those who were not affected by the cloud three factors were clear. The first was that each of them was able to fully subordinate what they were doing in order to achieve the goal. Whatever was written in Box A was very much more important than anything that might have been written in Box B. They recognised the importance of the goal, the objective, related to their own aspirations. They accepted that the obstacle was of greater significance to the organisation and that even though they felt certain aspects to be important to themselves, they always came second to achieving the goal. In other words they were able to subordinate themselves to the goal, or objective, of the organisation.

The second factor was that they were prepared to take responsibility, and be accountable for the results of their actions. They did not seek to apportion blame if things went wrong; they simply went back to the solution and improved it. They recognised and accepted that they were part of the problem and also part of the solution. They were already prepared to undergo the type of paradigm shift that is necessary for real change to take place.

The third factor was that they were prepared to both give and respond to leadership. They might be ready and able to give leadership, but even though they might be the top person, they were still ready to accept ideas and suggestions from any level, and act on them. The combination of these three factors gave confidence that change would take place leading to a successful conclusion of the implementation. One area of further research is to examine these factors in greater detail and to then make a comparison between those who are successful and those who are not. At this point in time the three factors described here seem to offer a way forward in overcoming the PLC. This is a prime area for further research.

7.4   Areas for further research

Other questions, which form areas for more research, include whether the lock, if identified, can be broken before it has any negative effects on the improvement process. Would the same results be obtained if the level of active participation were reduced with the researcher merely observing and analysing without the involvement of the people being studied? Though the time taken to collect the data was extensive, the question of time is still relevant. Can the results be obtained in a shorter time scale? The feedback from the others attempting to replicate this study, and discussed earlier in this chapter, suggests that the same problems were experienced. They are now examining the results of this research with the

additional element of setting their analysis into a structured approach to implementations. This approach in itself is an area suitable for further research.

The hypothesis is that the structure follows six distinct phases as outlined below: -

1. Consensus on the problem – this means that the people tasked with improving the performance of their organisation agree on the nature of the problem and the impact it is having on the organisation. They may have used a structured logical process to achieve this level of agreement, or come to the conclusion through their own intuition. The important element is the level of consensus achieved.

2. Consensus on the direction of the solution – this means that the broad direction of the solution is agreed. There are few details of the actual solution, merely an outline that gives the people concerned enough to recognise that if implemented this solution will deal with the problem agreed in the first phase.

3. Consensus on the benefits of the solution – this is where the full solution is developed and tested. It may involve rigorous analysis of the proposed benefits or it may involve the use of outside consultants to validate the solution. What is clear is that the solution is checked prior to implementation.

4. Dealing with the possible negative outcomes of the solution – this is where the people involved bring the input from many others within the organisation in order to check for potential negative outcomes, should the implementation proceed. Again the process used is less

important than the checking of the solution against the intuition of the people within the organisation.

5. Dealing with the obstacles to prevent the implementation taking place – this is where the obstacles to the implementation itself are debated and dealt with. It is part of the process that every obstacle must be overcome if the implementation is to be completed successfully.

6. Making it happen – simply if all the preceding phases have been accomplished then there is nothing to prevent the solution being implemented. It is at this point that the paradigm lock is considered to become effective in the prevention of implementations.

It is felt that this study and the impact the paradigm lock has begins with the 6th phase. Further research should be carried out to confirm both the validity of the six phases, and the impact the paradigm lock has at this sixth phase.
One further aspect of this study raises the possible existence of levels of clouds leading to the paradigm lock. Following this research, the researcher considers that there are three levels of clouds operating in a clear hierarchy. The first level is that of a decision cloud. This cloud is about the decision to implement a particular solution. The decision therefore is between two opposing approaches each purporting to deal with the problem under review. The debate that takes place prior to the decision appears to focus on the merits of each proposed solution rather than the ability of the solution to properly deal with the problem. It is this debate that gives rise to the existence of the cloud.

The second level is that of a conflict of subordination cloud. Here the decision that led to the existence of the first level cloud, the decision cloud, has been taken. The assumption now is that the people within the

organisation will subordinate to the decision and implement it. This research suggested that this is not always the case and there were times when people said they would support an implementation and then failed to do so when required. There could be many reasons for non-compliance with the implementation, some of, which could be perfectly reasonable such as a decision to not proceed due a change in the market or a change in the management structure. Whatever the causality for non-compliance these issues present themselves as valid areas of possible research.

However the main thrust of this research has shown that for some people the proposed implementation becomes a threat to their current paradigm. This leads to the third level of clouds – the paradigm lock cloud. Further research could examine this hypothesis concerning a hierarchy of clouds and consider approaches which ensure that the first two levels are properly dealt with thus possibly avoiding the third, paradigm lock, level altogether.

The TOC/TP itself is subject to on-going examination and improvement. This research focused on the use of the TOC/TP to managers within manufacturing. The issues raised by the research are not unique to manufacturing but to any manager or indeed any person trying to achieve a goal. This raises one final question for consideration in terms of further research. If the TOC/TP is a generic tool for problem solving then it should work for any problem. This research examined problems generated in manufacturing environment, however they could equally be raised in another environment. The clouds of chapter five are not exclusively about manufacturing, they are about relationships between people. They are also about how people feel about themselves and their own goals in life. Perhaps the real power of these tools lies in the ability of the individual to develop a personal focus about what they want to achieve in their lives and how to do it. These questions are already being

raised and work has already started to develop TOC/TP in this way, but that goes beyond the scope of this research taking it into the realm of psychology and psycho-dynamics.

7.5   Final thoughts

The area of Action Research is one that continues to raise questions about the dependability of the results and the possible impact the researcher has on the group being studied. It would have been more difficult to obtain both the quantity and quality of the data without the access offered. During the research period the researcher was playing an active role with each participant in addition to the research itself. This had the advantage of allowing a clear and honest relationship to develop which encouraged those being studied to open up and share secrets that might otherwise not surface.

The clouds described in chapter five were the result of a considerable effort by the researcher in gaining the trust and confidence of the people concerned. The emotions raised by these clouds goes deep, yet lie at the heart of the change process. It was essential to encourage them to share these feelings and emotions and to help them verbalise issues that were in some circumstances hurting them personally. It is doubtful that these results could have been obtained without the active participation of the researcher.

However it was recognised that the very level of active involvement can itself lead to a lack of detached and objective assessment. Recognising that this is an issue goes some way to ensuring that it does not become a major problem. Any process that involves active participation will by definition raise these issues. For this research a distinction was made when working with the people concerned between the normal working relationship and

the research. They chose to come to the researcher with issues that they felt were important to both the work they were doing and the research itself.

The role of the researcher in this study was clear. However other people work in the same way with manufacturing managers. One final area of further research is to consider reducing the level of active involvement and develop the issues either through simple observation or through quantitative methods. This may itself have substantial difficulties but would go some way to address the issues raised by the approach used here.

The final observation of this research is the impact it has had on the work carried out by the researcher in various organisations. Through the identification of the PLC and the nature of the impact it has on the individual it has been possible to take time with implementations to ensure that the threat to the current ruling paradigm is reduced and that such implementations proceed without the problems faced within the research case studies. The research has demonstrated that it is possible to use the cloud technique to examine the ways in which people approach change and in a manner that they can readily

Acknowledgements

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Appendix One

A Brief History of the Avraham Y. Goldratt Institute

A Brief History of The Avraham Y. Goldratt Institute

Many of the Institutes' partners actually began working together in the early to mid 1980's in a company called Creative Output, the predecessor company to the Institute. During this time efforts were directed primarily toward the development and implementation of a finite scheduling system. As the scheduling system provided an effective software solution to the problem of scheduling, we soon found ourselves with a growing number of successful implementations and a growing organization.

