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# **A CYBERNETIC APPROACH TO WORLD CLASS MANUFACTURING**

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## ABSTRACT

*South African manufacturers are facing increasing challenges given the rapidly changing market forces over recent years. Economic factors such as the position of the Rand versus leading foreign currency and the negative GDP growth continue to place considerable pressure on the consumer's wallet. The consumer is searching for maximum value in the manufacturer's offering - more so than ever before.*

*This leaves the manufacturer with no choice but to dramatically increase the value of its offering through substantial product differentiation and cost leadership. Many South African manufacturers have risen to this challenge by implementing step changes in their manufacturing methods as they adopt new management techniques. Some of these companies are striving to achieve world class manufacturing (WCM) status through the implementation of WCM change management techniques.*

*This qualitative action research study was conducted within a shop floor level group of the production department of one of South Africa's largest manufacturing companies. Despite valiant efforts by the company, this management research study suggests that several years after a WCM change management intervention, the company in question is still grappling with shop floor level implementation and change management.*

*The results of this study further suggest several reasons for failure. The key reason appears to be that the implementation strategy employed did not comprehensively account for systemic holism in the organisation. In addition, the absence of key elements of the WCM paradigm from this company's implementation methodology has resulted in failure in certain instances.*

*From the learning of this study, a model for implementation recovery is proposed based on the cybernetic principals of systems thinking as the backbone to the established WCM change management methodology.*

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# 1. INTRODUCTION

## 1.1 Background

South African manufacturers are facing increasing challenges given the rapidly changing market forces over recent years. Economic factors such as the position of the Rand versus leading foreign currency and the negative GDP growth continue to place considerable pressure on the consumer's wallet. The consumer is searching for maximum value in the manufacturer's offering - more so than ever before.

In addition, the reintroduction of South Africa into the global market has increased consumer power through the introduction of competition. Consumers now have a range of alternative sources of the desired product open to them. This increased consumer power has resulted in a new type of consumer that is looking for a wholly unique suite of product attributes. The requirement is for a product that boasts good quality all the time every time, is always available when desired in the quantities desired, is easily accessed irrespective of the consumer's location, is backed by exemplary customer service, is flexible enough to change in design to meet changing customer requirements and still comes at a highly competitive price.

This leaves the manufacturer with no choice but to dramatically increase the value of its offering through substantial product differentiation and cost leadership. Many South African manufacturers have risen to this challenge by implementing step changes in their manufacturing methods as they adopt new management techniques. Some of these companies are striving to achieve world class manufacturing (WCM) status through the application of WCM techniques.

They have embraced the management style of the Japanese by implementing "total" or holistic management principles such as Total Quality Management, Best Practise, Japanese 5-S, Total Productive Maintenance, Lean Manufacturing and sustainability through continuous improvement.

The key is the "holism" concept. The idea is that the entire organisation including people, processes, machines, customers, suppliers and the relationships that govern their interactions undergo a complete transformation. Decentralisation of management to the lowest levels in the organisation is key in the WCM concept. Cultural change, behavioural change, worker empowerment, redistribution of decision power and a complete change in roles and values are called for.

These are some of the espoused theories. What are the theories in use? How much redistribution of decision power has actually been realised by these companies? How many of these companies are able to boast successful decentralisation of management to the lowest levels in their organisations? How much cultural and behavioural change has been achieved?

This report presents the findings of a phenomenological study that maps the progress of a shop floor team through a change management process towards the acceptance of WCM principles. This study was conducted within the engineering

group of a production department of a leading South African manufacturing company that has been involved with change management to WCM principles for nearly ten years.

## **1.2 Problem Statement**

The purpose of this study is to improve understanding of the complex interactions that characterise the transition to a WCM organisation, from the perspective of shop floor level production staff. For the purposes of confidentiality I shall refer to the company in question as LSAM (Large South African Manufacturer).

I joined the packaging division of LSAM just over a year ago as manager of the packaging engineering group at one of LSAM's production plants. I had previously held the position of production engineer at an energy corporation in the nuclear industry. The roles and responsibilities of the two positions were not too different but there certainly were challenges not least of which was moving from an area of reasonable technological expertise to an area where the technology was new to me.

My plan was to learn as much as possible, as quickly as possible, so that I could add value through process improvements. LSAM is renowned in South African business management circles for its progressive management thinking and is generally considered a leader when it comes to implementing business change. My expectation was therefore that of a world class organisation where the step changes had already been made and hence my role as manager and team member would be that of directing the team towards further incremental improvement steps.

However, what I found was very different to what I had expected. There was very little evidence that the packaging engineering group had been through a large-scale organisational change process to WCM principles. Their performance was poor. Despite the emphasis on teamwork in the workplace, they did not function as a team. Plant reliability and availability indicators were the lowest in four years. These were just a few of the obvious problems at the time. The challenge was therefore to make a change – one that would take us in the direction of a WCM department.

My specific interest in the topic was thus based on a genuine need to improve the performance of the packaging engineering group as well as improve overall packaging plant performance.

## **1.3 Focus of Inquiry**

The primary focus of inquiry was to discover those key opportunities that would lead to an immediate and sustained improvement to the current situation. In addition, I also sought to understand why this group had not successfully made the transition after nearly ten years of WCM implementation. Understanding these obstacles to change could improve our chances of success this time around.

One of the key traits of a WCM company is that it is a learning organisation. Yet, I could find no documentation on site that captured the actual learnings that emerged out of the past years of change management towards achieving WCM status. Therefore, a further reason for treating this change process as a structured management research project was so that the learning could be captured.

Combining the outcomes of these approaches, I would propose a model for successful implementation of WCM principles at shop floor level within a packaging engineering context.

## **1.4 Research Scope**

The scope of this inquiry was largely based on the local situation within the packaging department at one particular region within LSAM's national division. Data was however collected from other regions in the South African division of LSAM to improve overall business context understanding and to assess the comparative value of the study.

Although I considered it necessary to understand the specific reasons for WCM implementation failure within a particular situational context, the study is not that narrow that it sacrifices all global relevance.

I also wished to take the group through a process of a new attempt at WCM implementation. With respect to the actual change process, in this case, the essential need was to effect local change. However the study also aims to share learning with other managers in similar situational contexts at least across the regional borders within the South African division of LSAM. In order to achieve this, the learning derived was tested against perceptions of managers and staff of other regional sites nationally.

Although this particular study has focused on the situation within LSAM, it is hoped that this study will form a basis for further research within the broader South African Manufacturing context.

It is particularly important to note that this study focuses on shop floor organisational design. It does incorporate learning about other management levels in so far as shop floor implementation is affected. However, the essential focus is on achieving transformation at the lowest level in the organisation. In the process of achieving this transformation several learnings have emerged for middle and senior management.

## **1.5 Research Design**

My research design was based on a combination of research methodologies that I considered relevant to the intended outcomes of this study. I matched the research needs, as I perceived them, with the available research techniques. I took the following factors into account:

I am a practising manager who wishes to improve a complex situation that is grounded in the reality of my job. My observations will therefore be made from within the system of which I am a part. The researcher therefore influences the situation being researched.

In order to improve the situation I need to understand the reality of the situation not only as I see it but also as seen by all those directly involved in the situation. It will be important when it comes to making decisions and implementing the changes that those people who will be directly affected by the changes understand the reasons for the changes and commit to the implementation, not because I say so, but because they honestly believe that it is the right thing to do. Furthermore, I wish to foster the aims of WCM by ensuring that the decisions are made at the lowest levels possible where they will be implemented. This requires a participative approach to research.

Changes can only be decided once I understand the situation and have identified the key leverage points. Only then will a theory be formulated in the form of an intended change that will be tested by implementation. Depending on whether the change is in the right direction or not, further theories will develop and further changes made. The number of changes at any one time can not be determined up front, neither can the 'experimental conditions' be determined up front or fixed.

A key outcome is not only to effect change but to understand what leads to change success or failure. The intention is to understand the dynamics and effects of the change process on the team without shielding the team from any other environmental changes or organisational change requirements or any other crises that occur from time to time within the working environment.

The overall purpose of the study was not to prove any particular theory but rather to develop an understanding that would lead to an improvement in the situation, improve my understanding of change management so that I could share the learning with other managers in similar situations and from the learning derived improve at least my own management practise in the future.

A review of the literature coupled with the foregoing requirements led me to the conclusion that the situation was best suited to a qualitative research approach. Qualitative research is concerned with understanding social phenomena from the participant's perspective (PART III)<sup>1</sup>. Ethnographic research in particular was the preferred methodology. It is a naturalistic-interactive approach to enquiry that entails entering the participant's environment in order to discover how participants interpret and react to the occurrence of events and processes. As the terminology suggests it entails interactive data collection methods such as fieldwork, participant observation, ethnographic interviews and the collection of artefacts and relevant documentation. In addition, data collection methods normally associated with quantitative research are also employed depending on the context. Using this research approach would therefore enable the understanding of the team's response to their situation.

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<sup>1</sup> PART III: Qualitative Research Designs and Methods - class notes OMDP 1998

Apart from the need to understand the situational context, I wanted to develop a means for improving the situation. Thus an additional requirement was to effect change. The situation that needed improvement was extremely complex. The people, technology and management issues were so inextricably bound that any improvement attempt would have to be subject to full participation by all involved. It is also widely held that any change process involving people is most likely to be sustainable if those affected have been an integral part of the design of the changes.

For this purpose I chose to adopt the Action Research approach. Dr. Abby Day (1994)<sup>2</sup> describes action research as an issue or problem centred research approach used to improve a situation that is grounded in the reality of the individual's job and organisation.

Combining the two methodologies provided a research design framework. Action research principles were employed to guide the group through the change process. At the same time ethnographic research methods were used to understand the change issues and the impact of the process on the participants from their point of view.

*In summary, this introductory chapter has served to introduce the research topic, presenting the purpose for the study as well as providing the background and situational context within which the study is relevant. It described the focus and scope of inquiry, and presented the research design.*

*The next chapter discusses World Class Manufacturing as a management concept for business improvement.*

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<sup>2</sup> Day, Abby. Action Research. International Management Centres. Class notes OMDP98

## 2 WHAT IS WORLD CLASS MANUFACTURING?

In this section I will explore the concept of WCM. I will not explain the specific techniques involved. There are multitudes of instructional manuals that cover at least some of the individual techniques. Instead I explore the WCM paradigm and the management philosophy that has given rise to this school of management thought. I will then position the relevance of WCM as a manufacturing strategy for South African industry and why the outcome of this study has relevance for manufacturing managers.

### 2.1 In Search of a Definition

World Class Manufacturing (WCM), as the name suggests, is essentially a manufacturing management strategy that aims to establish manufacturing organisations as world leaders in every aspect of their operation. WCM organisations are characterised by the achievement of business benefits such as waste elimination, minimisation of defects and total worker participation. These characteristics have the advantage of reduced overall manufacturing costs and improved product quality.

Not much has been written explicitly about World Class Manufacturing as a business improvement strategy. Far more literary space has been afforded to what I believe are the individual sub-strategies within the WCM strategy such as Total Quality Management (TQM), Just-in-time (JIT) production, and so on.

However, several authors define WCM as part of their discussions on the subject. Harrison (1998)<sup>3</sup> quotes the definitions given by several other authors on the topic including those by Womack et al (1990), Hayes and Wheelwright (1984), Oliver et al (1994) and Skinner (1995) to name a few.

Schonberger (1986)<sup>4</sup> perhaps sums up the gist of WCM best in his book entitled 'World Class Manufacturing: The Lessons of Simplicity Applied':

*"In the 1950s through the 1970s, running manufacturing companies became gentlemen's work. Decisions and policies were made by people twice and thrice removed from the manufacturing arena. Authority was in the hands of staff people who sifted data from other staff people. Venturing out into the plant was, well, venturing. It was prudent to stick around offices and conference rooms and make sure your backside was covered. Excitement in industry was confined to high-tech R&D. Manufacturing was stagnant.*

*How quickly things change. While the changes have scarcely touched small companies, the well-known manufacturers are caught up in revival, renewal, recovery, and renaissance. A popular term among those caught up is world-class manufacturing or a term like it. World-class manufacturing may sound like Madison Avenue hyperbole, but it is not. The term nicely captures the breadth and essence of fundamental changes taking place in the larger industrial enterprises. A full range of elements of production are affected: management of quality, job classification,*

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<sup>3</sup> Harrison, Alan. 1998. Manufacturing strategy and the concept of World Class Manufacturing. *International Journal of Operations and Product Management*. Vol 18. Emerald.

<sup>4</sup> Schonberger, Richard. 1986. World Class Manufacturing: The Lessons of Simplicity Applied. The Free Press. New York.

*labour relations, training, staff support, sourcing, supplier and customer relations, product design, plant organisation, scheduling, inventory management, transport, handling, equipment selection, equipment maintenance, the product line, the accounting system, the role of the computer, automation, and others."*

## 2.2 The Birth of WCM

The term 'world-class' conjures up notions of exceptional quality. Not surprisingly, WCM has its roots in the Japanese manufacturing change-management strategy of the early eighties when quality improvement became a focal point. The historical background goes that post war occupation by the Americans introduced the Japanese to the might of the American economy as portrayed by the sheer profusion of goods at phenomenally better quality standards than they were capable of (Micklethwait & Wooldridge, 1997)<sup>5</sup>. Instead of directly competing with the west, the Japanese decided to learn from Western management philosophers such as Joseph M. Juran, Armand V. Feigenbaum, and in particular, W. Edwards Deming of the earlier influences and later also Philip B. Crosby developer of the Zero Defects programme (Schonberger & Knod, 1988)<sup>6</sup>. The emphasis in these early days was on quality education.

The common theme in Deming, Feigenbaum and Juran's work was the 'holism' concept - the 'totality' aspect of the management of quality. Japan's Kaoru Ishikawa built on the work of Feigenbaum who proposed the Total Quality Control (TQC) concept in 1951, which explicitly placed the burden for proof of quality on the maker of the part. Ishikawa followed this lead with the introduction of the term: Company Wide Quality Control (CWQC). He was also the originator of Quality Control Circles in both concept and practise (Schonberger & Knod, 1988).

The Japanese quest for quality improvement focused on the importance of getting things right the first time rather than spending lots of time and money on finding the defects later. At the time, however, the prevailing western business model prescribed quality control. This entailed hiring a separate department of quality inspectors to check for defects after the production process.

Apart from the philosophical teachings of the western gurus, Japanese managers took to practical learning by visiting American mass production facilities in the hope of discovering what made them so successful and how they could be bettered. Two such managers combined the philosophies of Deming and others with their practical experience gained by visiting mass production sites, and transformed their theories into a new system of production. These men were Kiichiro Toyoda, the head of Toyota, and Taiichi Ohno, his right-hand man (Micklethwait & Wooldridge, 1997). Not only had

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<sup>5</sup> Micklethwait, John and Wooldridge, Adrian. 1997. The Art and Practise of Japanese Management. Strategy & Business, First Quarter of 1997. Available on line at: <http://www.strategy-business.com/strategy/971107.html>.

<sup>6</sup> Schonberger, Richard J. and Knod, Edward M. Jr. 1988. Operations Management: Serving the Customer. Third Edition. Business Publications Incorporated. Illinois.

they introduced a new quality management system, but they also designed a new production planning system. They called their system the Toyota Manufacturing System (TMS) also known as the so-called Lean Production system.

The basic aim of TMS was to overcome the *muda* that was rife in western countries. *Muda* is a Japanese term that refers to waste of resources such as wasted effort, material and time. The strategy that aims to minimise *muda* is a threefold manufacturing strategy that changes from a focus on economies of scale to what Micklethwait and Wooldridge (1997) describe as "economies of time". The essential differences are tabulated below.

**Table 1. Threefold strategy of TMS.** Adapted from Micklethwait & Wooldridge (1997).

<b>Economies of time strategy (TMS)</b>	<b>Economies of Scale strategy (Prevailing Model at the time)</b>
<ul style="list-style-type: none"> <li>➤ Every employee an empowered quality checker – quality of each production step checked and workers given the power to stop production to correct defects</li> </ul>	<ul style="list-style-type: none"> <li>➤ End of line quality inspectors. Emphasis on keeping the line running at all times meant that errors multiplied significantly until detected in final batch</li> </ul>
<ul style="list-style-type: none"> <li>➤ Just-in-time production. Parts arrived as and when needed for production. Supplier reliability is key and customer-supplier relationship building is emphasised (<i>keiretsu</i>).</li> </ul>	<ul style="list-style-type: none"> <li>➤ Just-in-case production strategy. Storerooms and warehouses filled with costly parts that gather dust until they are eventually needed. Organisations set up their own part-supplying divisions. Later as competition set in, supplier is typically awarded short-term supply contracts based on best price.</li> </ul>
<ul style="list-style-type: none"> <li>➤ Demand-pull production. Only produce based on demand. The <i>kanban</i> card re-order system.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Supply-push production – produce as much as possible so that product availability is high in case demand increases unexpectedly. Massive overproduction with product spoiling in storage.</li> </ul>

Around these three core strategic elements hinged further business principles. These included the principles of continuous improvement (*kaizen*), consensus building (*nemawashi*) and shared decision-making (*ringi*). As a total manufacturing change management approach, the former three strategic elements may be seen as the step changes required (*kaikaku*) and the last three as the sustainability elements.

The model is well suited to the Japanese way of life and therefore has achieved the success that it did during the eighties. One of Japan's respected management leaders, Kenichi Ohmae, explains that the 'communal village' lifestyle in Japan serves to naturalise a working environment where brash leadership is downplayed and decisions –

operational and strategic – are arrived at through a process of mutual agreement and consensus (Ohmae, 1982)<sup>7</sup>. Another underlying enabler for sustainability was the Japanese norm of lifetime employment coupled with the convention that even senior managers start from the shop floor ranks in the company.