For us, a successful implementation meant significant, continuous improvement in the company's performance. As it turned out, significant improvement in the company's performance was often accompanied by a change in the company's constraints, thus rendering the schedules defunct. As a result, having continuous improvement in the company's performance, through the use of scheduling software, required that we periodically send a rescue mission to readjust the schedules to match the company's new constraints. Needless to say, these rescue missions always required our best people. This was the beginning of what would later be known as "the revolving door syndrome," a situation where an increase in software sales would lead to an even greater increase in rescue missions which would eventually lead to our collapse, if this cycle is allowed to continue for too long.

Recognizing that software only provided answers to the questions asked, based on a given set of assumptions and corresponding relationships, and not the questions that needed to be asked, we began to introduce paradigm shift education, as a part of the software implementation. This paradigm shift education was referred to as "Thought ware," and was intended to be implemented hand-in-hand with the software. It was believed that this combination of software and "Thought ware" would provide the company, that decided to implement the software, with the conceptual understanding needed to keep the schedules aligned with the company's constraints. Furthermore, our experience had already revealed that the use of an approach based on finite capacity scheduling required changes in the company's mind-set, especially with regard to such things as resource efficiency. The result was a product offering that included software implementation in conjunction with a huge educational effort.

Finding the use of "Thought ware" and software together to be much more effective than just the software by itself told us that we were moving in the right direction. As such, we now faced another problem, namely the cost, both in time and money, to educate the number of people that needed to be educated if a company was to effectively go through this paradigm shift in production. Hidden

behind the specifics of production was an even greater need for better ways to communicate any good (paradigm shift) solution. The first satisfactory attempt to convey the thought process, the Five Focusing Steps, behind the production solution came in 1984 with the publication of The Goal, a novel written by Dr. Eli Goldratt with Jeff Cox. The Goal not only contained the essence of what, in later years, would develop into the Theory Of Constraints (TOC), but it proved to be an effective tool in enabling people to make the necessary change in mind-set. By the end of 1985 there were a significant number of readers who were able to effectively implement the solution outlined in The Goal. A trend that continues today.

With many more effective implementations of the production solution now coming from The Goal than from the software it was becoming apparent that software was probably not the first thing that most companies really needed to implement, but the last. The first thing being the tools to construct and communicate common sense (paradigm shift) solutions. With this realization came another, that we couldn't continue to operate within the confines of a company, whose purpose was to make money by selling and implementing software. As a result, in 1986 the Institute was formed with the stated purpose of generating and disseminating knowledge.

With our purpose now clearly stated and no longer obstructed we set out develop the tools to construct and communicate common sense (paradigm shift) solutions. Having the paradigm solution of production in hand and the need for better ways to communicate a good (paradigm shift) solution we began developing a more extensive set of educational tools based on the use of interactive computer simulations. Through the use of interactive computer simulations we were able to incorporate experiential learning, as a means of communicating this paradigm solution, into a series of Functionally (production, materials management, financial, engineering, etc.) oriented Education Workshops (FEW's). Each of the workshops was designed, based on the particulars of a given functional orientation, to transfer the conceptual understanding of the solution through guided experiential learning. The FEW's provided us with better tools to communicate the generic production solution outlined in The Goal and would latter become an integral part of the TOC Production Application, commonly referred to as "Drum-Buffer-Rope," and "Buffer Management."

Through the continued application of the Five Focusing Steps to the area of distribution, a second TOC application was developed. This application is generally referred to as the "Replenishment" solution, where the availability of product to the end user or consumer is maintained by replenishing rather than "pushing" product throughout

the distribution system. Once again, to facilitate the communication of this common sense solution a set of educational tools based on the use of interactive computer simulations were developed. These applications provided the basis on which we could teach others the use of the Five Focusing Steps as a decision making process. In 1987 we offered the first Jonah program where we taught the Five Focusing Steps and their associated applications. Shortly thereafter we began to encounter the issue of generic solutions not always working in all areas, which only served to highlight that the process for constructing common sense solutions was incomplete.

The next application was in the area of project management. This solution brought with it the need to address a new type of constraint. With a project the key factor is the overall lead time from start to finish. The overall lead time being directly impacted by the project layout, which is often used in determining the "Critical Path" and the availability of the resources needed to perform each of the project tasks, many of which are not dedicated to the particular project. Recognizing the need to consider both the project layout and the availability of the resources required to perform each of the project tasks surfaced a new constraint. The constraint that determines the overall lead time of any project was identified as the combination of both the project layout and resource availability. This is quite an advance from the earlier recognition of Bottlenecks in production as resources and the generally accepted approach to project management - "Critical Path." This application of TOC to project management is known as "Critical-Chain."

As the acceptance of these applications grew the need to address a deeper, more basic shift in mind-set, began to surface. A shift in mind-set that would later be stated as moving from the "Cost World" - where improvement efforts are directed toward each area or operation in the organization, as if they were independent links in a chain, to the "Throughput World" - where improvement efforts are focused on the area(s) or operation(s) that are, in fact, the weakest link(s) in the chain. In the context of a chain, improvement efforts that are aimed at the individual links in a chain are analogous to trying to reduce the overall weight of the chain. However improvement efforts that are aimed at the weakest link(s) in a chain are analogous to trying to improve the overall strength of the chain. The performance of a chain is determined by its strength not its weight, so once again the need to align common practice with common sense arose.

While the "Throughput World" view was, at least intuitively, recognized by most organizations as matching their reality, it was not what common practice mandated. Fortunately TOC wasn't the only approach addressing the need for this change. During this same time

period Just-In-Time's (JIT) Kan-Ban approach to scheduling and TQM's approach that "the customer is king" addressed exactly the same needs. This helped to make it easier for many organizations to formally recognize "Throughput World" view.

Throughout these changes the Institute remained determined to reach its objective, which was and still is, the development and dissemination of common sense approaches. It was also becoming increasingly apparent that the particular problems of an organization made each situation somewhat unique and as such even powerful, proven solutions needed to be tailored. Another element of organizational uniqueness was also beginning to surface. Since each improvement an organization made, made their circumstances more unique, a simple generic answer was less than sufficient. Recognizing the growing need to provide these organizations with the tools that would enable them to construct and communicate their own common sense approaches we began focusing our efforts on providing the tools along with their specific applications for internal use.

In the early part of 1990 the tools we were using, more intuitively than formally, to construct and communicate common sense approaches began to be formalized. Mid 1990 the teaching of these tools was incorporated into our educational offerings, in particular the Jonah Program. This shift to providing the tools to construct and communicate common sense in conjunction with specific applications represented a major change in our product offering and as such, this change was not without its difficulties. By the beginning of 1991 the *TOC Thinking Processes (TP)*, were reasonably well formulated and started to provide the central theme of the Jonah Program. People were now learning the *Thinking Processes* by applying them to their own specific problems while the specific applications developed earlier served as examples of how to apply these *Thinking Processes*.

With time, the tools became increasingly more complete and modifications in their use removed many of the difficulties people were encountering. Today, the *TOC Thinking Processes*, as a set of tools to enable both individuals and organizations to accelerate a "Process Of Ongoing Improvement", are quite complete and carry with them a normal level of difficulty in mastery that one would expect, learning anything new.

However, our development and dissemination efforts are not complete. In particular, there was and still is a growing recognition, on the part of so many people and organizations, of the need for better tools in the area of management skills. As such, Management Skills

tools in the areas of communications, effecting change, team building and empowerment have been developed and recently released.

In order to effectively achieve our goal of generating and disseminating knowledge the Institute is structured to operate with a core group whose responsibilities reside in both development and dissemination and an outer ring whose responsibilities reside solely in dissemination. The core group is comprised of partners and associates. Those working in the outer ring are licensees. Associates, are independent businesses that are involved with TOC on a full time basis and are intended to be certified to deliver most, if not all of the Institute's offerings. Licensees, on the other hand, may or may not be involved with TOC on a full time basis and they can be either external or internal to a company. They are restricted to providing a limited number of the Institute's offerings.

The TOC applications currently available for licensing are:

1. The TOC Management Skills Workshop,

2. The TOC Production Application,

3. The TOC Distribution Application,

4. The TOC Project Management Application.

Appendix Two

Using TOC to Accelerate a Process of On-Going Improvement

Using TOC to Accelerate a Process of On-Going Improvement

Using TOC To Accelerate A Process Of On-Going Improvement

Descriptive material drawn from the market brochures of the Avraham Y. Goldratt Institute

In today's environment, there is little need to convince anyone of the need for a process of ongoing improvement. However, as competition in the market becomes increasingly fierce, the question facing most managers is "How to accelerate a process of ongoing improvement?"
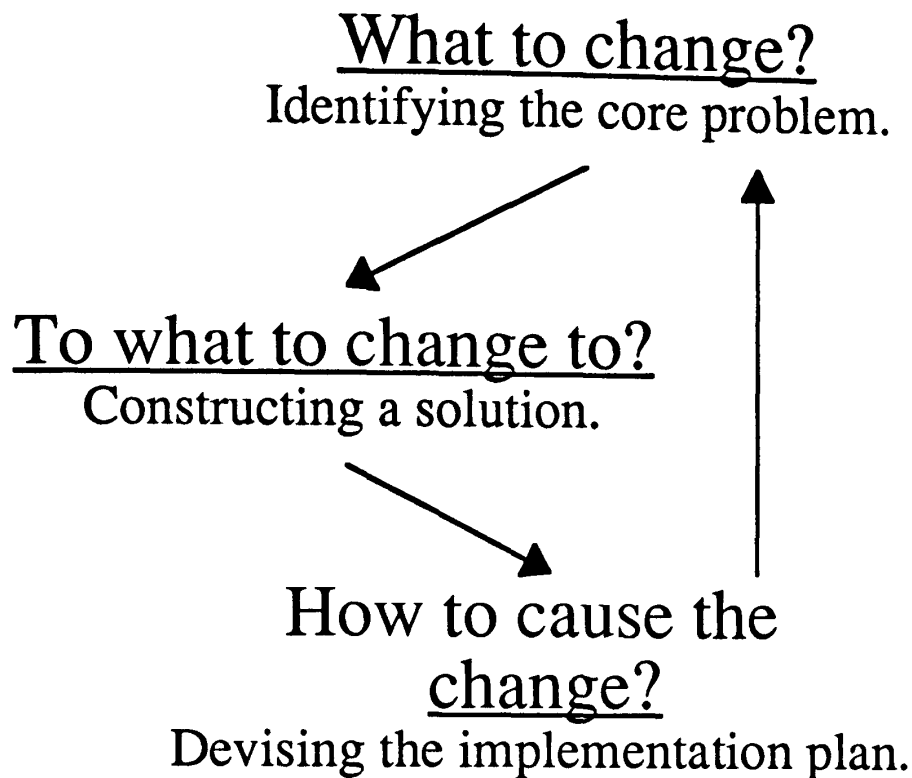
The first challenge is to define the primary subject which needs accelerated improvement.

Managers in engineering, for example, might choose as a primary subject the design of a specific product, or they might elect to concentrate on the general need to shrink the time to develop new products, or they might choose the subject of smoothing the transition from engineering to production and marketing.

Primary subjects in finance might be devising a suitable answer to the problem, usually referred to as "transfer prices," or to devise reliable procedures to judge appropriation requests for new investments, or to redesign internal reporting so that managers can use it effectively for decisions.

Managers in marketing might choose as a primary subject seizing a new market, or replacing misleading "product cost" numbers by information more useful to the sales force, or devising a good commission plan.

Managers in general, might simply choose as a primary subject "my area of responsibility." But, no matter what the subject: any improvement process, be it in marketing, engineering, production, or even personal life, is based on answering, in sequence, three different questions: What to change? To what to change to? How to cause the change? Therefore, acceleration of an improvement process must reveal more effective ways to answer these three questions.

What to change?
Identifying the core problem.

To what to change to?
Constructing a solution.

How to cause the change?
Devising the implementation plan.

SYMPTOMS, ROOT CAUSES AND A CORE PROBLEM.

To create a more effective process of improvement we should search for those few elements that cause most of the existing undesirable effects prevailing in our primary subject. The fewer the identified root causes that are responsible for the existence of the major undesirable effects, the more focused and thus more powerful our improvement process will be.

If we accept that an undesirable effect is usually a symptom – a resulting effect of a root cause – then in the search for root causes we must rely on cause-effect relationships.

Thus we should strive to build the current reality tree, the logical picture of the subject; the diagram that, through bonds of cause and effect, connects all the existing major undesirable effects.

Each statement in the tree that does not appear as a derivative of another statement – each entry into the tree – is a root cause. It is always possible to build a comprehensive enough current reality tree in which at least one entry leads to the existence of most of the undesirable effects. This entry is not just a root cause, it is the core problem. It should be the prime target for our improvement efforts.
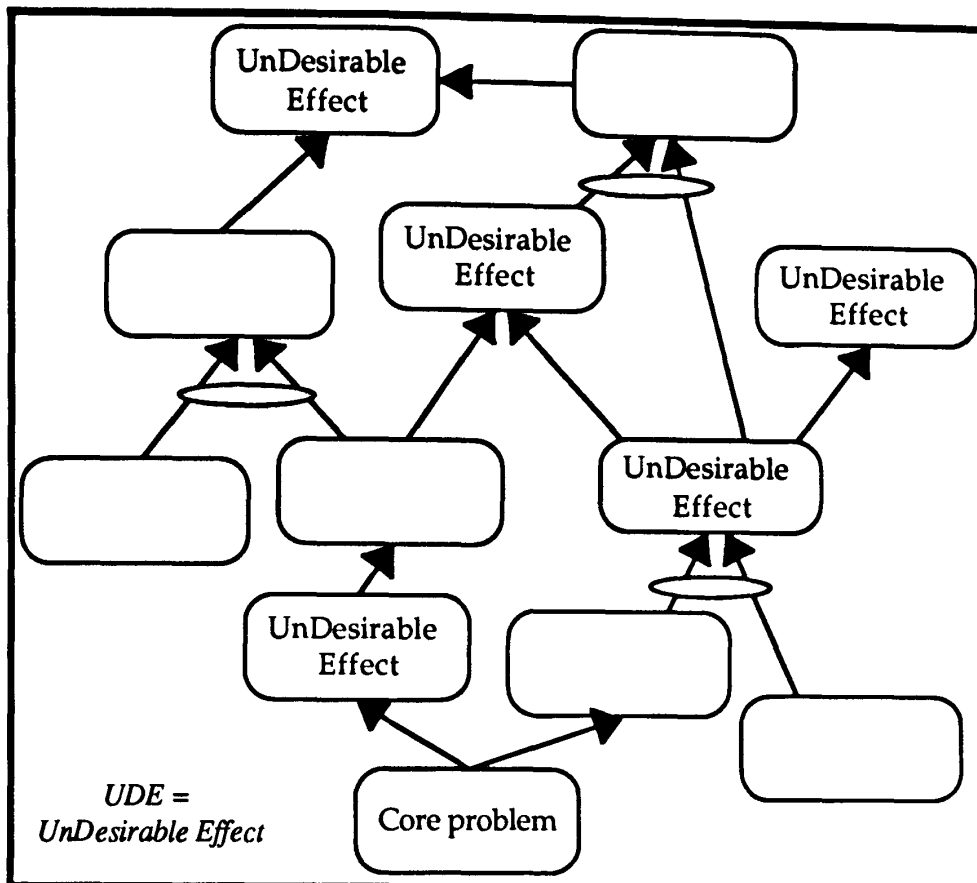
Current reality tree

Starting from undesirable effects and using available knowledge, this thinking process enables a person to pin-point the core problem.