### 2.3 WCM Moves West

At the time, the Japanese manufacturing strategy described above was not referred to as WCM. Although this strategy worked extremely well for the Japanese, it also started having relevance for the Western world when W. Edwards Deming was finally recognised in his own country in the eighties when Japan's dominance in the manufacturing world became severely tangible in the west (Schonberger & Knod, 1988). American organisations started implementing TQC, quality circles, quality at source, business process re-engineering, just-in-time production, supplier and customer partnering, and what became perhaps the most popular management panacea of all, TQM.

Along with the just-in-time strategy came the need for reliability and availability of plant equipment. This brought an increased focus on the maintenance of plant equipment and techniques such as preventative maintenance, reliability centred maintenance (RCM) and more recently Total Productive Maintenance (TPM) which has its roots in TQM, Japanese 5-S and *kaizen*. The essential difference between RCM and TPM lies not in the technological approach but rather in the systemic holism which is characteristic of TPM. Just as the burden of first line quality rests with the process operator in TQM, so too does the burden for first line maintenance rest with the process operator in TPM.

Several western companies managed to implement the above strategies with phenomenal success. In addition, the western organisations were able to reduce excess resources more rapidly than their eastern counterparts since the concept of a job-for-life was not seen as a prudent approach for achieving business success in the west. Instead strategies such as downsizing, rightsizing and delayering took the west by storm. Although these strategies can have undesirable consequences if not implemented systemically, some companies were able to take a holistic approach and achieved the Lean Production result they desired with greatly improved business benefits. Organisations such as Hewlett-Packard, Motorola, General Electric and 3M, to name a few, are among those who implemented a combination of several of these strategies in the eighties and have seen large scale manufacturing improvements with the coincident business benefits. These are the types of companies that first started using the term *world class* since they saw themselves as world leaders in their new-found successful approach to manufacturing (Schonberger, 1986).

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<sup>7</sup> Ohmae, Kenichi. 1982. *The Mind of the Strategist*. McGraw-Hill.

## 2.4 New WCM learnings for the East

As time progressed, the western world became so adept at modifying the Japanese TPS to their own systems that in the 1990's it is held that the Japanese are returning to the west to learn new successes (Micklethwait & Wodridge, 1997). The authors assert the reason for this is that the job-for-life and absence of harsh people decisions by Japanese management is slowing down the phenomenal progress enjoyed during the eighties. The impact has been felt even more during the last ten years when Japan's economy has been showing signs of crisis. On the other hand, western organisations have stripped organisations of their innovative resources through right-sizing, downsizing, delayering and hard people decisions. In addition, the key difficulty facing the modern western organisation is cost control. The only real strategy being employed is cost cutting which has a host of problems associated with it. The authors further assert that in recent years, the Japanese think tank has come into its own again by finding alternative cost management methods to downsizing which as was mentioned earlier goes against the Japanese business strategy principles.

Several business leaders of the nineties have come to realise that business strategies can no longer be assessed on their local fit – 'good for the west' or 'suits eastern styles'. As modern day Japanese guru Yotaro Kobayashi points out, globalisation is no longer a process but a condition (Kobayashi, 1999)<sup>8</sup>. Organisations have entered a new era of challenges that require them to be competitive in the global sense. He points out that Japan has suffered ten years of business crisis due to procrastination and the belief that what worked so well in the eighties would continue to bring success into the future.

The reality is that the world has learnt so well from the example set that several western organisations have surpassed the success of the Japanese and have built even leaner organisations taking multi-skilling to new levels. Kobayashi says that managers in the Asia-Pacific region are facing enormous challenges that need tough decision making that was perhaps not necessary in the past. He warns that although Japanese management need to take tough decisions, they should place even more emphasis than ever before on people as a core business focus.

*Kaizen* alone is not sufficient anymore. There are only so many small enhancements that can be made to the same old thing until something completely new takes over the market. It is now time to exercise radical change – *kaikaku*. The flexibility that demand-pull and just-in-time introduced to manufacturing compared with the traditional mass production, needs to be taken to new heights. In fact a kind of global diversification is called for that allows specific, diverse customer needs to be achieved by using the agility of the existing manufacturing capacity – mass customisation.

The trick however is to establish the right balance. Kobayashi calls for serious thought on balancing profitability and societal needs, including employment

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<sup>8</sup> Kobayashi, Yotaro. 1999. Bridge to the New Future: Challenges and Opportunities for Managers in the 21<sup>st</sup> Century. Keynote Address at the 48th PATA Annual Conference. Available online at <http://www.hospitalitynet.org/lodging/news/4001970.htm>.

security and a balance between profitability and ethics. Kobayashi says restructuring is inevitable for survival but the aim should be to achieve "globality". He places particular emphasis on the revitalisation of the middle management layer that rightsizing removed as a key to achieving both shop floor change and strategic objectives. The key, he says, is to get everyone on side, especially the community. He says that when organisations focus on the community as stakeholders, they take responsibility for their actions by establishing appropriate governance ethics.

## 2.5 WCM Relevance for the South African Manufacturer

From the foregoing discussion it can be seen that modern management principles have evolved over several decades to a point where business survival has come to mean global survival. The focus has shifted from assembly line workers who make widgets to workers who are responsible decision-makers from shop floor level up and organisations as value creation centres. In addition modern business strategies combine the learnings of the past decades with innovations that have been born along the way to give rise to a manufacturing strategy that has all the elements necessary to position a manufacturing unit as one of the best in a global sense – world class.

According to Lubrich and Watson (1998)<sup>9</sup>, organisations that aspire to WCM status have the following basic performance goals:

- 0% lost time accidents
- 0% unplanned downtime
- 0% scrap/rework
- 0% set-up time
- 0% inventory
- 100% participation

As will be discussed later, I believe that caution should be exercised when applying the zero-percent concept. Nevertheless several South African manufacturers, if not all, can gain enormous business benefits by reducing downtime and waste and increasing participation. Implementing WCM techniques can go a long way towards improving the business.

As mentioned previously, I have not found an explicit WCM model in the literature. Most texts describe the constituent ideas that characterise the WCM strategy rather than presenting an integrated holistic approach. However, I have extracted some of the key ideas of the above discussion and combined them with the manufacturing ideas put forward by Virginia O'Brein (1996)<sup>10</sup> to encompass what I believe to be the essence of World Class Manufacturing. The key concepts include:

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<sup>9</sup> Rubrich, Larry and Watson Madelyn. 1998. Implementing World Class Manufacturing. WCM Associates.

<sup>10</sup> O'Brein, Virginia. 1996. The Fast Forward MBA in Business. New York. John Wiley & Sons Inc.

- **Total performance**— the focus has shifted from producing large volumes at lowest cost to producing the required volume of a variety of high quality goods in the most efficient, cost-effective way.
- **JIT production** – daily demand-pull schedules are used to balance the cost of inventory against the benefits derived from accumulation in both materials and product management.
- **Lean Production** – focus is on speed, waste reduction, flexibility, simplification, cost-efficiency, quality, skills diversity and continuous improvement as opposed to 'volume at all costs'. The emphasis is cost control through elimination of waste in the form of excessive materials, resources, time and defects.
- **Capacity building** – capital, technology, materials and people are being used in increasingly diverse ways to yield greater productivity without necessarily increasing resources
- **Manufacturing teams** – multi-functional self-governing, self-directing, self-regulating teams who are empowered to make decisions that affect their working environment. Teams that work together to achieve flexibility in manufacturing, solving complex problems as and when they occur, collaborating together to improve process efficiency and product quality, and partnering to provide their immediate customers with better value. This concept replaces the old boss-employee relationship where the boss had all the answers and the employee performed as instructed.
- **Best Practise** – knowledge creation and knowledge management by documenting a shared vision by all employees as to what constitutes the current best methods for achieving agreed goals in their area. This is followed up with continuous examination of current practise to find ways of improving methods and standards as well as incorporating any new learnings as they emerge so that current documented methods at any time are the agreed best practises.
- **Technology Management** – technological capability in manufacturing provides cutting edge leverage in speed, innovation and flexibility. The key lies in integration with human potential and accessibility to everyone in the organisation.
- **Time is of the essence** – all required actions from the manufacturing process steps to the enabling tasks that the teams perform are subjected to time pressure. The faster the cycle time of a product – the better the manufacturing efficiency. The earlier a problem is discovered and the faster it is resolved the smaller the impact. Process maps and flow rate charts are used to identify bottlenecks or areas where flow can be improved.
- **Customer and supplier business partnerships** – customers and suppliers are not treated as outsiders but are respected as valuable team members in the overall value chain ensuring that products made to meet a known customer requirement and supplier offerings can be used with confidence
- **Total Quality Management (TQM)** – quality at source as opposed to end of run quality inspectors. Quality management is performed by empowered manufacturing teams who not only assess quality parameters and track quality trends through the use of Statistical Process Control (SPC), but who also continuously and constantly improve product and process quality, by taking thoughtful action according to the Plan-do - check-act cycle of Deming.

- **Total Productive Maintenance** – team driven maintenance practises where the manufacturing team are themselves responsible for the condition of the equipment they operate. The empowered teams who assess plant condition, trend plant performance, solve technical problems and perform RCM tasks achieve the management of plant availability and reliability. The teams also continuously improve plant condition through problem solving and PDCA learning cycles to improve plant effectiveness, plant efficiency, output quality, and personnel safety.
- **Learning organisation** – where knowledge creation and management of Best Practise is continuously fuelled by effective problem solving throughout the organisation. As new problems are encountered, new learnings emerge, standards are set and better methods are introduced, everyone in the organisation is continuously being developed to achieve the better standards, apply the better methods so that repeat problems are avoided.
- **Continuous Improvement** – everyone in the organisation is committed to driving improvement in all areas of the business not only through small incremental changes but also through large improvement steps and radical innovation when called for.
- **Systemic holism** – Business processes are linked. Vertically structured functional blocs are challenged. The impact of decisions assessed in terms of the overall effect on the organisation's functional ability.

The combination of the above concepts as a minimum provides a broad conceptual base of what I believe constitutes World Class Manufacturing. Each of the conceptual elements mentioned incorporates a host of practical methods referred to commonly as WCM techniques. (These will not be detailed here but further information can be read in Rubrich and Watson, 1998.) In section five I propose a model that integrates the essential underlying paradigm necessary for WCM as I see it, with the WCM strategies presented here.

*This chapter has served to introduce the concept of World Class Manufacturing, providing the background within which the study is relevant.*

*In the next chapter, a detailed discussion around the research methodology choice and the rationale for this choice is presented.*

### 3 METHODOLOGY

So much has been written on qualitative research and action research. However, there is no common ground in the literature as to where in the hierarchical 'logical levels' of thought they belong. Qualitative research is described as a paradigm by some, as a methodology by others, an orientation by yet another group, a research approach, and even a research method depending on whose work you read. Action research has been described in the same way with some authors pitching action research as a methodology within a qualitative research paradigm and others vice versa.

In this chapter I present the key assumptions associated with the various research paradigms and by overlapping these with my research intentions, I explain my choice of research methodology.

#### 3.1 Logical Levels in Thought and Action

The Chambers 20<sup>th</sup> Century Dictionary defines the terms 'research' and 'study' as follows:

- Research – a careful search: investigation: systematic investigation towards increasing the sum of knowledge.
- Study – ...application of the mind to the acquisition of knowledge...

Indeed, conducting a research study has as its main aim the generation of knowledge. However, knowledge claims must be subjected to validation. The method of collecting data and making inferences has to satisfy this requirement. The research approach adopted in turn has to satisfy an underlying philosophy of knowledge creation and verification. The particular philosophy adopted informs one's worldview and is itself reframed over time as one changes one's worldview. Thus we can draw a hierarchy of thought levels where each level informs the next as depicted in the schematic below.

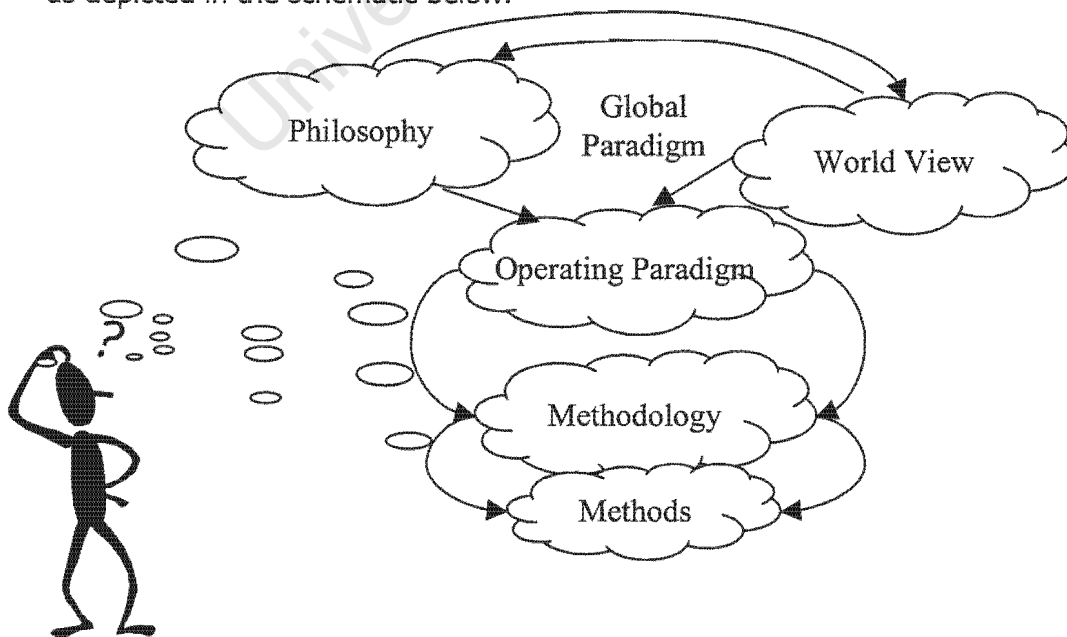


Figure 3.1 Logical Levels of Thought and Action

The above diagram indicates that the choice of research methods and methodology is dependent on the operating paradigm that contextualises the research situation.

In particular, the research approach adopted should enable the achievement of the following:

- Participation by all in the focal team
- Understanding of the situational reality from the team's perspective collectively and as individuals
- Assessment of the espoused theories and theories in use by gathering both narrative and 'hard' data
- Entry of the researcher into the situation to become part of the change experience rather than the notion of the totally independent researcher who has no personal effect on the research situation so that the results can be independently replicated
- Implementation of changes that are controlled only to the extent that it follows an emergent plan developed as the process advances
- The plan or theory being tested is not known fully until the inquiry begins and develops throughout the research process and is never cast in concrete at any stage nor is it stated as a hypothesis to be accepted or rejected
- The process allows for simultaneous changes in several variables which are related in a complex way that is not necessarily clear to the researcher at the time and without deliberately fixing any other variables
- A complex interacting set of results emerges that through an iterative process of theory development and testing eventually suggest a research outcome
- Reliance on emergent theories, hypotheses, insights and even research methods as the process evolves
- Because the situation being analysed is unknown to start with, the sample population beyond the immediate team can not be decided a priori but is rather directed by the process itself
- Other data requirements such as documents, quantitative results, artefacts, and the methods of obtaining this data can not be known until the precise moment during the research process when it becomes apparent that one or other data source or method may be relevant
- The aim as stated earlier being not to prove any particular theory but rather to gain the best understanding possible

I would therefore have to find a research methodology that subscribes to a philosophy of knowledge for a purpose and a worldview that recognises that reality is socially constructed. The following is a literature survey of the guiding epistemologies and ontologies governing research.

### **3.2 Philosophy and World View**

Philosophy as a discipline strives to propose a set of assumptions that may be used as guiding principles, laws, rules or theories to explain fundamental elements of life such as the nature and origin of existence, knowledge and thought. A philosophy may be considered to be a high-level theory used for judging and constructing more specific theories for decision and action.

A worldview can be described as a conceptual reference for understanding the complexity of everything we perceive to be our world. It is a mental model or conceptual framework that allows us to make sense of the phenomena, concrete experiences, social interactions, thoughts, feelings and everyday existence of what we have come to know as life. Heylighen (1996)<sup>11</sup> describes a worldview as a framework that will "... synthesise the wisdom gathered in the different scientific disciplines, philosophies and religions. Rather than focusing on small sections of reality, it would provide us with a picture of the whole." As such a worldview is our personalised set of theories about our world for decision and action.

As described here, there is a clear link between philosophy and worldview. One could conceive of a philosophy as the guiding theory for arriving at a worldview that explains enough about our world in order for us to make meaningful decisions. On the other hand, one could conceive of a worldview as the guiding ontology or metaphysics for framing a philosophy about the nature of existential reality. The intersection of these two can be seen to represent the global paradigm that guides our actions.

### 3.2.1 Philosophy of Knowledge

Since research has to do with increasing knowledge and improving understanding, it follows that any research methodology is based on a philosophy about the nature of knowledge. This branch of philosophy, known as epistemology, is centred on the question "How do we know that we know?" (Goolsby, 1998)<sup>12</sup>. Or stated slightly differently: "what distinguishes true (adequate) knowledge from false (inadequate) knowledge?" (Heylighen, 1993)<sup>13</sup>.

The history of epistemology suggests a shift in guiding position from knowledge as absolute, static, permanent, independent to relative, developmental, adaptive and interdependent on the world. Peterson (1998)<sup>14</sup> describes this shift as a move from deductive rationalism to inductive pragmatism. Trochim (1997)<sup>15</sup> presents this philosophical shift as one from positivism to post-positivism, while Lincoln and Guba (1985)<sup>16</sup> describe the shift as one from a positivist paradigm to an emerging paradigm or phenomenological paradigm (Maykut and Morehouse, 1994)<sup>17</sup>. The main phases of epistemological development are discussed below.

<sup>11</sup> Heylighen, F. 1996. What is a Worldview? Available on the Principia Cybernetica Web at <http://www.worldview.html>

<sup>12</sup> Goolsby, Jerry R. 1998. Modern Management Philosophy. Available on line at <http://www.bluecrab.org.members.jkalister.know.htm>

<sup>13</sup> Heylighen, F. 1993. Epistemology, Introduction in Heylighen, F., Joslyn, C. and Turchin, V. (editors): Principia Cybernetica Web (Principia Cybernetica, Brussels). URL: <http://peppmc1.vub.ac.be/EPISTEMI.html>

<sup>14</sup> Peterson, T. 1988. Three Essays on C.I. Lewis's Mind and the World Order. Available on line at [http://deming.ces.clemson.edu/pub/den/deming\\_peterson.htm](http://deming.ces.clemson.edu/pub/den/deming_peterson.htm)

<sup>15</sup> Trochim, W.M.K. 1997. Research Methods Knowledge Base. Available on line at <http://trochim.human.cornell.edu/>

<sup>16</sup> Lincoln, Y.S. and Guba, E.G. 1985. Naturalistic Inquiry. quoted in Maykut and Morehouse (1994).

<sup>17</sup> Maykut, Pamela and Morehouse, Richard. 1994. Beginning Qualitative Research: A Philosophical and Practical Guide. London: The Falmer Press

### 3.2.2 Ancient Greek Philosophy

I begin with the Greek philosophers from the Socratic school, Plato (427BC - 347BC) and Aristotle (384BC - 322BC). Plato viewed knowledge as absolute in itself, as being universal in nature, as describing a reality that transcends experience and independent to the extent that it is innately *a priori* (Heylighen, 1993; Peterson, 1998).

It is worthwhile to note that Socrates' ideas as developed further by Aristotle in many respects may have formed the basis of modern cybernetics and systems thinking. At the time a popular Greek philosophy of physics was that of the organismic model of the universe – that nature could be understood as “*a man himself – moving towards goals, striving toward the best possible arrangement, in short, acting like an organism*” (Wilson, 1999).

While Aristotle accepted this theory he nevertheless rejected the reductionist approach of atomism as too simplistic. He dismissed the view that all matter could be reduced to infinitism moving haphazardly as if without intention. Instead he believed that everything that exists has purpose and is always in a state of motion, striving towards an end. This insistence on holism for physical explanation as opposed to reductionism can be seen in the following quotations from Aristotle's manuscripts quoted in Wilson (1999):

*“For it is not enough to say what are the stuffs out of which an animal is formed, to state, for instance, that it is made of fire or earth – if we are discussing a couch or the like, we should try to determine its form rather than its matter ... for the formal nature is of greater importance than the material nature ... the true object of architecture is not the bricks, mortar or timber, but the house; and so the principal object of natural philosophy is not the material elements, but their composition, and the totality of the substance, independently of which they have no existence”.*

Aristotle ascribed to the traditional rationalism of Plato to the extent that knowledge was universal, however, he believed that practical means to knowledge were plausible, such as observation and empirical methods. The ideologies held by these two great Greek thinkers are brilliantly summarised by Wilson (1999)<sup>18</sup> in his papers on Science and Human Values where he writes that:

*“Of the great philosophers of Greece, Plato and Aristotle, the latter was the one who relied on observation. Raphael's The School of Athens shows the two great philosophers in the centre of the painting, surrounded by the other great Greeks, with Plato holding his hand upright as if to indicate, 'look to the perfection of the heavens for truth', while Aristotle holds his arm straight out implying, 'look around you at what is if you would know truth'.”*

### 3.2.3 Kantianism

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<sup>18</sup> Wilson, F.L. 1999. Papers on Science and Human Values. Rochester Institute of Technology. Available on line at <http://www.rit.edu/~flwstv/>

These two epistemological approaches of rationalism and empiricism largely dominated for several centuries through the Renaissance period when science as the 'truth' provider dominated. An important era was that of the German Philosopher Immanuel Kant (1724 – 1804) who synthesised the philosophies of traditional rationalism and empiricism into the beginnings of what many consider to be a constructivist viewpoint.

He accepted that *a priori* knowledge about the world – such as derived from mathematical principals – could be acquired purely by reason in the absence of experience. However, it was not possible to discover the world in its entirety through abstract reasoning alone. These two ideas were not new. The real break from traditional thought was Kant's assertion that it was not possible to access a 'true' external reality (Heylighen, 1997)<sup>19</sup>. Instead, knowledge was limited to the extent that the mind could use fundamental built-in or inborn 'categories' to organise experiences. Thus he proposed that while we can never know how things really are, we can closely approximate reality through mental constructs. Wilson (1997)<sup>20</sup> writes that the word '*phenomenon*' originates from Kant and was taken to mean '*close to the real thing*'.

These built-in or inborn categories for thought were taken by Kant to be universal delineators such as time, space, objects and causality (Heylighen, 1993). Thus he acknowledged the requirement for *a priori* enablers for knowledge generation but did not make allowance for the subjectivity of basic concepts such as space or time between two minds.

### 3.2.4 Modernism and Positivism

The worldviews within which the foregoing philosophical beliefs are relevant are the modern and positivist worldviews. Although there are no clear timelines in the literature, the era following ancient Greek philosophy and inclusive of Kantianism is considered to be the modernist era. The emphasis of modernism was on revealing the truth through certain defined methods of discovery – replacing superstition and tradition with rationality and scientific method (Wilson, 1997). Validity was dependent on strictly controlled procedures, the results of which could be replicated independently by other scientist following the same procedure.

Positivism is essentially a modernist scientific worldview with particular emphasis on direct observations and measurements as the purpose of scientific research (Trochim, 1997). The positivist worldview is that of a deterministic world operated by natural physical laws. The aim of science in positivism is to understand these universal laws so that reality can be predicted and controlled.

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<sup>19</sup> Heylighen, F. 1997. Epistemological Constructivism in Heylighen, F., Joslyn, C. and Turchin, V. (editors): Principia Cybernetica Web (Principia Cybernetica, Brussels). URL: <http://peppmc1.vub.ac.be/CONSTRUC.html>

<sup>20</sup> Wilson, B.G. 1997. The Postmodern Paradigm. Available on line at <http://www.cudenver.edu/~bwilson>

### **3.2.5 Postmodernism and Post-positivism**

The early to mid twentieth century marked the next significant progression in epistemology. The epistemologies developed since then are relevant within the worldviews of postmodernism and post-positivism.

Postmodernism represents a shift from the total dependence on 'positivistic science' – control, precision, independent verification through exactly observable and directly measurable means – to less mechanistic theories of inquiry. Postmodernism rejects the universality of truth and reality in favour of circumstantiality. The aim of post-positivism then is the understanding of contextual realities in totality – without carefully controlling certain variables in favour of understanding others. Postmodernism further holds that empirical truth is at best probabilistic and therefore predictions are not deterministic.

### **3.2.6 Constructivism**

Radical Constructivism is a key postmodernist epistemology. Constructivists reject the idea of *a priori* knowledge. All knowledge is conceptually constructed from scratch (Heylighen, 1993). There is no dependence on empirical experience, data, inborn categories or cognitive structures.

This differs from Kantian ideas of *a priori* schemas for knowledge construction although the idea of a representation of reality is similar.

### **3.2.7 Pragmatism**

Pragmatism was suggested by C.S. Pierce in the late 1800's and has formed foundations for modes of inquiry such as logical positivism, conventionalism and certain interpretations of quantum mechanics (Peterson, 1993; Heylighen, 1993). Pragmatism accepts that knowledge is constructed and rejects the rationalist notion of ultimate truth. The key focus of pragmatism is on utility of these knowledge constructions or models in problem solving. The purpose of pragmatic knowledge is to develop rules for action.

### **3.2.8 Conceptual Pragmatism**

Radical Constructivism did not answer the question about the purpose or verifiability of knowledge since models are not seen as connected to the reality they represent. Pragmatism emphasises purpose of models for decision about reality but does not adequately explain where knowledge constructs or models come from (Heylighen, 1993).

Enter C.I. Lewis (1929) who's philosophy of Conceptual Pragmatism built on the ideas of Immanuel Kant and C.S. Pierce to find an epistemological link between abstract concepts, experience and reality.

Lewis's philosophy as expressed in his book *Mind and the World Order*, rests on three pillars of thought (Peterson, 1993):

- Concepts are developed by making sense of reality through a priori meaning structures that are the result of prior experiences.
- Conceptual knowledge is of no importance beyond its usefulness for decision and action, for anticipating the future to satisfy our practical needs.
- Certainty is impossible. Absolute uniformity of experience is impossible. The degree to which knowledge is accurate is socially constructed, relies on commonality of understanding, and since laws are subject to error by a single invalidatory experience, knowledge is at best probable.

### 3.2.8.1 Perception through *a priori* Knowledge

The first part of his theory has to do with the mechanism of perceiving raw data. As per Kant, there is a necessary *a priori* analytic for constructing knowledge. However, according to Lewis these previously defined criteria are not absolute but reliant on experience. The 'categories' or in-built knowledge schemas are related to experience and do not transcend it. They are implicitly held by the subject and are therefore not universal. Lewis provides the following explanation of *a priori* knowledge that he says answers many problems in epistemology: "*Through reflective examination of experience we may correctly formulate the principles of categorisation that are implicit in dealing with the empirically given. ... They (principles of categorisation) are therefore a priori because they place no limit on the given, but as principles of interpretation, condition it as a constituent of reality*" (C. I. Lewis, 1929 in Peterson, 1993).

### 3.2.8.2 Interpretation

According to Lewis, interpretation has to do with using our *a priori* mental categories for recognition or fitment of underlying principles to our experience. Through the use of these implicit principles we make sense of our experiences. The implicit principles are a result of previous experiences and meaning evolved through those experiences.

### 3.2.8.3 Application

Application of knowledge has to do with validation through experience and action. Here Lewis builds on the pragmatic theories of James, Dewey and Pierce by positioning knowledge as purposeful and not purely for knowledge sake. Lewis denounces emphasis in epistemology on explaining reality and the perception of reality in favour of understanding the application of knowledge to a purposeful end: "The definition of the real and the picturing of reality in general are less important and may not be possible" (Peterson, 1993). The pragmatic view is also that no one categorisation has more merit than another does except that one form may be more useful than another may. This emphasis on utility of knowledge for purpose and action is the basis of pragmatic thought.

Lewis denounced radical constructivism through his theory of a priori meaning constructs that are experience related. He further believed that each subsequent experience allowed meaning to evolve into new meaning structures, as does purpose. Lewis believed that purpose is *a priori* because it occurs prior to experience. However, as a result of experience and the meaning ascribed to that experience, purpose itself evolves in terms of the experience. Mental schemas or *a priori* knowledge categories also evolve through experience. This notion of emergence of purpose and meaning is key to Lewis's conceptual pragmatism or the reflective method as Peterson calls it and it is this acceptance of emergence that separates it from pure Piercean pragmatism.

#### **3.2.8.4 Co-operation**

The other key concept in Lewis's epistemology is that of shared knowledge or a social truth. He accepts the Socratic notion that knowledge validation has to do with cohesive consistency and agreement of minds. However, he notes that "*agreement between minds about fundamental criteria and principles should not be taken to indicate universal patterns of human reasoning, or transcendent concepts, or self-evident principles. Nor should it be taken to mean complete agreement*" (Peterson, 1993).

Lewis believed that we could achieve such agreement of minds, like language, because of our similarities as humans and our similar experiences. However, he notes that such agreement is not automatic but the product of a process of social interaction. Neither is such agreement total because of our different mental structures, which has resulted from different experiences and therefore will always perceive and interpret differently. However, such agreement is sufficient to validate knowledge claims as long as it was arrived at through a process of critical and logical rationalisation.

#### **3.2.8.5 Probabilistic Knowledge**

Finally, Lewis believes that certainty is impossible. He acknowledges that given sequences of experiences could legitimately result in a generalisation that such a sequence is possible in the future. However, he noted that such absolute uniformity of experience is not possible because as he puts it: "every identifiable entity in experience is not equally associated with every other" (C.I. Lewis in Peterson, 1993). This inability to know with certainty does not invalidate such a generalisation, except that we recognise the limitations of such laws. Lewis says that it is not required of our knowledge that every concept gives rise to uniformity that can be predicted with certainty forever (Peterson, 1993). Instead, Lewis notes that at a sufficiently high level there are essential wholes that provide the basis for generalisation. Such prediction is valid as long as we find current significance in its use and can be abandoned if future experience invalidates it. This does not mean that it was not valid to begin with because it was useful until our experience changed.

As an example, Peterson (1993) uses the analogy of a game of cards. If we are dealt a certain sequence, what is the probability of it being repeated? Sufficient trials will lead us to a conclusion that the process is purely random. This does not mean that we have no knowledge just because we have no laws for a sequence of any hand. We do have sufficiently high level wholes such as the total number of cards in the deck, the size of a trick, the total number of tricks, suits, colours, etc. to make some inferences. Our laws will, however, at best be probable.

Conceptual Pragmatism can be summed up in the following quotation by C. I. Lewis in Peterson, 1993:

*"The significance of concepts is that they lead to knowledge;  
the significance of knowledge is that it leads to action,  
community of knowledge leads to community of action."*

### 3.2.9 The Systems Thinking and Cybernetics Paradigm

The early organismic worldview of Aristotle and the socio-situational worldview of Lewis embodied a common theme: that knowledge generation is a purposeful activity. General Systems Theory (early 1900's) built on this theme of purposeful existence. Systems Theory is concerned with the organised complexity of purposeful systems. Indeed, by definition, a system has no existence without a purpose (Ackoff, 1984)<sup>21</sup>.

Cybernetic Theory, is concerned with how to effectively regulate the complexity within a system. Cybernetics has been defined in many different ways. Norbert Weiner, accredited as being the founder of cybernetics, defined it from the Greek word steersman or governor, to be the '*science of effective communication and control in man and the machine*' (Clemson, 1984).

Stafford Beer, one of the great systems thinkers of our time, took this definition beyond engineering into social systems when he defined cybernetics as the '*science of effective organisation*' (Clemson, 1984). The word *organisation* here is meant as a verb not as the noun describing a concern or company. Cybernetics therefore has to do with how systems organise themselves.

Stafford Beer defined systems as having the following main characteristics:

- **Complex** – having more relevant detail than any given observer can deal with
- **Dynamic** – constantly changing in behaviour or structure or both
- **Probabilistic** – exhibiting behaviour that is at least partly random
- **Integral** – the system elements act as a unit
- **Open** – embedded in an environment which affects the system but which is also affected by it.

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<sup>21</sup> Ackoff, R L. 1994. The Democratic Corporation. Oxford University Press. New York.

Simply put, cybernetics is the science of systemic regulation. Stated slightly differently, cybernetics is the scientific approach to complexity management – the complexity being due to the behaviour of a complex, dynamic, probabilistic, integral and open system. Cybernetics is therefore in direct contrast to reductionism – the science of reducing a system to its parts and by studying the parts derive a theory about the whole.

Being a science, there are several laws, principles and rules about effective system governance. I have extracted here some of the most significant ones and explain the terms as they may relate to a social system in a business context.

Firstly, a system in focus is a theoretical construct of reality. It exists only in the mind of the observer(s) or manager(s) of the system who have defined it. Secondly, our operationalisation of the human activities within the defined system and our set of theories for managing the system are all mental models of that system. Thirdly, the laws of cybernetics apply only to a bona fide system – not a group or conglomerate or collection.

Such a system is defined as a set of interacting elements that act together to achieve a commonly defined purpose. A system cannot exist if it has no purpose. The parts of a system cannot perform their function without interacting with other parts of the system. The system as a whole cannot achieve its purpose without the interaction of the parts in achieving their purposes. The system as a whole has characteristics that none of the parts taken separately have; and the parts have characteristics that the system as a whole does not have.

The human body as a living system is a good example of a bona fide system. The system may be defined in many ways by simply defining various purposes. The purpose may be to survive, grow, be happy or reproduce depending on the observer's definition. If we choose the purpose of the system to be that of survival, then we can define the purpose of each of the sub-systems (cardio-vascular system, gastric system, lymphatic system, central nervous system, etc.) in terms of their contribution to the overall purpose of survival. Finally, we will also need to define the essential interactions between these subsystems without which the purpose of survival can not be achieved.

If this were our system defined, then cybernetics would aim to understand how all the interrelated sub-systemic activities occurring in the body all the time collectively achieve the purpose of survival. This is not an easy task. Several years of medical research with several incurable diseases still out there attest to the fact that understanding complex systems is not an easy task.

When applied to more complex social systems with multiple interacting human activities, then the business of system definition becomes even more complex. Several systems thinking tools have been developed over the years to assist with this task. Checkland's Soft Systems Methodology is one such approach (Dick, 1998) as is the diagnostic approach of Stafford Beer's Viable

Systems Model (Espejo and Harnden, 1989)<sup>22</sup>. Peter Senge also presents a number of systems thinking methods (Senge et al., 1984)<sup>23</sup> in the Fifth Discipline Field Book.

However, Clemson (1984) warns against blind application of systems thinking methodologies without understanding the underlying cybernetics of complex systems. W. Ross Ashby wrote three basic cybernetic laws of complex systems (Clemson, 1984):

**Self-Organising Systems Law** – Complex systems are continually organising themselves through the ability of the parts to regulate each other. This self-regulation means that at any given point in time, the structural and behavioural patterns that characterise a given system are due to the interconnections between the parts. A system re-organises itself in order to survive environmental change by maintaining its essential variables within certain critical parameters. This process is known as **homeostasis** (Clemson, 1984). According to Ashby, for a system to preserve its integrity and survive, its rate of learning must at least match the rate of change in its environment (Boisot, 1986)<sup>24</sup>.

**Feedback Law** – The outputs of a complex system is dominated by feedback such that within wide limits, the input is irrelevant. Thus, all outputs that are important to a system have built-in feedback loops to ensure their achievement. An important corollary of this law is therefore that any desired output that has no associated systemic feedback loop will not be achieved by the system.