Diagram labels: UnDesirable Effect (multiple), Core problem, UDE = UnDesirable Effect

WHY HASN'T THE CORE PROBLEM BEEN SOLVED?

Let's face it, people do have intuition and they do want their organization to succeed. How can it be then that for so long the core problem was not properly addressed? Something must have prevented the implementation of a solution. What can it be if not an inherent conflict, a conflict that deflects efforts toward a tug-of-war.

If this is the case, the conflict will be revealed in the current reality tree, and the tug-of-war will be very noticeable in reality.

To solve the core problem, we should first define it precisely: clearly state the desired objective – the opposite of the core problem; highlight the two necessary conditions – those requirements which are essential for having the objective; and verbalize the resulting conflict – the direct clash between the prerequisites for complying with the requirements.

Now it is necessary to overcome the tendency to look for a compromise – if there were an acceptable compromise, the organization would have found it a long time ago. Bearing in mind that the best solution is the removal of the problem, we should systematically ascertain what change in our reality will remove at least one of the reasons for the conflict. We should "evaporate the cloud."
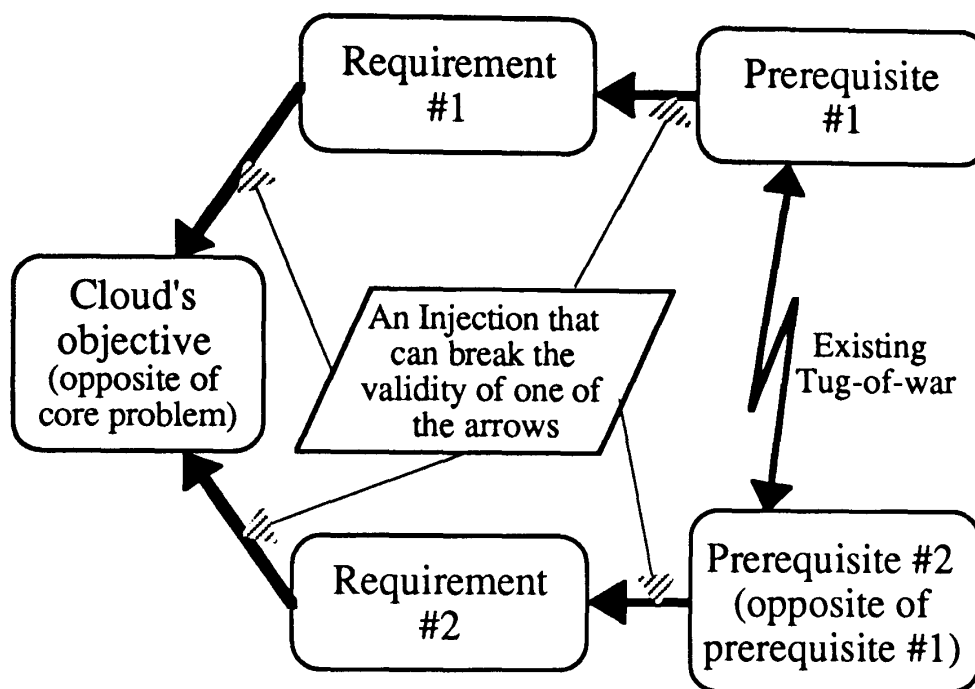
Evaporating cloud
The thinking process that enables a person to precisely present the conflict perpetuating the core problem, and then directs the search for a solution through challenging the assumptions underlying the conflict.

AN IDEA IS NOT YET A SOLUTION.

Finding an injection – a breakthrough idea that can free us from the grip of the conflict – is just the first step. It provides us with the starting point, but by itself it's far from sufficient.

Let's not forget that our original intention was, and still is, the removal of many, specific, undesirable effects. We want our improvement efforts to lead to an environment where, instead of these undesirable-effects, their opposites, the corresponding desirable-effects, will exist. We should check if the initial injection leads to the specified desirable-effects. Thus, assuming the existence of the injection and

relying on cause-and-effect relationships, we can predict the unavoidable outcome – build the future reality tree.

Often the original injection turns out to be insufficient, but the process of building the future reality tree leads to the missing elements – to figuring out what additional injections are needed in order to reach the desired outcome.

Bearing in mind that often a brilliant idea can turn sour, that too many times the medicine is more harmful than the disease, we should also carefully examine that the solution will not cause new, devastating undesirable-effects. These additional efforts complete the solution, the set of things that should be injected into our environment.

DE = Desired Effect
(opposite of UDE)
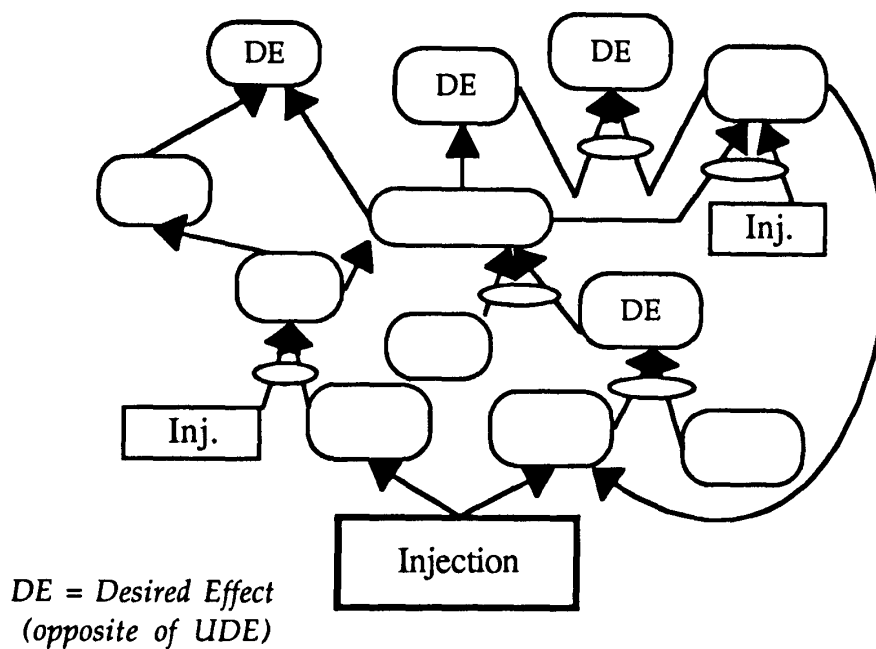
Future reality tree
The thinking process that enables a person to construct a solution which, when implemented, replaces the existing UnDesirable Effects (UDEs) by Desirable Effects (DEs) without creating devastating new ones.

A LONG JOURNEY NEEDS ITS MILESTONES.

Now the tactical objectives of our improvement efforts are clearly defined; we need to implement the injections. Simply, the future reality tree has logically shown that once these injections are implemented, the desired outcome - all the strategic objectives – will be accomplished.

Implementing the injections is not a trivial task. Let's not forget that at least one of the injections is a breakthrough, a departure from the currently prevailing tradition. Thus, it is usually necessary to break the implementation task into smaller increments.

For this we use the prerequisite tree. Starting with the obstacles that we expect we will encounter, the necessary milestones – the intermediate objectives – are verbalized. Each obstacle gives rise to an intermediate objective, the one we assess will be sufficient to overcome the corresponding obstacle.

To complete this step the intermediate objectives are sequenced; which one is first, which ones can be accomplished in parallel, etc. The connections are provided by the fact that any time dependency is due to the need to overcome an obstacle.

The power of the prerequisite tree stems from the fact that it doesn't ignore the obstacles, on the contrary, they are used as the main vehicle for this entire step.