**Law of Requisite Variety** – The amount of regulation attainable is absolutely limited by the variety of the regulator. This law means that the more complex a system compared with its regulator, the lower the degree of (external) regulation achievable. Thus the self-organising law holds. In statistical or engineering terms this law can be seen as stating that the best model for regulating a system is one that has sufficient degrees of freedom to match the variety of the system.

These laws provide a context for thinking about complex social systems such as organisations. The essential ontology of the cybernetic manager is that reality is a network of highly organised complex systems that exists for a purpose. In order to regulate such a system, a manager needs a good model of the system. Application of systems thinking concepts and cybernetics enables understanding of complex social phenomena. More detail is provided in the model development section (chapter 5).

### 3.3 A Global Paradigm for Social Research

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<sup>22</sup> Espejo, R. and Harnden, R. 1989. The Viable System Model: Interpretations and Applications of Stafford Beer's VSM. Chapters 9, 10 and 12. John Wiley & Sons. Chichester.

<sup>23</sup> Senge, P., Kleiner A., Roberts C., Ross R. and Smith B. 1994. Fifth Discipline Field Book. First Edition. Nicholas Brealey Publishing. London.

<sup>24</sup> Boisot, M. Preparing for Turbulence: The Changing Relationship between Strategy and Management in the Learning Organisation. (class notes. OMDP98)

From the foregoing discussion on philosophy we see that ontological theory has shifted from reality as a single transcendental entity to reality that is socially constructed through experience into multiple realities. Epistemological theory has shifted from knowledge for knowledge sake, to knowledge of the ultimate truth for prediction and control, to knowledge for reaching a common understanding, making meaning and interpreting social phenomena in order to take purposeful action. The nature of valid knowledge has shifted from abstract ideas that can be validated through reasoning alone, to knowledge claims that can be independently verified through defined empirical means, to knowledge that is at best probable, valid to the extent that it adequately represents a shared vision of reality. Perhaps most saliently, the commonality of knowledge has come to be seen as a relevant factor in social action.

The intersection of these two positions results in a paradigm for inquiry which seeks to understand the nature of complex multiple perspectives of reality that drive social phenomena as a whole. The aim of such an understanding would not be to prove any *a priori* law but would rather lead to the uncovering of themes and patterns of proposition that could suggest a theory for future decision and action. Such inquiry would be relevant in an ontological position of multiple realities so the observed is considered to be dependent on the mental constructs of the observer.

Given the requirements of my research (detailed earlier) it can be seen that the research methodology choice should reside within the paradigm described here. Thus, my research assumptions articulated previously are satisfied by the Qualitative Research paradigm. Qualitative research is not concerned with objective observation, quantifiable data and verifiable 'truths'. The aim of qualitative research is to understand phenomena in all its complexity within a particular situation and environment (Maykut and Morehouse, 1994). Qualitative research methodologies are therefore particularly relevant in complex social systems such as business organisations.

### **3.4 Qualitative Research Methodologies**

If qualitative research is to achieve the aims outlined above, then traditional positivist research methodologies can not be used. This has implications for how data is gathered and interpreted, and how propositions are validated. According to Maykut and Morehouse (1994), the qualitative researcher seeks patterns that emerge from data as the basis for making propositions. The approach is not to verify universal laws by creating a test environment, but to discover explanatory 'laws' that are suggested by the complexity of the contextual environment itself.

#### **3.4.1 Research Design – Phenomenological Inquiry**

This exploratory and descriptive focus of inquiry requires a methodology that supports such discovery. Lincoln and Guba (1985)<sup>25</sup> describe the methodology as *Naturalistic Inquiry*. The design of such a methodology is itself subject to

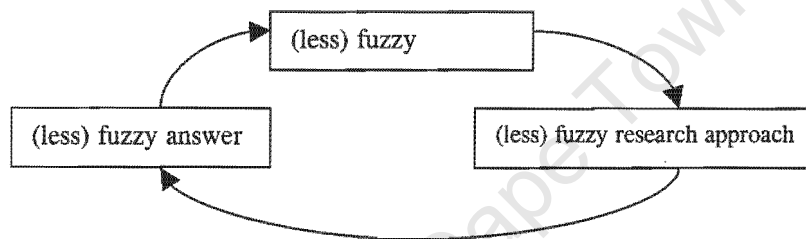
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<sup>25</sup> Lincoln, Y.S. and Guba, E.G. *Naturalistic Inquiry*. Beverly Hills. Sage

emergence. There is no up-front definition of which variables will be studied for how long or from which precise sources data will be collected or which measuring instruments will be used for observation. Instead, salient early discoveries provide the lead for further inquiry.

Each new phase raises new questions, results in new observations which may suggest new avenues of data collection or may prompt a re-look at previous data through a new 'lens' (Maykut and Morehouse, 1994). This narrowing and broadening of the focus of inquiry is not random, but is structured to the extent that a change in focus is justified by the need to validate previous propositions.

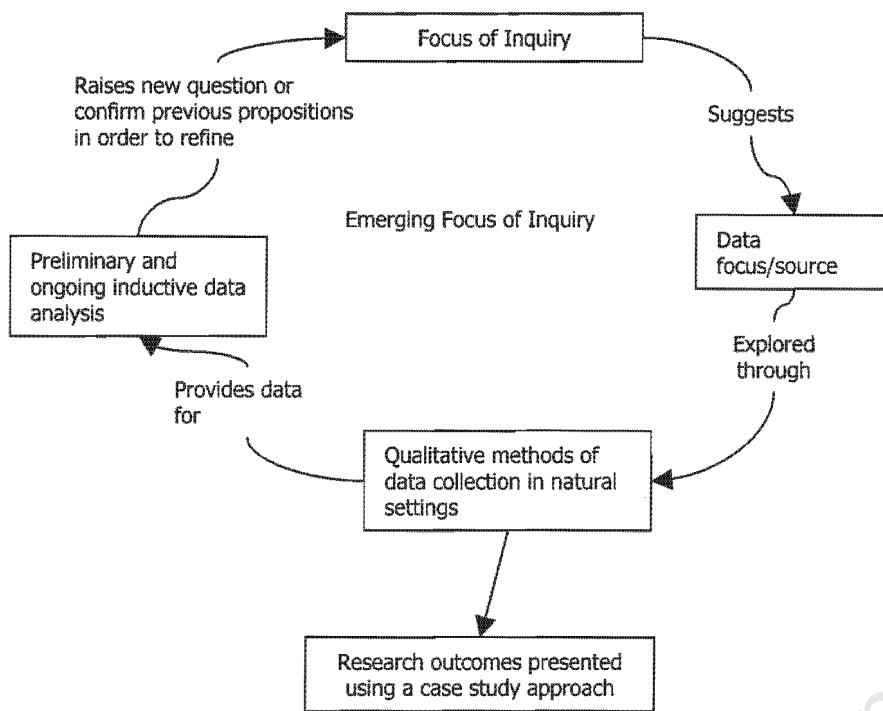
Dick (1998)<sup>26</sup> has described this iterative approach of gradual refinement of the researcher's understanding of the situation as a move from a 'fuzzy' situation to a less 'fuzzy' one. Each cycle should add to the clarity.



**Figure 3.2. Qualitative research design – liberally adapted form Dick (1998).**

Typical methodologies include ethnographic research, participant observation, hermeneutic inquiry, fieldwork study, naturalistic inquiry, case study research and exploratory social study. These are all variations on a theme of phenomenological inquiry aimed at understanding the complexity of a situation from the participant's view of their social reality. All phenomenological study relies on emergence of themes to refine the focus of inquiry and so through an iterative process a situational theory is arrived at. This is depicted in the schematic overleaf.

<sup>26</sup> Dick, B. 1998. How to conduct and Report Action Research available on line at <http://www.scu.edu.au.schools.gcm.ar.art.thesis.html>



**Figure 3.3. Qualitative Research Design (Maykut and Morehouse,1994) - adapted.**

### 3.4.2 Research Design – Action Research

Phenomenological study such as ethnography has its origins in anthropology, where the aim of the research was traditionally to understand human experiences in so-called 'primitive' cultures. The role of ethnography has evolved over time into a useful methodology for understanding human experiences in any social context. However, a key requirement of this research study was to effect change as well as to understand the situational phenomena. For this reason I have turned to a research methodology known as Action Research.

As the name suggests, action research is a methodology that has the dual aims of *action* and *research*. The key outcomes of action research are therefore change and understanding. Action research methodology subsumes a qualitative research paradigm. Thus ontologically, it recognises that reality is socially constructed through experience into multiple realities and systemically, seeks to understand the nature of complex multiple perspectives of reality that drive social phenomena as a whole. The purpose of this understanding is to drive change. Action research as a methodology is therefore relevant in an epistemology of Conceptual Pragmatism. To re-quote C. I. Lewis (in Peterson, 1993):

*"... the significance of knowledge is that it leads to action, community of knowledge leads to community of action."*

Action research is systemic in nature. Russell Ackoff, one of the main champions of systems thinking, argues that traditional management strategy in addressing organisational problems, tends to be characterised by the following (Johnson, 1997)<sup>27</sup>:

<sup>27</sup> Johnson, L. 1997. *From Mechanistic to Social Systems Thinking*. Pegasus Communications. Cambridge.

- analytical in nature - break down a complex entity into its components, so that by understanding the components, an understanding of the whole will follow
- linear in approach - unidirectional cause and effect statements
- sectional in style - the problem itself and the management of that problem are separate areas i.e. an analysis of the management of the problem is not necessary in solving the problem itself

Thus traditional problem management focuses on events, and the problem resolution is often characterised by reacting to these events (Anderson and Johnson, 1997)<sup>28</sup>. Ackoff argues further that only when the organisation is viewed as a social system, can the full extent of the complex interactions between all the factors, which affect the system, be appreciated. The ability to understand social systems affects our ability to control them. Thus by adopting a systems thinking approach to problem solving, the understanding of the problem is aided (Gharajedaghi, 1984)<sup>29</sup>.

The main characteristics of such an approach to problem solving would have to be:

- Systemic in nature: an understanding of the components of the complex entity or situation is important. However, equally important are the interactions between these components and groups of components with each other and its effect on the whole, as well as the effect of the whole on each of the components and groups of components. In addition a systems approach takes into account the effect of the environment on the system and vice versa (Goodman, 1997)<sup>30</sup>.
- Cyclic in approach - the cyclic nature of cause and effect relationships are considered in addition to linear ones. This approach embodies the concept that a cause results in an effect which itself could either directly or indirectly be a cause of the original cause. It therefore also advocates the consideration of causal loops in the solution to a problem. What is the effect of the proposed solution on the system as a whole, its parts, the relationship between the parts and the environment? The realisation that "today's problems could be a result of yesterday's solutions" is a key concept in systems thinking (Goodman, 1997).
- Holistic style - the management of a transformation is not only affected by the apparent problem variables, but a key variable is the manager and management style itself which forms part of the system. This is analogous to the system gamma in Revans's model of management (Revans, class notes).

Thus a systems thinking approach to problem resolution enables the uncovering of the patterns and underlying structures of the events, which leads to complete understanding of the problem as a whole, not simply at

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<sup>28</sup> Anderson, V. and Johnson, L. 1997. Systems Thinking Basics - From concepts to Causal Loops. Pegasus Communications.

<sup>29</sup> Gharajedaghi, J. 1984. Toward a Systems Theory of Organisation. The Systems Inquiry Series. Intersystems Publications

<sup>30</sup> Goodman, M. 1997. Designing a Systems Thinking Intervention. (OMDP98 class notes)

the event level. (Anderson et al, 1997). Such an approach to problem solving is embodied in the action research methodology.

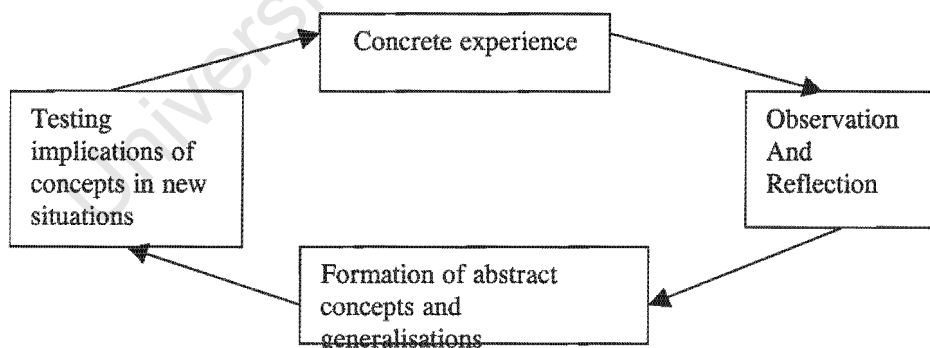
Learning by taking thoughtful action has been described by Reg Revans, Handy, Kolb and Deming, to name a few. This process is known as action learning. Several authors see action learning and action research as synonymous concepts. In developing a methodology, I have taken action learning to mean knowledge gained about a particular situational aspect based on the experience of a particular deliberate action. Action research, then, is the *macro* activity of synthesising all the action learning outcomes derived through the research process into a cohesive whole.

### Action Learning

Reg Revans (1998)<sup>31</sup> considered by many as the father of action learning proposed that learning (L) is a function of programmed knowledge (P) and questioning (Q):  $L = P + Q$ .

Revans proposed that learning by doing occurs when one questions what was, what is and what is intended. Unanswered questions lead to experimentation and hence experiential learning. Revans was interested in social learning. He saw the outcome of learning as an answer to the question: "How best can we help each other?" (Revans, 1998).

David Kolb (1982)<sup>32</sup> described learning as the process whereby knowledge is created through the transformation of experience. Kolb added to Revans' work the element of formulating concepts from experience, and then testing them to produce new concepts through reflection, that leads to a cycle of knowledge refinement. This theory is known as Kolb's learning cycle.



**Figure 3.4. Kolb's Learning Cycle (in Mumford, 1982)**

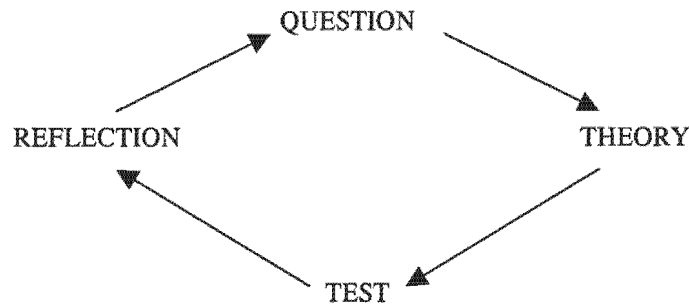
Handy (1998)<sup>33</sup> synthesised the learning models of Revans, Kolb, Agyris and Schon to produce Handy's Wheel of Learning (see figure 3.5 below). The wheel is a model for personal learning – learning that the individual has initiated based on a personal question. Handy holds that if learning is not initiated by *our* question but by another's question, then reflection is

<sup>31</sup> Revans, R. (undated). *The Learning Equation: An Introduction*. OMDP class notes 1998.

<sup>32</sup> Kolb, D.A. in Mumford, A. 1982. *Learning Style and Learning Skills*. *Journal of Management Development*, Vol. 1 No. 2.

<sup>33</sup> Handy, C. (undated). *The Age of Unreason*. Chapter 3: *The Theory*. OMDP class notes 1998.

impossible and learning does not take place. He also holds that the purpose of learning must be a change in behaviour and that if after learning we do not change then we have not learnt at all.



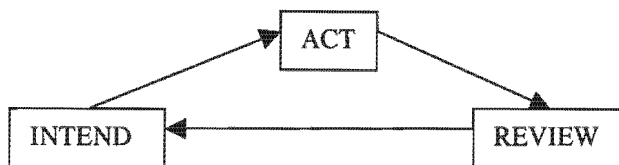
**Figure 3.5. Handy's Wheel of Learning (Handy, 1998).**

Handy further suggests that true learning is rare because the wheel turns with great difficulty. He therefore suggested three learning lubricants:

- *A proper selfishness* – the notion that what is to be learnt or the question that needs an answer has personal future implications
- *A way of re-framing* – the ability to see things, problems or situations, people in different ways. The ability to take multiple views on a situation.
- *A negative capability* – the capacity to live with mistakes or perceived failure

### Action Research in Perspective

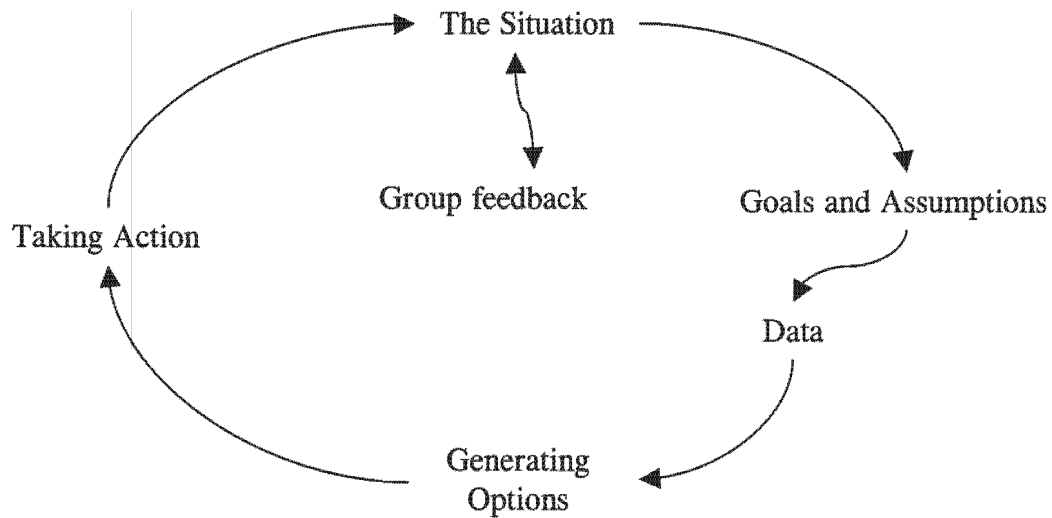
Action research requires action learning at an individual level so that collectively shared knowledge based on action results in organisational knowledge, which leads to decision and further action and new knowledge. This basic cycle of action research has been described by Dick (1998) as an intention (or decision or plan) to act, followed by a review of the consequences of the action, which leads to a better plan.