I.O. = *intermediate*
objective
obst. = *obstacle*
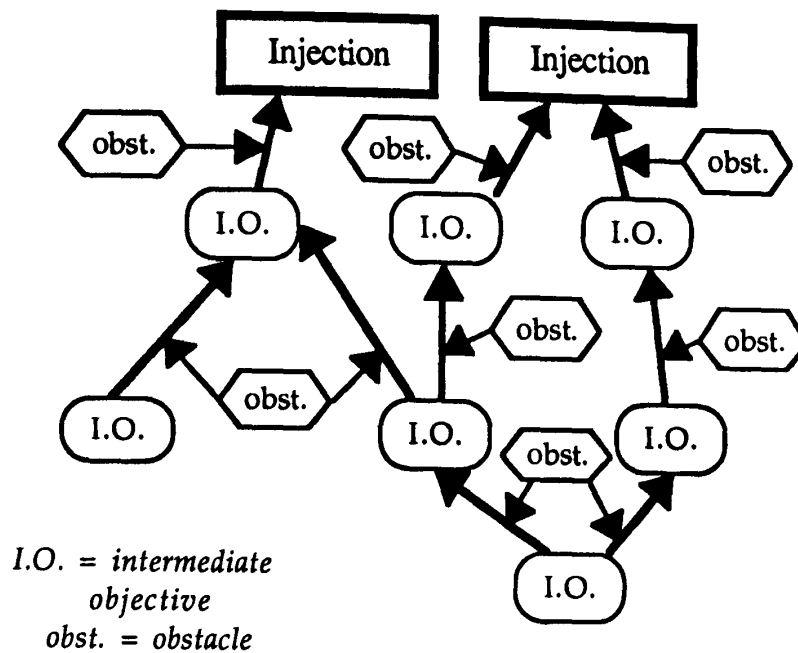
Prerequisite tree

By relying on everybody's "expertise" at pointing out obstacles, this thinking process enables dissection of the implementation task into an array of interrelated, well-defined, intermediate objectives.

THE ACTION PLAN.

We know where we stand; we have identified the core problem causing most of the undesirable effects. We know where we want to be; we have determined the injections that will result in the desired outcome. We also outlined the milestones of the journey; the logically sequenced intermediate objectives. All the ground work has been done, but if we don't take actions, reality will not change.

In determining the needed actions, attention should not be on what we plan to do, but on what we want to accomplish. Thus the "backbone" of the transition tree is the detailed description of the gradually evolving change we envision will occur in reality. The "ribs" are the actions needed to unavoidably cause that gradual change until the objectives are met.

This method forces us to carefully examine which actions are really needed and if they are sufficient to guarantee the required change. Too often we rely on a set of actions just because "it's the thing to do," without checking if they fit our particular situation.

Above all, putting the gradual change as the backbone of the plan provides the safety net which is essential when planning the future. Simply, the important thing becomes *causing a specific change in reality*, rather than sticking to a specific action just because we have planned to take it.
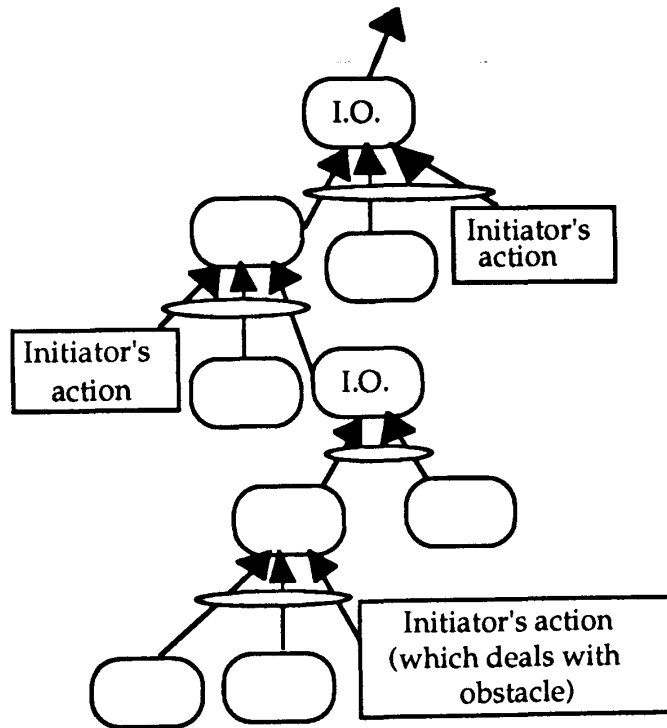
Transition tree
The thinking process used to construct a detailed implementation plan, based entirely on the initiator's actions (other's actions appear as reactions).

Appendix Three

TOC Applications

TOC Applications

The TOC Applications are a subset of the innovative solutions created by applying the TOC Thinking Processes to a specific application area, where the conceptual framework of the resulting solution has proven to be quite generic. Currently, there are three specific application areas having powerful, generic solutions: production, distribution and project management. The generic solution for production is commonly referred to as "**Drum-Buffer-Rope**" and "**Buffer Management**," while the generic solution for distribution is called "**Replenishment**," and project management, "**Critical Chain**" and "**Flush**."

Being generic, each of these three solutions can be readily tailored to a particular environment. Those individuals or organizations that have already determined the need to significantly improve one or more of these areas of their organization will find the TOC Applications particularly worthy of their attention.

There are several means available for exploring an application. For those who want to expose themselves and/or their organizations to one of the applications, there is a two-hour **Overview** presentation. If an individual or an organization wants to explore one of the applications in depth, the two-day **Workshop** is the appropriate choice. The five-day application **Program** is best-suited for those who want to tailor and implement the application in their environment.

TOC Application Overview

A two-hour TOC Application Overview is for organizations that have recognized the need to improve the production, distribution or project management aspect of their organization and want **exposure** to the corresponding TOC Application. Through presentation, open discussion, and interactive exercises, the participants:

- Explore the ramifications of their organization's current decision-making process with regard to their improvement needs;

- Understand how TOC and its respective application relates to their improvement needs and environment; and

- Discuss the question of how to best go about implementing the solution in the participants' organization, including what the next steps should be, how to go about getting the active collaboration of other functions in the organization, and how to overcome the all-too-prevalent "resistance to change."

TOC Application Workshop

The two-day TOC Application Workshop is for individuals and organizations that want to thoroughly explore a particular TOC Application. Through the use of the TOC Thinking Processes, open discussion, interactive computer simulations and/or interactive exercises, the participants obtain an in-depth understanding of the application by:

- Analyzing the problems that currently exist in a typical production, distribution or project management environment, resulting in the clear identification of the core problem proven to cause a whole host of those problems;

- Examining the basic direction of the solution;

- Systematically addressing issues related to the generic solution that reflect the general concerns of most organizations; and

- Discussing the question of how to best go about implementing this solution in the participants' organization, including what the next steps should be, how to go about getting the active collaboration of other functions in the organization, and how to overcome the all-too-prevalent "resistance to change."

TOC Application Program

The five-day TOC Application Program is for organizations that want to **implement** a particular TOC Application. Through the use of the TOC Thinking Processes, open discussion, interactive computer simulations and/or interactive exercises, the participants obtain an in-depth understanding of the generic solution, tailor the generic solution to fit their environment and construct the overall implementation plan by;

- Analyzing the problems that currently exist in a typical production, distribution or project management environment, resulting in the clear identification of the core problem proven to cause a whole host of those problems;

- Examining the basic direction of the generic solution;

- Systematically addressing issues related to the generic solution that reflect the general concerns of most organizations; and

- Using the TOC Thinking Processes to systematically address the questions

    "Why won't the generic solution work in our environment?"

    and

    "What are the obstacles that will prevent us from implementing the solution?"

the participants tailor the generic solution to their specific environment, and construct the overall implementation plan in a way that builds consensus, active collaboration and an implementation team.