**Figure 3.6. Basic Action Research Cycle – Dick (1998).**

Abby Day (1998)<sup>34</sup> describes action research as an issue or problem centred research approach used to improve a situation that is grounded in the reality of the individual's job and organisation. The emphasis in Day's model is on participation by a group of key stakeholders. The basic process is depicted in the diagram below:

<sup>34</sup> Day, A. (undated). Action Research. OMDP class notes 1998.



**Figure 3.7. Action Research Process proposed by Dr Abbey Day (adapted).**

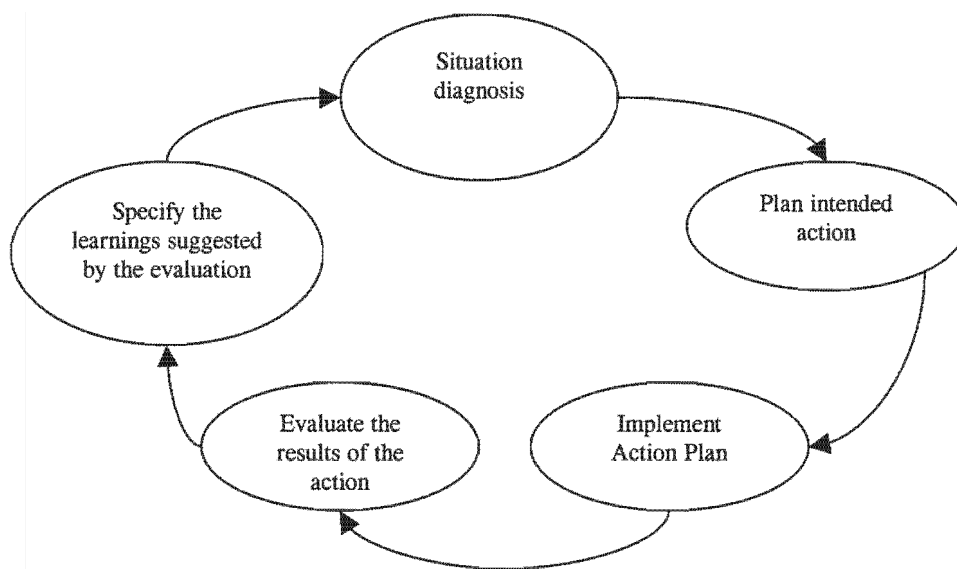
In the process depicted above, the essential starting point is the description of the situation. This step involves identifying clearly what the issues or opportunities are that require focus. The next step involves setting goals about what the desired outcome of the project should be as well as establishing the assumptions that have to be made about the conditions surrounding the project. These could include assumptions about the current organisation structures, prevailing management policies and availability of key persons involved with the project.

The next step involves decisions around data collection methods, how the data will be analysed and the physical process of actually gathering and interpreting the information. The next step involves the generation of useful and meaningful options for action. The next step includes selection of the most appropriate action from the options generated and implementation of the action.

The final step closes the loop on the situation and involves monitoring and evaluating how the situation is being changed by the action implemented. The cycle is then repeated with each new pass bringing some level of improvement in the situation.

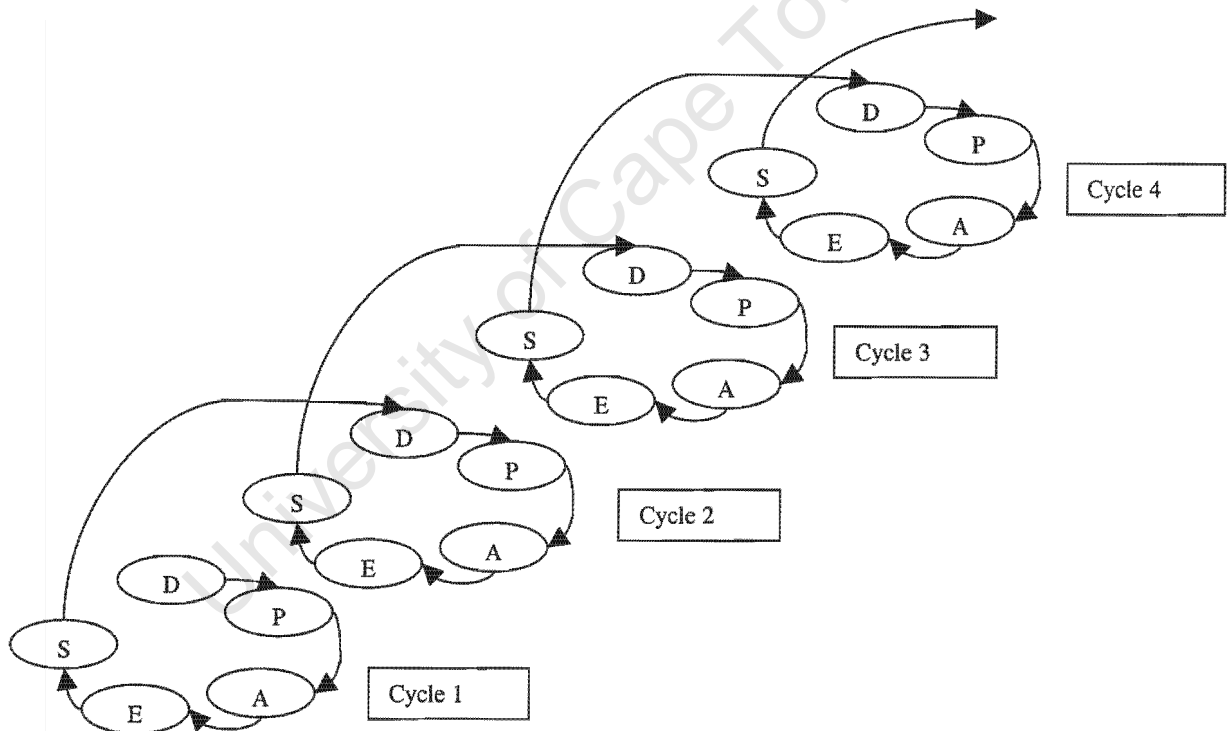
Gerald Susman (1983)<sup>35</sup> offers an essential addition to the basic action research cycle. He advocates the surfacing of specific learning as a key process activity for making emerging learnings or theories explicit. The basic cycle assumes this activity to be part of the reflection/evaluation step. Susman's model is depicted below.

<sup>35</sup> Susman, G. I. 1983. *Action research: A Sociotechnical Systems Perspective*. In G. Morgan (Ed.), *Beyond Method: Strategies for Social Research*. Newbury Park, CA: Sage.



**Figure 3.8. Action Research Model (Susman, 1983)**

Finally, the action research process moves through multiples of these cycles with each cycle adding to the general understanding of the situation. This process is depicted below.



**Figure 3.9. Spiral Convergence in Action Research Process. Adapted from Kock, McQueen and Scott (1999)<sup>36</sup>**

The learning offered after each cycle is tested in the new (changed) situation. This concept of spiral convergence through consecutive action research cycles is essential for validating emerging learning and provides rigour to the process. The emerging learning can also be applied to a different situation with

<sup>36</sup> Kock, N.F. (Jr), McQueen, R.J. and Scott, J.L. (1999) Can Action Research be made more rigorous in a positivist sense? Available on line at <http://www.scu.edu.au/schools/gcm/ar/arr/arow/kms.html>

seemingly similar problems. This is also a method for theory validation and improves process rigour.

### **3.4.3 Validity and Rigour in Qualitative Research**

Validity is concerned with the degree of credibility or trustworthiness associated with research outcomes. In quantitative scientific methodologies, credibility is achieved by careful control of the research process, adherence to standard procedures, and data interpretation by mathematical or statistical methods. This approach has the dual attribute of ensuring internal consistency and generalisability of conclusions. In order to achieve validity, researcher objectivity, precision and quantification is required.

In qualitative research methodologies such as ethnography and action research, standard procedures, controlled conditions and numerical analysis defeat the purpose. The very virtue of qualitative research is that it leads to understanding of a dynamic, complex, interactive, social situation where the researcher is immersed in the reality of the situation. This requires a responsive and flexible methodology that converges on an adequate research explanation in spite of constantly changing research conditions.

How can qualitative research then be credible? Two aspects of validity need to be looked at:

- How inferences are made from evidence
- How these inferences are tested

#### **3.4.3.1 Validating Meaning – Inferences from Evidence**

One of the difficulties associated with qualitative research is the difficulty of validating the meanings ascribed to the research data by the researcher. Data often takes the form of narratives or 'stories' told by persons from the perspective of their particular worldview. These stories are then interpreted for meaning by a researcher from the perspective of the researcher's worldview. How do we ensure that the meaning ascribed is valid? In this research study the meanings ascribed were tested for validity by triangulation as well as the exception method.

Triangulation is essentially a three-fold verification of the ascribed meaning, whereby a minimum of three independent sources are used to qualify an assessment. There is thus a need to carefully evaluate each part of a narrative so that meaning ascribed can be validated elsewhere. By the same token, care should be taken not to reduce the narrative to only those clusters of meaning that can be validated independently. Nancie Burns-McCoy<sup>37</sup> warns about the pitfalls of applying too much structural meaning to parts of a narrative when the 'story' itself often imparts compelling meaning when taken as a whole. She warns that researchers are so hung up about validity that essential parts of the

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<sup>37</sup> Nancie Burns-McCoy. 1997. Water is to Chocolate like Story is to Qualitative Research: Questioning Credibility and Narrative Studies. <http://www.lib.wmc.edu/pub/jcp/issue1-2/burns-mccoy.html>

story are discarded as 'outliers' because they do not fit the generally accepted themes that emerge from the rest of the data.

In this research study 'outliers' were used extensively as a second validation method described here as the exception method. Exceptions to generally recurring meanings often reveal 'logic flaws' in assumptions held by those involved in the study and the researcher. Actively seeking and using exceptions improves internal validity.

The question of validity to ascribed meaning is not only applicable to the narrative data but also to the personal observations of behaviour, events and activities made by the researcher. In ethnographic research this is referred to as participant observation. There are a number of factors to consider here. Firstly, Clemson (1984)<sup>38</sup> explains through cybernetic laws that the very presence of the observer influences the observation made. Secondly, the observer filters the observed data through his/her worldview in order to ascribe meaning. Explicit surfacing of assumptions is critical to maintain validity. Participative methods of inquiry such as action research improve internal validity through the use of multiple perspectives. Participants are an excellent source of challenge to each other and to the researcher.

A particular threat to internal validity within a participative environment is the notion of single loop learning. Single loop learning is a concept developed by Agyris in his theory on Action Science. In the paper by Enhanced Designs entitled *Action Science, A description*<sup>39</sup>, the authors describe Agyris's theories of action as following either a single loop learning approach (Model 1) or a double loop learning approach (Model 2). Model 1 is essentially characterised by the protection of the individuals in the team to the extent that no real learning takes place, the system is not really changed for the better and the real issues are not tackled. Thus there is no participant challenge to assumptions made but rather passive compliance with the change for the sake of predetermined change goals. Among the essential features of the Model 1 action theories are:

- No embarrassment threat for any team member
- No validation of claims
- Protection of individuals
- Do not highlight errors
- Defensiveness
- Diplomatic approach
- Conflict avoidance
- Withhold criticism
- Failure to deal with difficult issues
- No exposure of assumptions
- Single loop learning (goals are pre-defined, change is about achieving the goals)

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<sup>38</sup> Clemson, Barry. 1984. Cybernetics: A New management Tool. Kent: ABACUS PRESS

<sup>39</sup> Enhanced Designs. 1999. Action Science, A Description. Action Science Network.

<http://www.actionscience.com/actinq.htm>

The value of participation in validation is seen when action research is conducted in accordance with Argyris's double loop learning approach. Double loop learning occurs when participants are free to challenge the assumptions made, the theories arrived at and the very purpose of the process itself. This approach is referred to as Model 2 and is characterised by:

- Assumptions exposed
- Minimum interpersonal defensiveness
- Criticism is made part of the values
- Validity of claims publicly tested
- Difficult issues are handled by effective problem solving
- Recognition that espoused theory is not always theory in use and aims to minimise the gap between the two
- Double loop learning (the goals are also questioned as part of the process)

The key concept here is that for action research to be truly effective and sufficiently rigorous, it should be modelled on a double loop learning approach.

### **3.4.3.2 Inference Testing**

The biggest pitfall with following an action research approach is the compelling desire on the part of the researcher to take action. Taking action is certainly central to this methodology since without action there can be no action research. While taking action is the key discerning factor in action research that distinguishes it from other methodologies, it should be noted that learning is a result of thoughtful action – as opposed to any action. Learning from any action is best described as 'trial and error' learning. Action learning should not be mistaken for 'trial and error' learning. The former is a structured process that hones in on a desired outcome through cyclic iterations. The latter is largely an unstructured process that finds a desired outcome more often by chance than by design.

To be rigorous, the method has to rely on careful planning and constant testing of each emerging theme in later cycles of implementation. Iterative numerical methods in mathematical applications are able to yield adequate solutions after sufficient iterations. How many cycles are required? There is no general answer to this question. However, validity is achieved when later cycles confirm theories developed in previous cycles and evidence is actively sought to refute prior claims.

Increased rigour can be achieved by testing the learnings in similar contexts in differing environments. This leads to an increase in external validity. Thus as one moves from left to right in figure 3.9 (page 32), the more credible and trustworthy the eventual research outcome is likely to be.

### **3.4.3.3 External Validity**

External validity has to do with the generalisability of the research conclusions. The very nature of qualitative research is contextual. The conclusions arrived at have emerged as a result of the unique systemic combination of variables associated with the specific situational phenomenon in question. The power of the methodology resides in the notion that each spiral of action, reflection and

learning is designed through participation, with a key research outcome being that the researcher has gained understanding of the change phenomenon from the participant's perspective.

Is it possible then for such research to have relevance to other managers in the field outside of the specific situation in question? The researcher must assess the importance of finding an absolute exact explanation for the specific situation, compared with contributing to the general body of knowledge on the research subject. There is a trade off between specificity and utility to management in general.

#### **3.4.4 Research Requirements Revisited**

The research methodology chosen has stemmed from my requirements as a practitioner. I am a practising manager who wishes to improve a complex situation that is grounded in the reality of my job. My observations will therefore be made from within the system of which I am a part. The researcher therefore influences the situation being researched.

In order to improve the situation I need to understand the reality of the situation not only as I see it but also as seen by all those directly involved in the situation. It will be important when it comes to making decisions and implementing the changes that those people who will be directly affected by the changes understand the reasons for the changes and commit to the implementation, not because I say so, but because they honestly believe that it is the right thing to do. Furthermore, I wish to foster the aims of WCM by ensuring that the decisions are made at the lowest levels possible where they will be implemented. This requires a participative approach to research.

Changes can only be decided once I understand the situation and have identified the key leverage points. Only then will a theory be formulated in the form of an intended change that will be tested by implementation. Depending on whether the change is in the right direction or not, further theories will develop and further changes made. The number of changes at any one time can not be determined up front, neither can the 'experimental conditions' be determined up front or fixed.

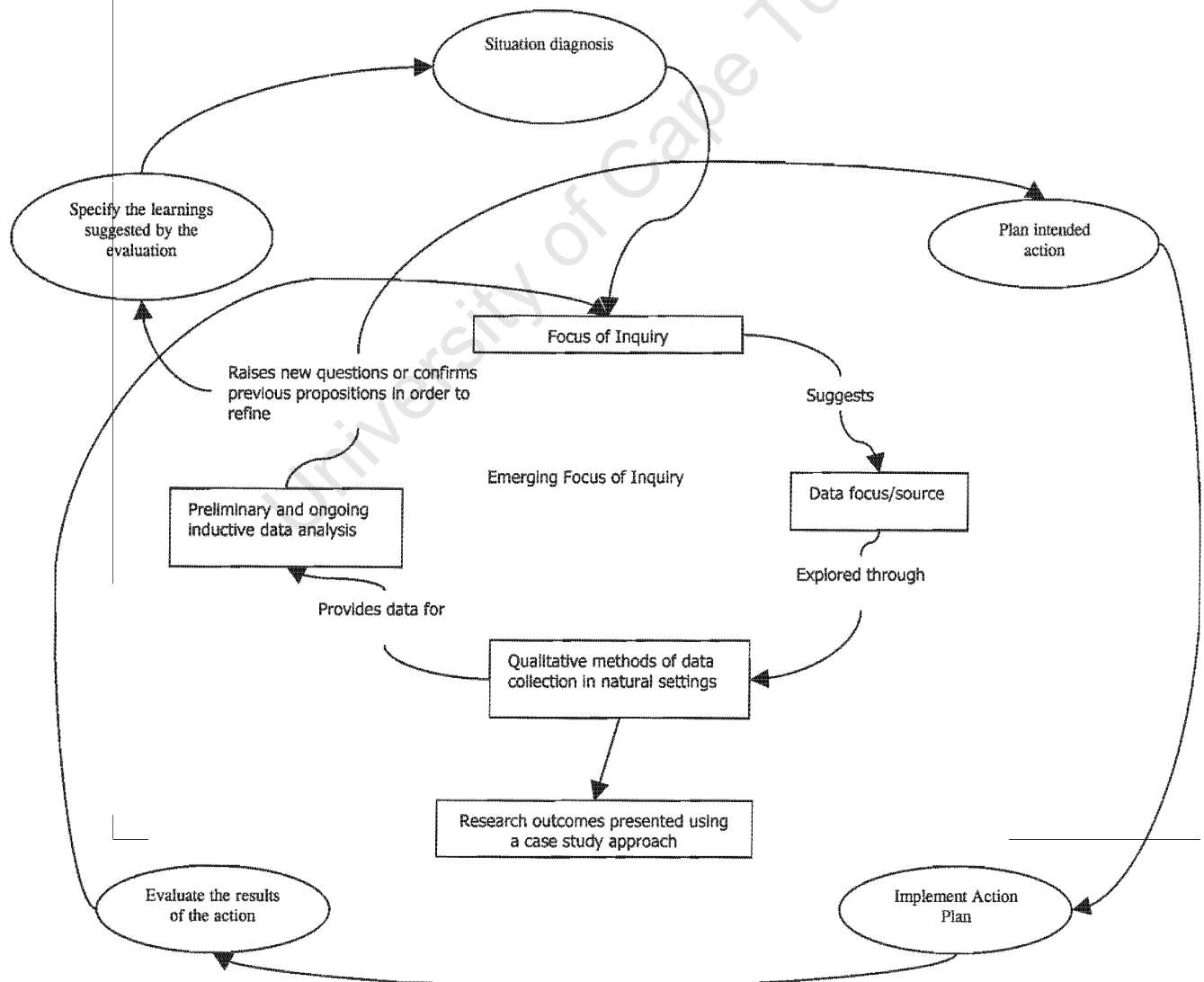
A key outcome is not only to effect change but to understand what leads to change success or failure. The intention is to understand the dynamics and effects of the change process on the team without shielding the team from any other environmental changes or organisational change requirements or any other crises that occur from time to time within the working environment.