Using TOC To Improve Production

The "TOC Production Application," commonly referred to as "Drum-Buffer-Rope," is for those individuals and organizations that have recognized the need to improve their production operations and are contemplating changes reflective of those illustrated in The Goal. These changes are often referred to as the shift from the "Cost World" to the "Throughput World." In the "Cost World," management efforts are directed toward improving each operation, as if they were separate links in a chain. These efforts often result in improvements in the overall weight of the chain, but not necessarily in its' strength. And, generally it's strength not weight that determines the overall performance of any chain. And, what determines the strength of a chain? The weakest link. In the "Throughput World," management efforts are directed, via the focus provided by the weakest link(s) - the constraint(s), toward improving the various links in the chain. These efforts lead to improvements in the overall performance or strength of the chain, but not always in its' weight.

Viewing an organization as a chain may simply be common sense, but managing an organization as a chain is certainly not common practice. While most managers have, at least, intuitively recognized that the "Throughput World" view more closely matches the reality, it's common sense. It has only been in the last decade or so, as competition in the market has become increasingly more fierce, that the need to turn the "Throughput World" view into common practice has become so intense. The recognition of the "Throughput World" view is further evidenced by Just-In-Time's (JIT) Kan-Ban approach to scheduling and by TQM's advocating that "the customer is king."

Many organizations, in trying to make this shift from the "Cost World" to the "Throughput World," have come to realize that changing common practice is not so easy, even when the change is based on common sense. What is it that makes this change so difficult to accomplish? Could it be that our organizations are so entrenched in the decisions, actions and measurements of the "Cost World," that those very same practices, that once helped us, are now what blocks us from putting into place the decisions, actions and measurements we need to effectively operate in the "Throughput World?"

Using TOC To Improve Distribution

For certain types of products "immediate" availability is an essential part of doing business. In such environments, you will often find that the Customers' Tolerance Time (CTT) - the amount of time that the customer is willing to wait to receive a product that they wish to purchase - is significantly less than the time it takes the manufacturer to produce and deliver the product. In order to comply with a such a short CTT, many of the companies that manufacture these types of products must produce and distribute their products according to forecasted, rather than, actual market demand.

We know that forecasting the markets' specific demands is a lot like forecasting the weather. On average, the overall forecast for the year is pretty good, but the detailed forecast by day or even by week, well that's another story. Forecast accuracy is definitely a problem, especially with regard to its impact on operational decision making within a distribution network. Rather than discussing the issues associated with forecasting, let's examine how the distribution of products is generally managed.

The distribution of most products is generally accomplished through a distribution network, which either belongs to the manufacturer or to another company to which the manufacturer sells their products for distribution and resale. The resale of the product, through a distribution network, may either be directly to the end user - the actual consumer - or it may be sold to another distribution network for further distribution and resale. In any event the product is transported from one location to another, through one or more distribution networks, until it finally arrives to the location from which it will be sold to the end user. When viewed in this way, the entire distribution network looks very much like a chain.

Viewing a distribution network as a chain, may not represent a major revelation in understanding, it's simply common sense, but it can and often does represent a major change in the way we manage a distribution network, the common practice. The differences between common sense and common practice, at least with regard to production, are particularly noticeable if you are familiar with The Goal.

While the examples in The Goal are production related, the same underlying understanding can be used to improve the performance of a distribution network. The changes outlined in The Goal, are often referred to as the shift from the "Cost World" to the "Throughput World." In the "Cost World," management efforts are directed toward improving each operation, as if they were separate links in a chain. These efforts often result in improvements in the overall weight of the chain but not necessarily in its strength. And, generally it's strength not weight that determines the overall performance of any chain. And, what determines the overall strength of a chain? The weakest link. In the "Throughput World," management efforts are directed, via the focus

provided by the weakest link(s) - the constraint(s), toward improving the various links in the chain. These efforts lead to improvements in the overall performance or strength of the chain, but not always in its' weight.

As long as the overall lead time to produce and distribute the product is longer than the CTT, then the distribution network will have to hold inventory in order to satisfy the end users' demands for "immediate" availability. Since, reducing the overall lead time of production and distribution to be less than the CTT is very unlikely, not that we shouldn't strive to do so, it means that the distribution network will always have to hold enough inventory to protect sales. The question is, how much inventory do we need to hold at each distribution location within the distribution network in order to ensure a very high fill rate of end user demands?

If we make use of the TOC Thinking Processes, the Five Focusing Steps and the chain analogy in answering this question, then it becomes apparent that one of the constraint(s) in almost any distribution network, is "**satisfying the uncertain demands of the end user within their CTT.**" Improving the detail forecast will certainly help, but how long will it be before we have a really good crystal ball? So what else can we do to improve the performance of the distribution network?

We could hold enough inventory, at the distribution location(s) closest to the end user, to satisfy the expected best case demands of the end user during the time it takes to reliably replenish the distribution location(s) with what was actually sold. This is conceptually, what is commonly referred to as the TOC "**Replenishment**" solution for distribution. If this were to be repeated throughout the distribution network, then each distribution operation would only hold enough inventory to cover expected best case sales during the time it takes to be reliably replenished from the upstream distribution location.

Most managers have recognized for a long time, that the "Throughput World" view matches their reality, it's common sense. It has only been in the last decade or so, as competition in the market has become increasingly fierce, that the need to make the "Throughput World" view common practice has become so intense.

Using TOC To Improve Project Management

Most projects finish <u>behind</u> <u>schedule</u> and/or <u>over</u> <u>budget</u> and/or with <u>less</u> <u>functionality</u> than originally planned! Why?

Most projects, whether big or small, are undertaken either to create a new structure, such as a plant, an airport, an Olympic stadium, a bridge, a new product, etc., or to modify an existing structure, such as a plant expansion, adding a new production line, expanding a highway, etc. In most cases, the late completion of the project, such as finishing the Olympic stadium two weeks after the opening of the Olympics, or having a new airports' opening delayed until after the elections, etc., generally carries with it some significant negative ramifications for the project owner. At the same time, there are many cases where the early completion of the project will provide the project owner with significant positive ramifications, such as the market share gained by preempting the competitions' launching of a new product, or the increase in sales achieved by bringing the plants productive capabilities on-line sooner, etc.

Another important characteristic of most projects is that many of the resources performing the individual project tasks are sub-contracted resources, at least in terms of their relationship to the project manager. As sub-contracted resources, they are often committed to completing more than one project specific task during any given window of time. The issue of resource availability is often further complicated by the nature of the disturbances associated with most project specific tasks. As a result, most sub-contractors will only commit to completing a project specific task within a window of time and by a specific date, regardless of the fact, that the actual time required to complete the project specific task is generally much smaller than the allotted time window. Hence, the detail scheduling of the sub-contractors resources is generally something that most project managers have little or no direct control over.

Lastly, most projects usually involve the investment/expenditure of one or more limited resources, such as money, peoples time, skills, equipment, etc. As a result, most people try to maximize the return on these investments/expenditures, thus making the overall <u>lead</u> <u>time</u>, from start to finish, the <u>key</u> factor in almost every project.

As with most decisions involving the use of limited resources, there is the need to consider <u>trade-offs</u>. Trade-offs that often appear as a conflict between the availability of the limited resource, which is usually money, and the overall project lead time from start to finish. As long as the decisions involve trade-offs which cannot be quantified into a single measurement, that is without a <u>Final</u> <u>Judge</u>, then the determination of "best" will always remain somewhat less than objective. Hence, the problem of "how to best evaluate" the myriad of proposed

projects, particularly when all of them promise great benefits, also remains highly subjective.