The overall purpose of the study was not to prove any particular theory but rather to develop an understanding that would lead to an improvement in the situation, improve my understanding of change management so that I could share the learning with other managers in similar situations and from the learning derived improve at least my own management practise in the future.

Hence, combining the two research methodologies described in this chapter – ethnography and action research – provides a powerful base for the design of a research methodology for achieving my research requirements. A diagrammatic representation is shown overleaf in figure 3.10.

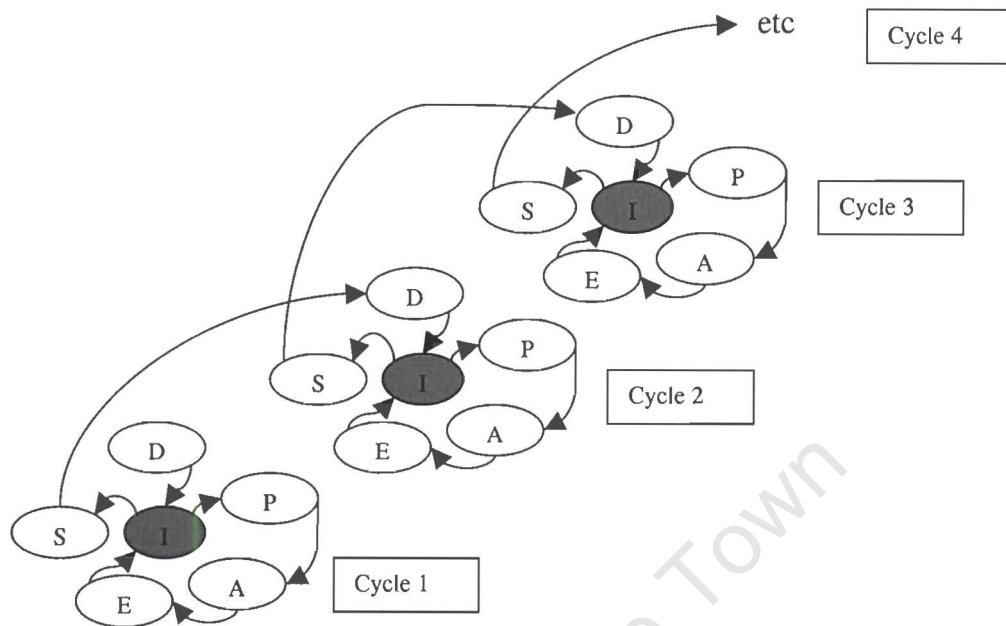
The entry point is the Situation Diagnosis, which requires entry into the Inquiry Loop since initially the situation is unknown. Several cycles in the Inquiry loop may be required before the situation is understood well enough to plan an intervention. The Action Plan is then implemented. The observations made, as a result of the action, needs to be understood by the same process used before. Hence, the Inquiry Loop is entered again. After sufficient cycles, the theory arrived at is agreed as a Specific Learning which needs to be tested by repeating the outer loop. This completes the first iteration. Every iteration achieves the following:

- Observe system in its 'natural state' – gather naturalistic / phenomenological data
- Interim Data Analysis step – what does the system look like? What are the issues, problems or opportunities?
- Design an intervention then implement changes
- Observe two things: (a) does the change improve the situation? (b) What was the system's response to the change process?
- Analyse data collected during observations of the change – look for patterns in behaviours, use systems analysis tools, what does the system look like now after the changes?
- Find explanations in the patterns and representations of what has been happening to the system during the change process
- What does this suggest for management practise/theory?
- The answer to these questions suggests a theory for improvement and for the management of change to be tested in the next iteration.



**Figure 3.10 Ethnographic Action Research Design used for this research study**

Subsequent iterations follow the same rigorous process of moving between inner and outer loops until an overall set of research conclusions are arrived at. This process is diagrammed in figure 3.11.



**Figure 3.11. Spiral Convergence in the Ethnographic Action Research Process**

### 3.4.5 Data Analysis Approach

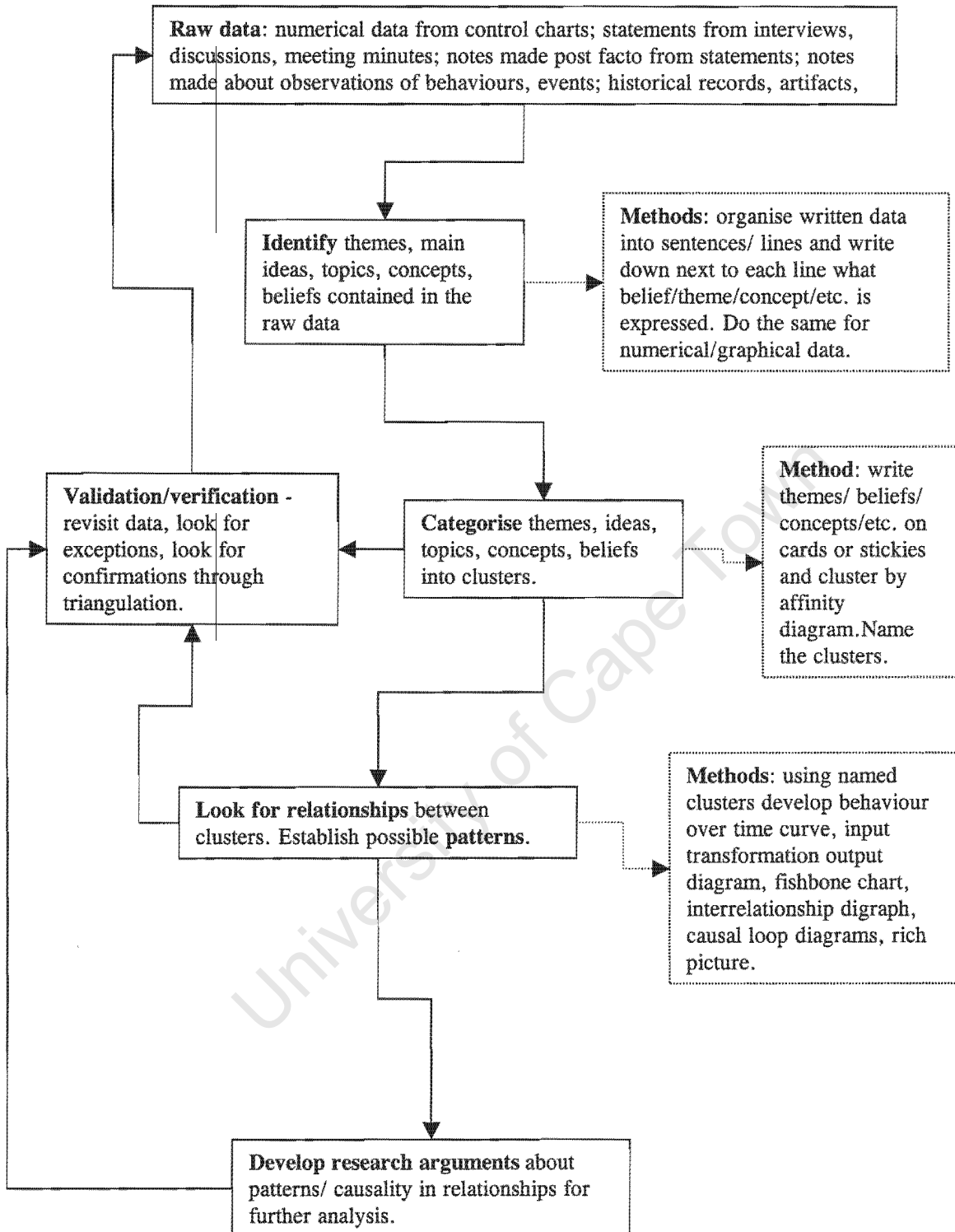
The internal inquiry process needs to be clarified further. The data analysis process is integral to an emergence theme. The methods of collecting and organising data are particularly important to ensure the quality of the inferences made. The following guiding principles were used:

Throughout the information gathering process look for themes, common concepts, common mental models and categories of ideas that emerge from the data at each stage of the data collection process.

Organise data into clusters of topics or chunks of meaning by looking at similarities and distinctions in data. As the process is followed research questions will emerge. After categorisation into clusters, find relationships between the various categories. Look for patterns in the relationships.

The main outcome of the data gathering process would be a 'picture' of the system – a simplified representation of the complexity of the real situation that would enable further analysis and decision making.

A schematic representation of the Data Collection and Analysis process followed is shown overleaf:



**Figure 3.12. Diagram of Data Analysis Process followed**

Data sources used included:

- Interviews

- Meetings – official minutes and notes made during meetings detailing observations made and discussion dialogue
- Informal discussions
- Appointments
- Requested meetings
- Problem solving sessions
- Training sessions
- Records (staff time-keeping/attendance records, training records, line performance data, HR system data records, line quality data, plant maintenance system records, financial records, problem solving records, shift logs, production plans)
- Objects/artifacts (documentation, procedures, manuals, reports, drawings, correspondence)
- Observations of behaviour, tasks, activities, processes, events.

### **Internal Validity**

In this study validation of the meanings ascribed to observations is achieved through explicit articulation of the assumptions by the researcher, triangulation, participative double loop learning and the exception method.

### **External Validity**

In this case the essential need was to effect local change with the additional aim of sharing the learning with other managers in similar situational contexts. There was a need for an element of global relevance at least across the regional borders within the South African Division of LSAM. In order to achieve this, the learning derived was tested against perceptions of managers and staff of other regional sites nationally. Although this particular study has focused on the situation within LSAM, it is hoped that this study will form a basis for further research within a South African Manufacturing context.

*In this chapter I have presented the key assumptions associated with the various research paradigms. I have outlined the philosophical basis for research in general and have explained qualitative research from an ontological and epistemological position. I have also outlined the basics of systems thinking and cybernetics as it relates to the management of social systems. By overlapping these with my research intentions I have developed a methodological research design which has formed the framework for this management enquiry.*

*The next chapter presents a summary of the research outcomes of this study.*

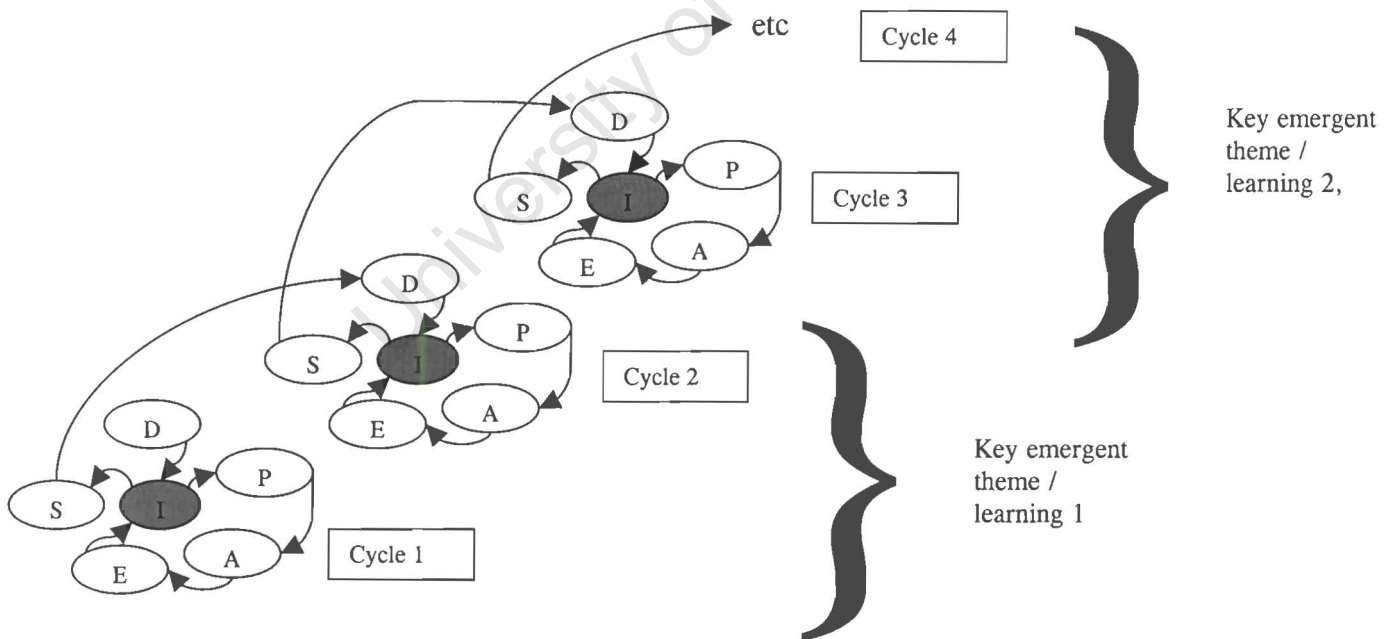
## 4 RESEARCH OUTCOMES

This chapter presents the key learnings from the ethnographic action research study conducted in the packaging department at LSAM's north region plant.

The research was conducted over a period of thirteen months. The scope of the research was defined by my need to improve the packaging plant performance from an engineering point of view. My role as packaging management team member meant that I was indelibly linked to the research situation.

Through ardent implementation of the methodology presented in the preceding chapter, I took the group through sixteen learning cycles, which upon further reflection, could be structured into four higher level learning cycles each with a thematic learning outcome. Although the emergent learnings were unique to the local situation, I shared these emergent theories with managers at other regional plants within LSAM as well as with head office management and technical consultants in order to sweep in multiple perspectives beyond the immediate contextual boundaries. I also tested some of the emerging learnings on staff from our Natal operation who were at shop floor level at the time when LSAM started its national WCM initiative and have since moved on. These learning's were incorporated into the final model.

The cyclical models of action research fit together into a methodological whole as depicted in the diagram below:



**Figure 4.1 Action Research Methodological Process followed to arrive at key themes**

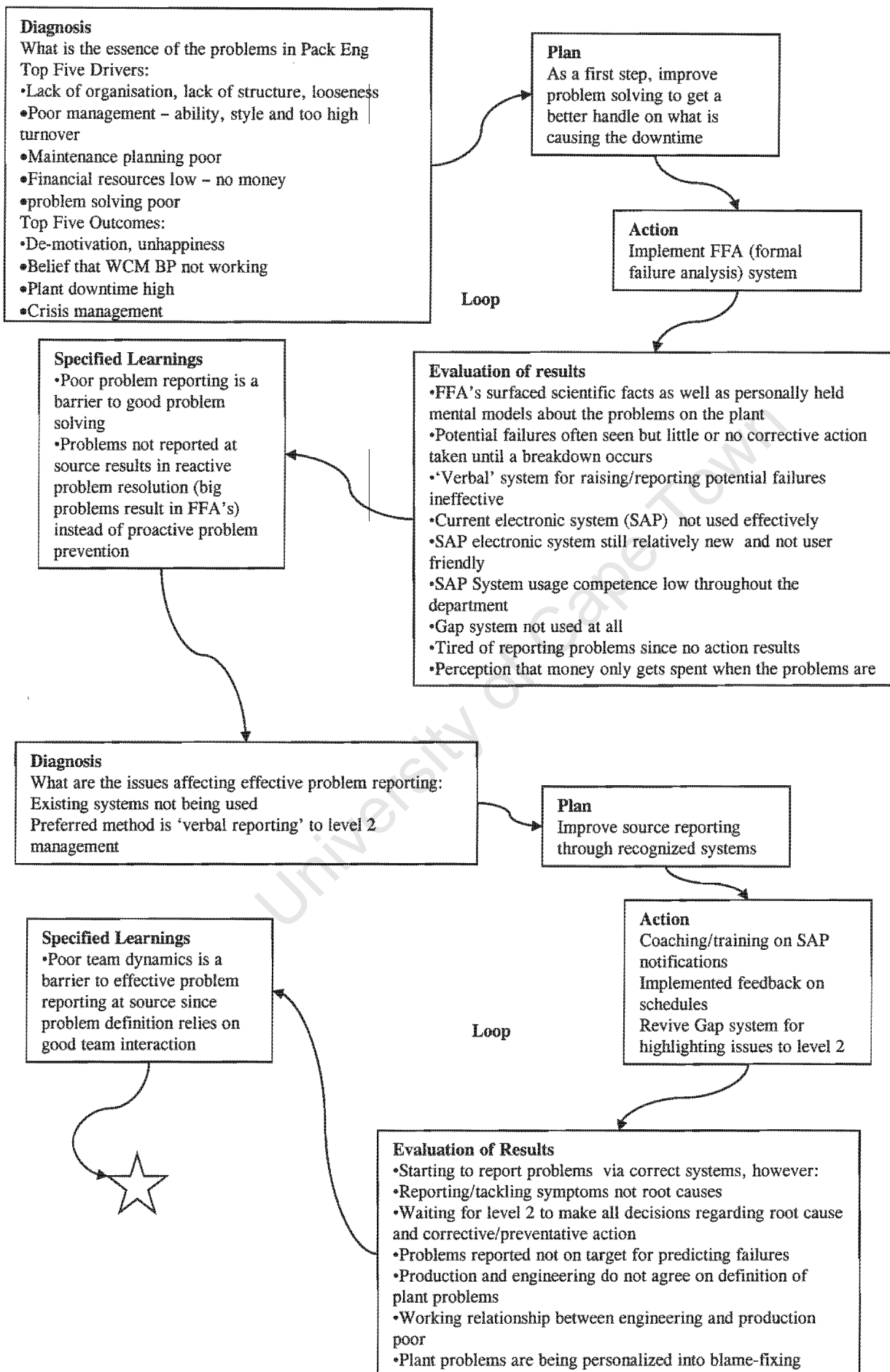
The overall learning cycle is made up of four main action research loops. The first action research cycle spans the period from August 1999 to November 1999 and presents the learnings in moving from a situation of chaos to building internal