Through the use of the TOC Thinking Processes it becomes apparent why the existing methods used to quantify such decisions, such as "Net-Present-Value" or "Net-Future-Value," did not really provide the sought after Final Judge. The main reason stems from the fact that the true investment value of a limited resource is not adequately represented by considering only the number of limited resource units to be invested. As with any limited resource, the real key to its value resides in its limited nature. Hence, determining the true value of any limited resource investment requires a quantification that is based on both the number of limited resource units (dollars) to be invested, and even more importantly, the number of time units (days) that these limited resource units (dollars) will not be available. This combined unit of measure, often referred to as "dollar-days," is used in a number of the TOC applications.

In the TOC application to project management, the "dollar-day" unit of measure is used to quantify a projects' limited resource investments as a function of time. When all of the limited resource investments of a project are quantified in this way the end result is a single measurement that does, in fact, prove to be good Final Judge. This Final Judge is commonly referred to as "Flush."

Having a Final Judge solves only part of the problem as it addresses only the quantification of limited resource investments but not the timing of these investments. The planned timing of limited resource investments in most projects is a result of project planning. While having the project completed as planned, on time and within budget is the objective of project planning, it is very often not the reality. Sometimes, to the extent, that the operating rule used by some companies is, that "no project ever finishes as planned and/or on time and/or in budget." Hence, there is a need to have a realistic project plan if the quantification provided by a Final Judge is to have any real meaning.

While the examples in The Goal are more production related, the same underlying understanding, with regard to statistical fluctuations (disturbances) and dependent events (chains), can be used to improve project management. The changes outlined in The Goal, are often referred to as the shift from the "Cost World" to the "Throughput World." In the "Cost World," management efforts are directed toward improving each operation, as if they were separate links in a chain. These efforts often result in improvements in the overall weight of the chain but not necessarily in its strength. And, generally it's strength not weight that determines the overall performance of any chain. And, what determines the overall strength of a chain? The weakest link. In the "Throughput World," management efforts are directed, via the focus provided by the weakest link(s) - the constraint(s), toward improving the various links in the chain. These efforts lead to improvements in the overall performance or strength of the chain, but not always in its' weight.

If we make use of the TOC Thinking Processes, the Five Focusing Steps and the chain analogy, then it becomes apparent that one of the constraint(s) that any project planning approach must addressed, is " **to provide the shortest overall lead time from start to finish.**" In most projects it is not only the project layout, as in "Critical Path" planning, but also the availability of the resources assigned to each of the project tasks, that determines the overall project lead time. Thus it is the combination of resource availability and project layout together that actually determined the overall lead time of any project and as such both together should be managed as the <u>constraint</u>. With the constraint(s) properly identified, it is now possible to buffer them against disturbances, thus providing a realistic project plan, which is the TOC approach to project planning generally referred to as "**Critical Chain.**"

Appendix Four

The Jonah Programme

The Jonah Program

The Jonah program is for those individuals and organizations that want to accelerate the improvement process in their area of responsibility or in a subject matter of primary interest.

<u>Turning the wheel</u>

The method by which participants learn to use each one of the thinking processes to gradually construct a full, implementable solution to their primary subjects.

Participant's primary subject

A small example

A comprehensive example

A small exercise
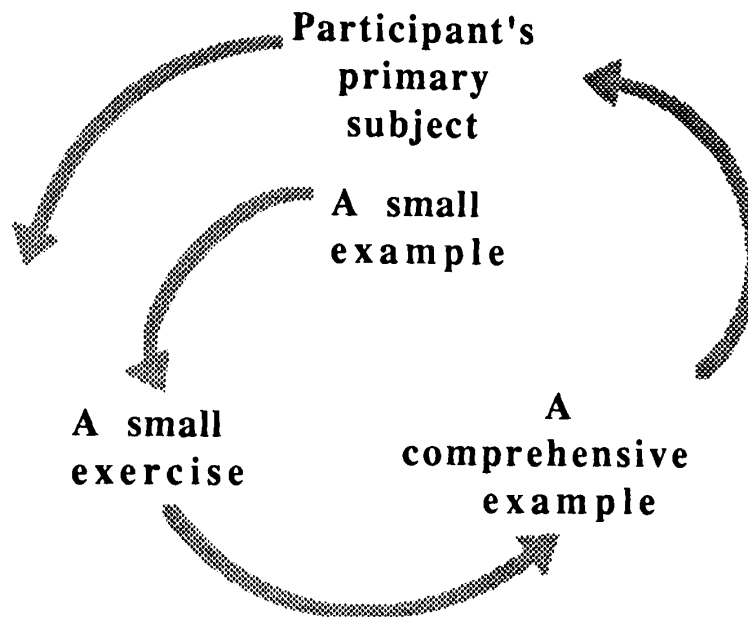
By turning the wheel on their primary subject, whether it be their area of responsibility or a particular subject matter, the participants learn to apply the TOC Thinking Processes - as a set of problem solving tools - to logically and systematically answer the three questions essential to accelerating any process of ongoing improvement: "What to change?", "To what to change to?" and "How to cause the change?" The understanding of the TOC Thinking Processes that is gained in each step is then used, in conjunction with the participants understanding of their own environment, to actually work through to completion the solution to the problems identified in the participant's chosen subject; and

- While learning the TOC thinking processes the participants get used to thinking and communicating in terms of "cause and effect" (if...then...), they realize the common sense perspective that is gained when a subject is presented as a cause and effect tree, they improve their ability to strongly argue a point without upsetting the other side,

they realize that true consensus is possible, and they gain a deep, fruitful insight into the subjects, such as "human behavior in organizations" or "marketing and sales" or "distribution", etc., that are used as examples and exercises and an understanding of all the steps of constructing a Current Reality Tree (CRT); and

- Through the Current Reality Tree they find the core problem of their chosen subject, the ability to prove it to others, the ability to repeat the process on other subjects, and a deep internalization of the relationships between UnDesirable Effects (UDEs), root causes and the core problem; and

- They acquire the ability to present a conflict without provoking finger-pointing, through the use of the Evaporating Cloud (EC), while at the same time learning how to expose the hidden assumptions of any argument, thus providing an approach to evaporating conflicts rather than seeking nonexistent compromises, which also enables the participants to verbalize the injections that can evaporate the core problem of their chosen subject; and

- They use the Future Reality Tree (FRT) to construct a solution for their chosen subject that eliminates all the specified undesirable effects without creating any devastating new ones, they acquire the ability to construct a solution for other subjects and the ability to constructively scrutinize a solution; and

- They make use of the Prerequisite Tree (PRT) in setting the intermediate objectives for implementation of their solution, while learning how to use obstacles as levers, how to verbalize the hidden reasons for time dependencies and how to systematically dissect a major task into a set of interdependent intermediate objectives; and

- They construct, through the use of Transition Trees (TT), a detailed, logically connected, action plan for the implementation of their solution, while learning how to more effectively deal with immediate difficult tasks, how to convert a strategic plan into a comprehensive tactical action plan, and how to effectively solicit the needed collaboration of others.

Appendix Five

Using TOC to Improve Management Skills

Using TOC To Improve Management Skills

Most people realize that the only way to make their organization successful is to collaborate. They also realize that if each of us will only look out for our own interests, ignoring what is good for the organization as a whole, the end result will be a lose-lose for everyone.

If this is so, then why are almost all organizations dissected by walls of distrust between levels and between functions?

Can it be that egotistical self-interests are so strong and so blind? Or maybe it's because most organizations are using measurements that lead to distorted behaviors? Measurements that almost force people to concentrate on local optima, sacrificing the global objectives of the organization?

We firmly believe that erroneous measurements/objectives are the major cause fostering walls of distrust between levels and functions, and that many of these erroneous measurements/objectives are already deeply imbedded in our organizations' cultures. Bearing in mind that inertia exists, uprooting these erroneous measurements/objectives will be a very slow process unless we teach people some vital managerial skills. A quantum leap in skills is needed; in communicating, team building, empowering people and effecting change.

Unfortunately, the way most organizations have gone about improving these skills has almost reduced their sincere efforts into nothing more than lip service.

In order to cause a quantum leap in people's skills, we need to first identify the core problem(s) that the skills are supposed to address; second, to carefully construct, in detail, powerful tools to overcome these core problems; and last, we must make sure that people learn to use them effectively.

TOC Management Skills Overview

Today, almost every manager is aware of the need for better management skills in communication, team building, empowerment and effecting change. In fact, many managers have already embarked on programs that are intended to help them address exactly those needs, only to find their sincere efforts yielding less than satisfactory results, sometimes to the extent that the entire effort has become nothing more than lip service. Why?

Could it be that we recognized the need for these skills but failed to properly identify the underlying core problems that these skills are supposed to overcome and as a result our well intended programs missed their mark? Or maybe the tools we provided our people with weren't powerful enough to overcome these core problems? Or maybe the tools were just too difficult for people to learn to use them effectively? Let's begin addressing these questions by examining what each of these management skills and their related tools should provide, in the context of their corresponding core problems.

- *COMMUNICATION* skills and tools should provide people with:

    The ability to recognize win-win solutions, thus overcoming the tendency to resolve conflicts by compromising - which so often results in a lose-lose situation; and

    The ability to pin-point the aspects of an idea that need to be addressed and do so in a way that strengthens the idea and the relationship at the same time, thus enhancing peoples' ability to correctly criticize ideas - which will prevent bad ideas from being implemented and while allowing the good ideas to become more rounded.

- Effective *TEAM BUILDING* skills and tools should enable people:

    To break-up an insurmountable task into all its obstacles, thus providing everyone involved with a clear definition of what makes the task seem so insurmountable; and

    To realize that each obstacle can be overcome by determining a corresponding intermediate objective, thus providing everyone involved with a more coherent strategy; and

    To understand that proper sequencing will allow all the objectives to be achieved, thus coordinating the tactics of everyone involved.

- The skills and tools for *EMPOWERMENT* should enable people:

    To recognize and remove the blockages that prevent others from effectively doing their job, thus removing the need to repeatedly deal with the same fires; and

    To make their objectives clear to those whose role is to achieve those objectives, thus reducing the confusion that so often accompanies delegation.

• The skills and tools to better *EFFECT CHANGE* should:

Bring people to recognize their ability to cause change, thus overcoming the tendency to accept chronic conflicts as "a part of life".

This two-hour presentation is valuable for anyone interested in exposing their organization to the TOC application to management skills and the corresponding TOC management tools to support these skills.

The TOC Management Skills Workshop

COMMUNICATION skills and tools should provide people with:

The ability to recognize win-win solutions, thus overcoming the tendency to resolve conflicts by compromising - which so often results in a lose-lose situation; and

The ability to pin-point the aspects of an idea that need to be addressed and do so in a way that strengthens the idea and the relationship at the same time, thus enhancing peoples' ability to correctly criticize ideas - which will prevent bad ideas from being implemented and while allowing the good ideas to become more rounded.

Session 1, COMMUNICATION: Resolving day-to-day conflicts.
Duration: 4 hours

Conflicts are a major reason for resentment and communication breakdown. At the same time they are very common. Using the Evaporating Cloud technique, participants learn to verbalize conflicts in a non-adversarial way, leading to resolutions which are not compromises but win-win solutions.
The participants exercise this technique on examples drawn from their recent experience and they come to recognize that the faster conflicts are dealt with using the Evaporating Cloud approach, the higher the chances of finding amicable solutions. In the days until the next session participants identify conflict situations and exercise the Evaporating Cloud technique in real life.

Session 2, Part 1 - COMMUNICATION: Learning from experience
Duration: 3 hours

The participants present actual cases where they have tried to use the Evaporating Cloud approach and learn from each other how to do an even better job in the future.

Session 2, Part 2 - COMMUNICATION: Dealing with half-baked solutions
Duration: 5 hours

If there is something that most people shy away from, like from the plague, it is constructively criticizing an emotional inventor. This is the case with half-baked solutions. Since they are not yet complete, we do have valid criticism and the inventor further supports their logic with emotion. In those cases, we usually say "Let me think about it," or if we can, we just don't say anything.

Participants learn to use the Negative Branch approach to make sure that wrong ideas will not be implemented, that meaningful ideas will not lead to negative side effects, that good ideas will become more rounded, and to do it in a way that strengthens relationships and builds mutual respect.

Session 3, Part 1 - COMMUNICATION: Learning from experience
Duration: 3 hours

The participants present actual cases where they have tried to use the Negative Branch approach and learn from each other how to do an even better job in the future.

Effective *TEAM BUILDING* skills and tools should enable people:

To break-up an insurmountable task into all its obstacles, thus providing everyone involved with a clear definition of what makes the task seem so insurmountable; and

To realize that each obstacle can be overcome by determining a corresponding intermediate objective, thus providing everyone involved with a more coherent strategy; and

To understand that proper sequencing will allow all the objectives to be achieved, thus coordinating the tactics of everyone involved.

Session 3, Part 2 - TEAM BUILDING
Duration: 5 hours

It is very exciting to participate in a team that has a common objective, coherent strategy and well synchronized tactics. The Prerequisite Tree is an ideal tool to create such a team, where the starting point is a worthwhile but very difficult target. Participants practice this technique on existing targets that have already been abused to the level that they are not more than lip service.

Session 4, Part 1 - TEAM BUILDING: Learning from experience
Duration: 3 hours

The participants present actual cases where they have tried to use the Prerequisite Tree approach and learn from each other how to do an even better job in the future.

The skills and tools for *EMPOWERMENT* should enable people:

To recognize and remove the blockages that prevent others from effectively doing their job, thus removing the need to repeatedly deal with the same fires; and

To make their objectives clear to those whose role is to achieve those objectives, thus reducing the confusion that so often accompanies delegation.

Session 4, Part 2 - EMPOWERMENT
Duration: 5 hours

Two things stand in the way of effective empowerment: First, the habit of putting out the fires for the people you are trying to empower and secondly, giving unclear instructions.
Participants learn another way to use the Evaporating Cloud technique, that enables their people to put out their own fires without needing or requesting help.
The usage of the Transition Tree is taught to give a new meaning to instruction. The Transition Tree forces clarification of the reasoning for each instruction; the need which triggered the instruction, the desired objective of the instruction and why it is expected that the desired objective will be achieved by following the specified instruction . It also guarantees the clarity of the logical sequence in which the instructions should be carried out. The Transition Tree fosters empowerment by shifting the focus to

the evolving change we would like to see in reality, thus turning the instructions into a set of reasonable recommendations and leaving enough room for improvisation.

Session 5, Part 1 - EMPOWERMENT: Learning from experience and summary
Duration: 3 hours

The participants present actual cases where they have tried to use the Evaporating Cloud and Transition Tree approaches in empowering others and learn from each other how to do an even better job in the future.

The skills and tools to better *EFFECT CHANGE* should:

Bring people to recognize their ability to cause change, thus overcoming the tendency to accept chronic conflicts as "a part of life".

Session 5, Part 2 - EFFECTING CHANGE: Dealing with chronic conflicts
Duration: 5 hours

A chronic conflict causes us a lot of grief but we pay it almost no attention, we have simply learned to live with it as if it is a part of life. Participants learn to use a combination of Evaporating Clouds and Negative Branches to try and resolve chronic conflicts. Actual examples are dealt with by small teams.

Session 6, EFFECTING CHANGE: Learning from experience
Duration: 4 hours

The participants present actual cases where they have tried to use the Evaporating Cloud and Negative Branch approaches together and learn from each other how to do an even better job in the future.