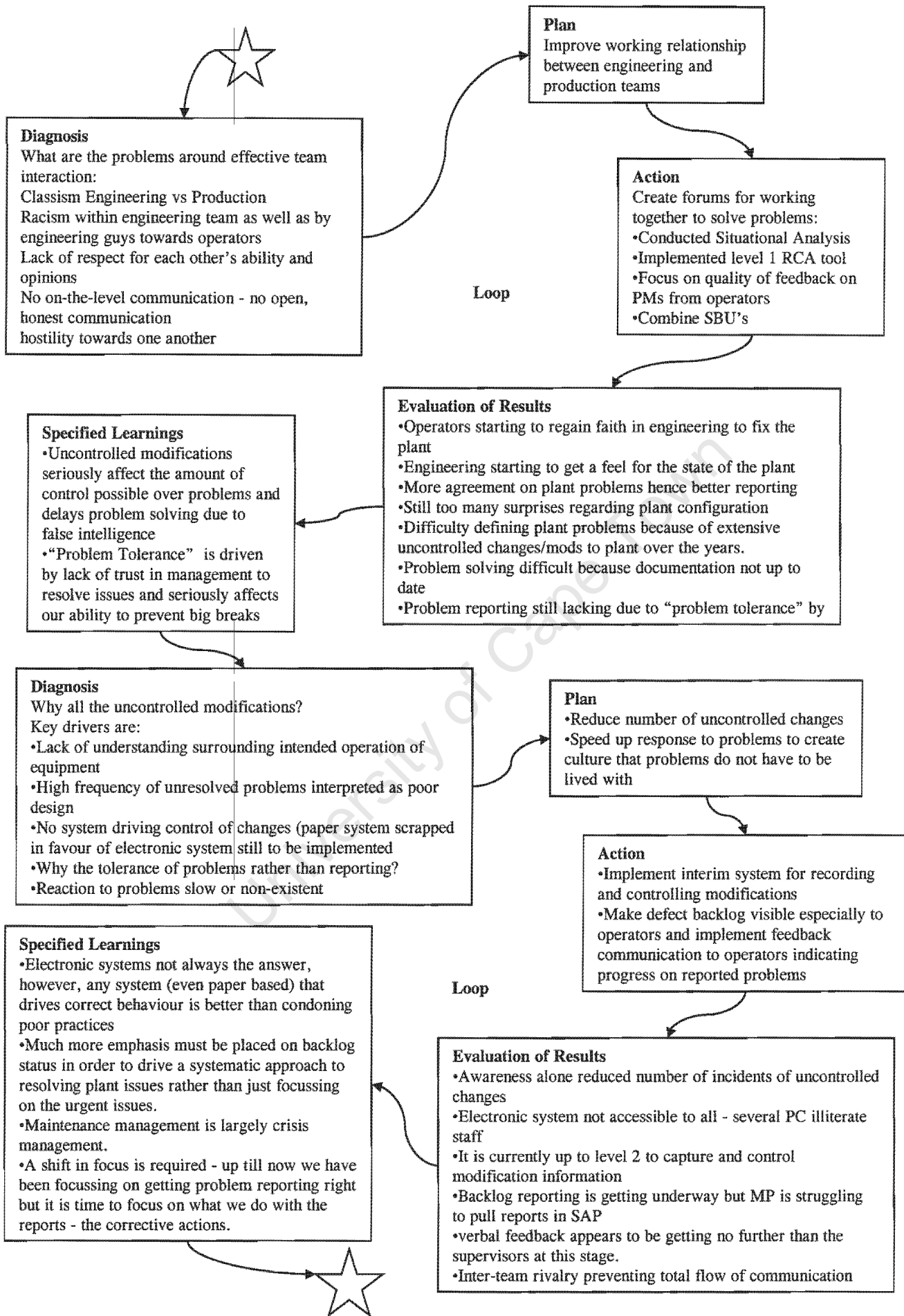
intelligence on our problems. The second cycle from November 1999 to February 2000 tracks our learnings from inaction to meaningful action. The third cycle from Feb 2000 to May 2000 summarises our learning at a systemic level having been subjected to team disintegration and rebuilding. The fourth cycle from June 2000 to August 2000 presents a reflection of our progress and an evaluation of the new challenges facing the team as it moves into the future. This last cycle is incomplete as it points to future action, which has to be evaluated at a later stage as part of the ongoing learning and continuous improvement in the department.

Each of these main four loops are further comprised of smaller learning loops. This confirms the iterative nature of action research. A summary of the actual research cycles is presented in the pages that follow. Details are contained in the Action Research Report (Appendix 2).

University of Cape Town

Loop 1 -From broad sea of problems to first major learning (Aug 99 - Nov





## **First Learning cycle – Uncovering the problems**

The theme emerging from the first learning cycle was centred around the the system's effectiveness at uncovering problems. The four contributing learning cycles consecutively revealed learnings about the obstacles to effective problem intelligence.

In a highly complex, high-speed operating system such as this, internal intelligence is essential. There has to be mechanisms and systems in place to reliably assess impending problems so that these can be resolved speedily. Tackling the wrong things or still worse waiting for small problems to result in a crisis before taking action are signs that firstly, there is an inability to notice problems and secondly, there is an inability to amplify problem reports to the level where it will receive attention.

Once reported, there has to be a system for analysing the problems in order to determine their causes. The system has to be easily understood at the lowest levels in the organisation so that failure analysis is tackled at source.

Effective problem resolution requires accurate problem definition. The learning here was that accurate problem definition requires effective teamwork. In this study I found that the problem stemmed from poor working relationships between production and engineering teams, and within the engineering team itself. The working relationships were so bad that team members were unable to have a meaningful discussion about the plant issues without becoming aggressive and argumentative, and hence could not agree on either problem definition or root causes.

Following from this learning, a further learning was that a healthy working climate allows for meaningful information sharing. It is not always possible to remedy deep-seated relationship problems overnight. However, by implementing root cause analysis tools that forced teams to work together to find problems and their origins, I was able to slowly improve working relationships over a period of time. The more team members have to interact with one another, the easier it becomes to share meaningful information.

In the final loop of this learning cycle we learnt that problem intelligence is but the first step. We were getting better at defining our problems at source. However, our response to these problems was as poor as ever. We were only focussing on the urgent issues. Problem elimination is impossible without an effective corrective action system.

This completes the first cycle of learning: from being faced with a sea of problems, to actually finding the best ways of defining and highlighting these problems for easier, speedier and targeted corrective action.

The next cycle shows learnings around the barriers to taking this meaningful action and how these can be overcome.

**Loop 2 - Establishing the core issues (Nov 99 - Jan**

**Diagnosis**

Why are we taking so long to respond to problems and why do we only seem to respond in emergencies?  
 • Looking back, all the interventions to date were done in an attempt to isolate the problem - not fix it.  
 • There was focus on finding our problems through root cause analysis, reporting of problems at source, working together to find our problems. But, there was a lack of purposeful, meaningful action.  
 • The actions that were recorded were not getting done. Our maintenance effort was haphazard - crisis management - a lack of structured maintenance management processes (random events that happen to coincide like Brownian motion).

**Loop**

**Plan**

• Improve maintenance planning and execution processes

**Action**

• Maintenance planning process interrogated and formalised from defect report through to completed action.

**Evaluation of results**

• Focus on CMs (fixing) only, no time for PMs  
 • Resource planning poor  
 • Planner competence an issue  
 • PMs not always effective in identifying potential failures/predicting failures  
 • Best Practice not reviewed - organisational learning form maintenance PMs ineffective  
 • SAP maintenance system cumbersome and not well entrenched.

**Specified Learnings**

• Maintenance planner's competence is a key factor in ensuring effective maintenance planning.  
 • The use of electronic systems without proper training and entrenchment negates business benefits.

**Diagnosis**

• Problems with getting to grips with SAP is a divisional gripe at this stage but the tool is here to stay.  
 • Planner's problems not only confined to difficulty with SAP but also struggles with producing plan in any software and is not intimately offay with TPM - espoused theory is TPM, while theory in use is breakdown maintenance.

**Loop**

**Plan**

• Rigorous training for maintenance planner

**Action**

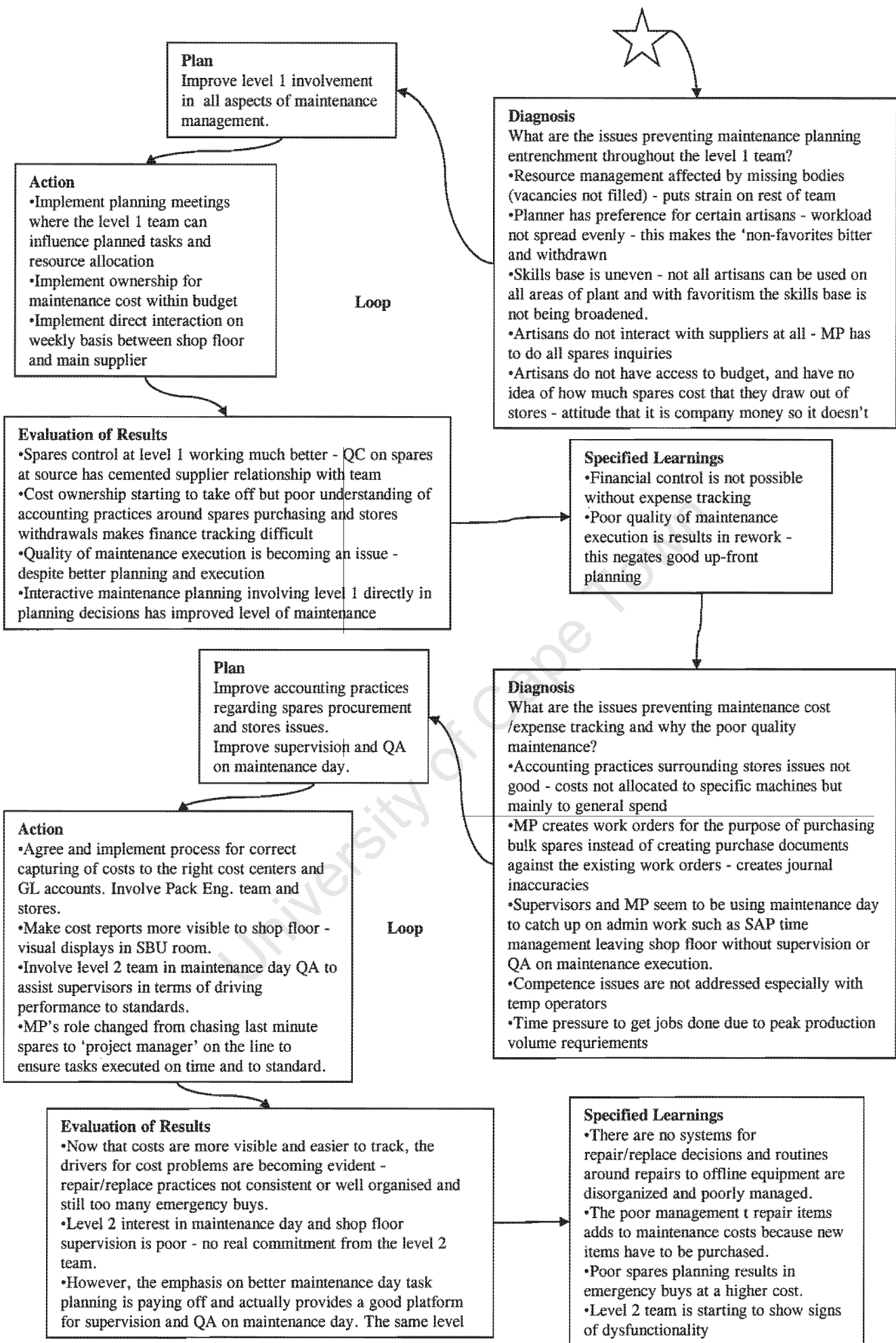
• Maintenance Specialist Course  
 • BIS support brought in to entrench systems usage  
 • Refresher on TPM  
 • Training on MS project and how to download plans from SAP to MS project  
 • Continuous hands-on coaching and support for several weeks  
 • Focus on PM quality ito frequency, standards, etc.

**Evaluation of results**

• Planning more structured and delivering better results, however:  
 • Planner overloaded with level 1 issues  
 • Level 1 team not committed to plans since they are not party to resource allocation  
 • Resources in engineering a limiting factor  
 • Costs control at level 1 non-existent  
 • Spares management limiting engineering performance  
 • Level 1 decision making happening at level 2

**Specified Learnings**

• Even a competent planner cannot and should not do planning in isolation of the team  
 • Level 1 lack of ownership and bias for action is hindering effective maintenance practices  
 • Financial management and spares management requires a team effort - currently handled solely by planner with poor results.  
 • Resource management is key in any human activity planning process





**Plan**  
 Improve repair planning processes.

**Diagnosis**  
 What are the factors affecting 'midweek' planning?  
 •Planning of tasks on maintenance day has improved drastically, however:  
 •Planning of other weekday tasks such as follow-up on breakdowns, repairs to equipment that came off the plant, planning of spares and /or expertise to enable outstanding repairs to be done, etc. is poorly done.  
 •Poor planning of repair tasks means that items that should be returned to stores gets kept on a back shelf in the workshop which is costly.  
 •Replace/repair decision making not consistent - it is easier to replace and discard but more costly.  
 •Financial pressure is seen as a barrier to spares procurement until it is a crisis.

**Action**  
 •Method of replace/repair decision making challenged.  
 •Standards for discarding not always clear in maintenance procedures - reliance on gut-feel.  
 •Formulated generic standards for decision making as a start with plans to formally interrogate procedures for standards  
 •Implement system for managing and planning repair items and returning to stores upon completion.

Loop 2.5

**Evaluation of Results**  
 •Repairs management system starting to show benefits.  
 •Interesting to find that the systems introduced here had been done before but had fallen away.  
 •Several of the systems introduced over the past few cycles have been a revisit to seemingly excellent systems of the past.

**Specified Learnings**  
 •It appears that in all the cases so far, the good systems of the past collapsed when the system proponents left. Turnover of key staff is fairly high.



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## **Second Learning cycle – Removing the barriers to meaningful action**

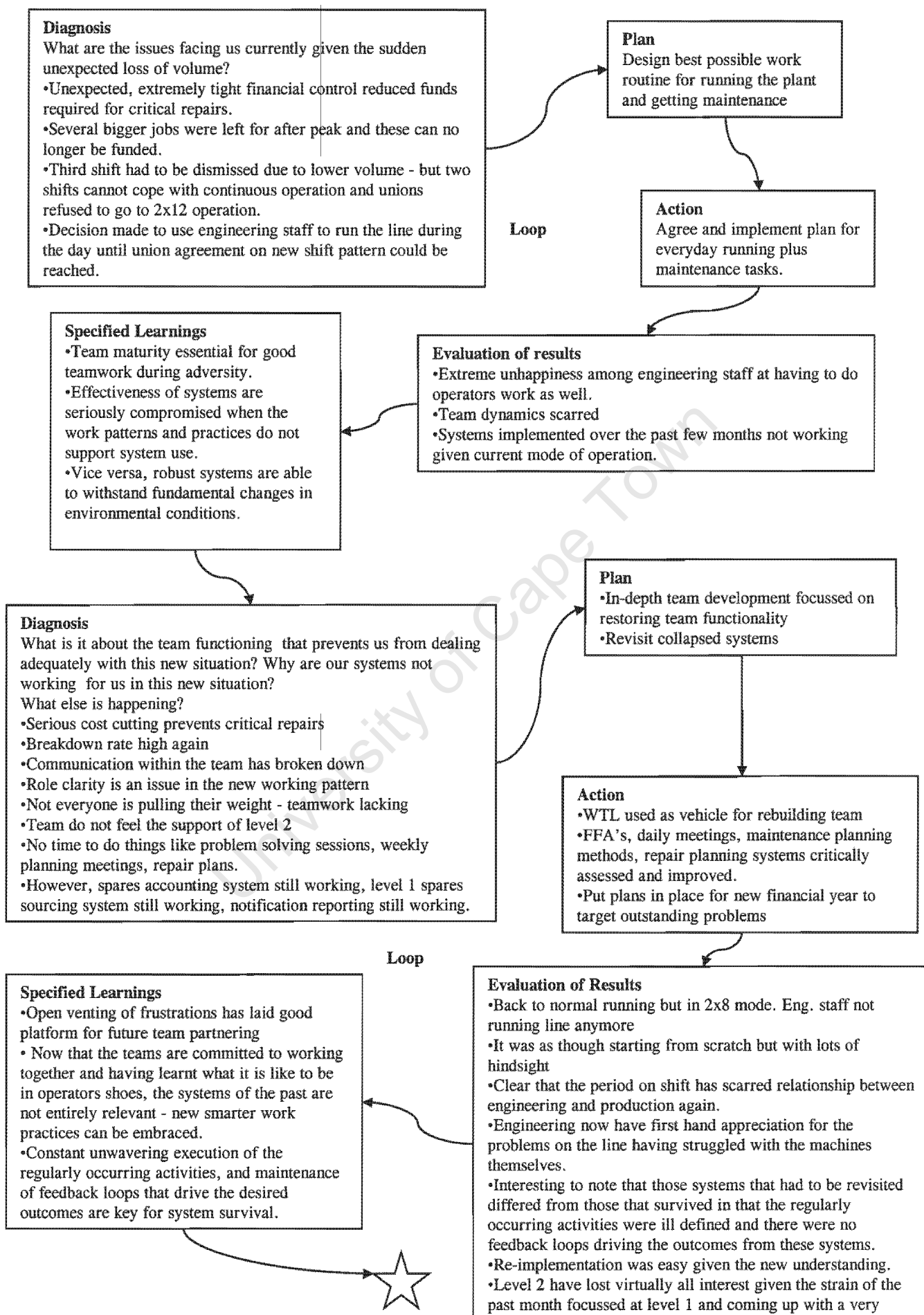
Having an effective reporting system is meaningless if no action is taken in response to these problems. There are several reasons why effective structured action is not taken. Within the engineering team in question, action is effected through the maintenance management system which was found to virtually non-existent. Instead, a crisis management approach to maintenance was being practised.

The five contributing learning loops to this second learning cycle reveal that the crisis maintenance management approach hinged around lack of understanding regarding maintenance management processes, poor resource allocation, poor spares management, questionable maintenance quality, poor financial planning, unstructured replace/repair decision making, and poor workshop repair planning. In addition, lack of shop floor level bias for action results in overloading the planner with hour-to-hour tasks and decisions.

An essential overall learning that emerged during the implementation of systems to correct all the above, was that most of these systems existed in the past and collapsed when the key system proponents left the department. This is explored in a later learning cycle.

The next cycle traces a period of huge team turmoil when the engineering team were uprooted from their normal working pattern and placed on the line as operators as an interim step between the abrupt loss of our third production shift and reaching an agreement with the unions on the new working patterns.

**Loop 3 -Fundamental changes to system Environment, discovering higher-level system problems and entrenching good behaviours (Feb 2001 - May 2001)**





**Diagnosis**  
 Are we winning with the revived team drive and systems?  
 •Team development program off the ground  
 •Degree of accountability at level 1 increasing  
 •Relationship between engineering and production improving  
 •Strong motivated individuals start pulling team together  
 •Level 1 see little value in traditional morning meeting between supervisors and level 2 team partially because of level 2 disinterest and partially because the rest of level 1 are left out of communication structures.  
 •Guys have come to appreciate the importance of communication and feedback when working on the line.  
 •Level 1 problem solving working well again. Maintenance planning routines still too reactive.

**Plan**  
 Establish best possible structure and systems for engineering and production level 1 teams to communicate and solve problems.

**Action**  
 Started combined Production & Engineering SBU. One combined daily performance review meeting for the newly formed manufacturing team involving both engineering and production at level 1 with morning meetings run by supervisor who reviews past 24hours performance and highlights problems for action. Team members then allocate

Loop

**Specified Learnings**  
 •Focus is too broad to hone in on problem resolution.  
 •No effective systemic feedback loop driving closure of outstanding actions.

**Evaluation of results**  
 •New meeting system well supported at level 1 because it was designed by the team themselves.  
 •Rate of action completion and problem resolution too slow.  
 •Too many problems to deal with in one meeting.  
 •Meetings are long and drawn out.  
 •Plant performance still subdued.

**Diagnosis**  
 How do we concentrate our efforts where most needed?  
 •Too much problem solving in morning meetings which drags meeting out to point where meeting has to end without all the issues for the day being discussed or conclusions being drawn.  
 •Immediate and long term problems given equal weighting.  
 •No follow-up system to ensure actions agreed to are being completed.

**Plan**  
 •Ensure information gathered at source is easily summarized to show problem areas and related potential causes.  
 •Find way of separating urgent day to day problems from long term ones.  
 •Implement visual gap management system to drive closure of actions.

Loop

**Evaluation of results**  
 •New method of crystallizing daily problems and driving actions to completion is starting to pay off in that the number of repeat problems are decreasing.  
 •Long outstanding repairs are being effected.  
 •General plant state improving, downtime decreasing.  
 •Team interactions improving.  
 •With level 1 starting to function as an empowered team, level 2 has lost all sense of what it should be doing now that it is no longer functioning at the wrong level. The team is not functioning well at all. Individuals are immersed in there own personalized missions as they deem fit.

**Action**  
 •Implement machine specific downtime summary graphs to focus problem areas  
 •Implement machine focus groups (MDT's) to handle longer term issues.  
 •Start recording actions, names and due dates on permanent flip chart and record daily feedback against open actions.

**Specified Learnings**  
 •Systems function well when the regularly occurring acts and systemic feedback loops driving desired outcomes are in place.  
 •When management has collapsed a level, then concerted effort is required to restore such a management team.



### **Third Learning cycle – WCM techniques are not sustainable without a cybernetic base**

Having spent nearly six months analysing our problems and having implemented systems to ensure that the problem resolution was sustainable, we were struck by a sudden turn in the market and loss of production. The financial pressure brought to bear and the massive loss in production was such that a decision was made at plant level to reduce the packaging production staff compliment by one shift. With the unions unhappy to change the shift pattern of the remaining two shifts, a decision was made that the packaging engineering team would fill in for the third shift as an interim measure. Important learnings emerged out of this disruption in the team's working pattern – learnings that strike at the very fundamentals of organisational design.

It was clear that our system was not robust enough to withstand fundamental changes in environmental conditions. Our system was not robust enough to survive a sudden step change.

Effectiveness of systems is seriously compromised when the work patterns and practices do not support system use. All our problems solving systems, repair shop systems, spares management systems, maintenance day planning systems, etc. came to a halt because there simply was no time to perform several of the key activities associated with these systems while running the line. System flexibility to be able to adapt the key process steps to suit the new conditions is required. In cybernetic terms the learning is that there are certain regularly occurring activities (ROA's) that have to happen for a system to achieve it's purposeful outcomes. Without the ROA's there is a systemic collapse.

The interim working patterns having come to an end after agreement with the unions on 2x8 shift configuration, it was time for in-depth team development focussed on restoring team functionality and also focus on revisiting our collapsed systems. During this phase we learnt that partnering within teams and among team members is required to build effective relationships that bind teams. It was also clear that empowered teams exist only if the individual members of the team are empowered individuals. In cybernetic terms this points to the interdependency of system parts in order to fulfill the purpose of the whole.

Working as operators enabled all of us to see our plant with new eyes. Having this added insight – having looked at the system through a new lens – enabled us to build even better systemic structures than we had before. These new systems are more relevant to our changed environment. In cybernetic terms the learning is that our mental model of the system lacked the requisite variety to be used as an effective regulatory mechanism.

Having had the opportunity to witness and analyse the reasons for systemic collapse it has become clear that

- No system can survive without those regularly occurring activities (ROA's) that drive the desired system outputs.
- The ROA's will fade over time if there are no systemic feedback loops that drive the occurrence of the ROA's.

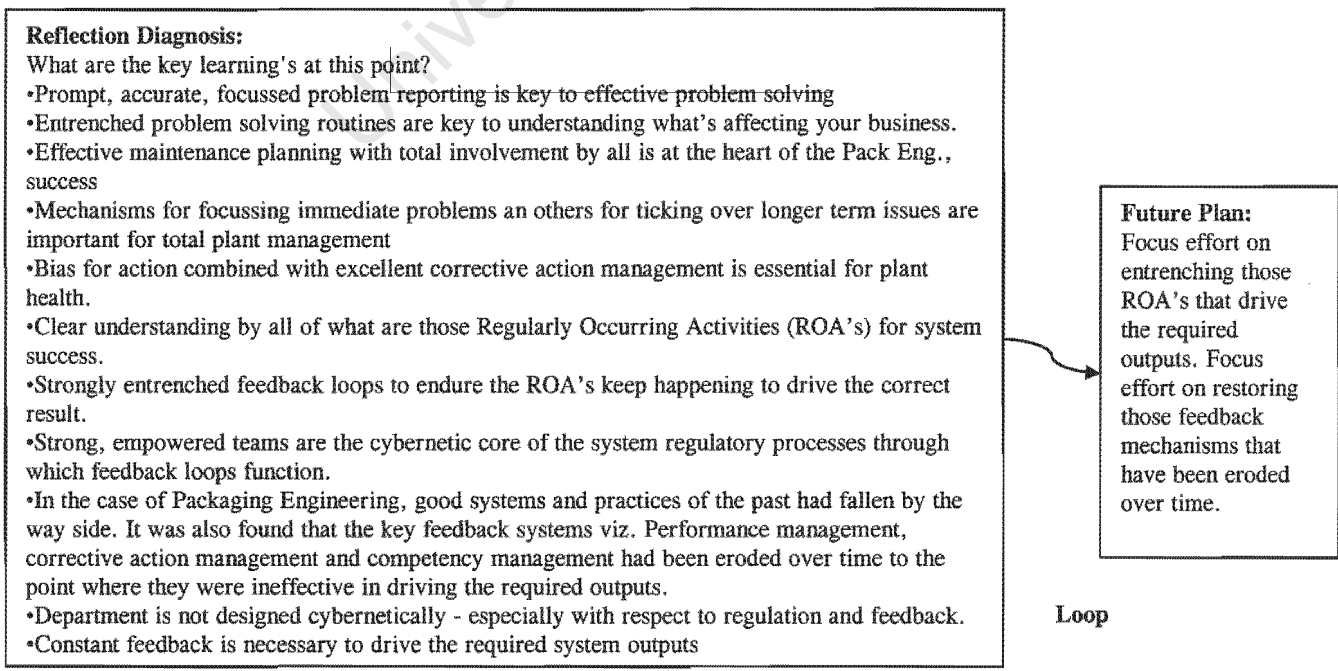
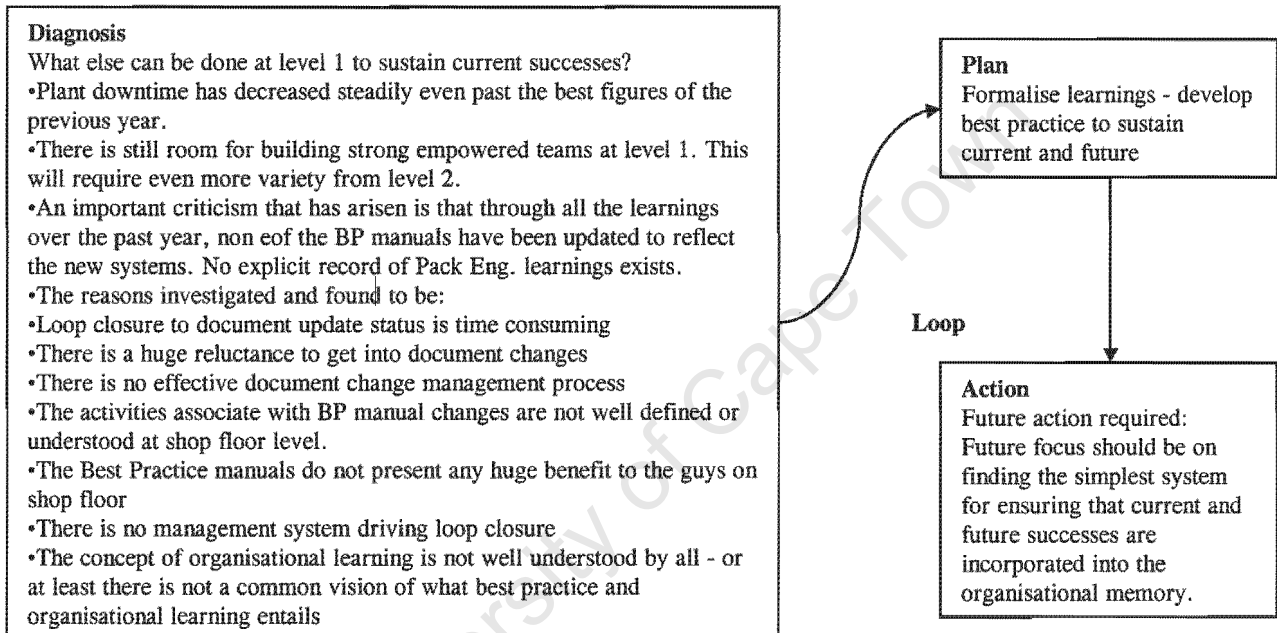
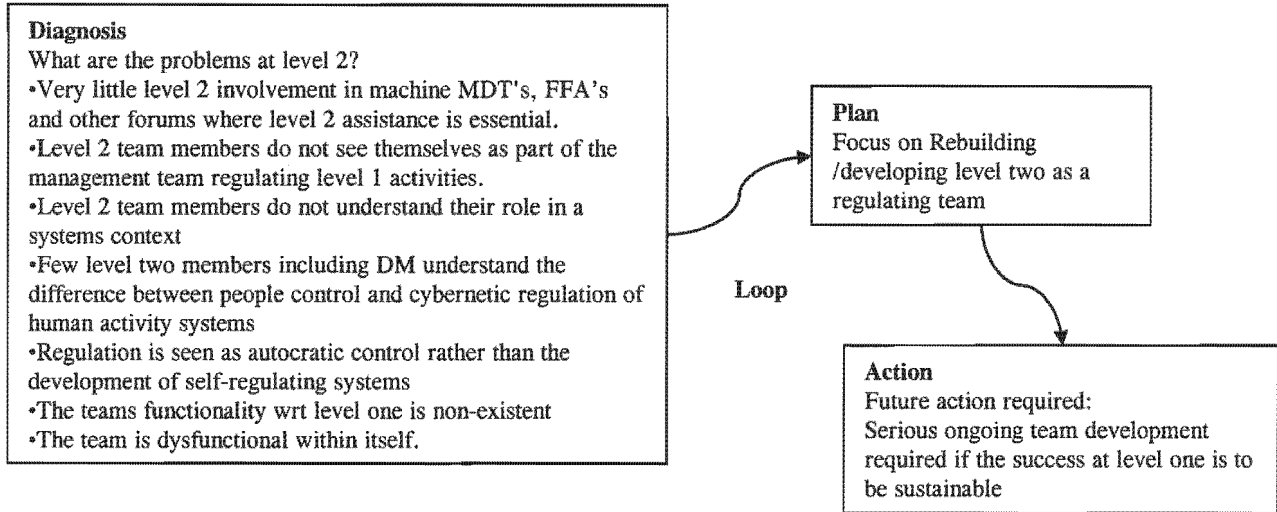
It also became clear that role clarity was the single biggest reason why ROA's do not happen when they should and without role clarity no feedback system (e.g. performance management) can be made to work. In cybernetic terms, role clarity is akin to clarity of sub-system purpose and the interconnections required to achieving this purpose.

The rate of corrective action closure is too low. No one was driving the system either. The key learning here being that without a systemic feedback loop driving corrective action closure, it could not be achieved.

With shop floor level regaining control of what it is they are supposed to do, shop floor management lost all sense of what it is that they should do given that they were free to operate at the right level. The key learning here is that once a management system has collapsed down a level, concerted effort is required to re-establish such a system.

Having a fresh approach at organizing surfaced another learning – that the ability to sustain multiple systems requires a high level of organisation. The higher organisation required at shop floor level due to the multiple systems cannot be maintained without an effective regulation system. Shop floor management currently lack the required variety to manage such a system.

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#### **Fourth Learning cycle – Overall leanings and future focus**

Diagnosis of the problems at level 2 (shop floor level management) reveals that the management team does not understand its role as cybernetic regulator of the Packaging system as a whole. Future action should be on rebuilding the team into a functional unit firstly, and then to develop the team into an effective management team.

The success measured in hard numbers (plant efficiency, downtime, etc.) over the past year tells a story of exceptional improvements. However, the learnings derived during this success process have not been captured in the organisation's best practise documentation. From the analysis we learn that there is no system in place for capturing learnings and the department has no feedback loop driving the capturing of new best practises. Understanding of organisational learning as related to continuous improvement and best practise is extremely low. In fact, understanding of what WCM really is, is extremely low. Cybernetically, from the self-organising systems law we learn that for a system to preserve its integrity and survive its rate of learning must at least match the rate of change of its environment. Future action should focus on re-implementing a process for capturing best practise with the necessary feedback loop in place to drive the systemic outputs.

This final loop served as reflection over the entire action research process, drawing together the key learnings. Out of all the learnings summarised above the following has emerged as the overall high-level learnings and key to the problems in LSAM's North plant packaging engineering department:

No matter how elaborate or simple the WCM systems that were implemented originally, these have not succeeded because of the absence of the following:

- Mature, empowered teams who see themselves as partners in the process – not just a group of people working in the same area.
- Teams who understand their systemic purpose as subsystems of the whole and understand how their interactions determine the achievement of their purpose.
- Clearly defined regularly occurring activities (ROA's) for achieving desired outputs.
- Feedback loops for driving the occurrence of the ROA's.
- Effective regulatory systems through which the feedback loops function.
- A living best practise system for capturing organisation learning that is understood by all and relevant to the system. Without learning the system collapses under environmental change.

## 5 MODELS FOR WCM ORGANISATION

This chapter presents a discussion on three models of organisation referenced in literature. These models will be used as a starting point from which I can position my own model of organisation WCM organisations.

A literature search on WCM theory has shown that very little has been published under the WCM banner *per se*. Most of the literature refers to *elements* of WCM such as TQM, JIT, TPM and so on. Of the literature available, most deal with WCM organisation at the technique or method level rather than the theoretical or philosophical level. The techniques presented by Lubrich and Watson (1998) capture the essence of what WCM organisations 'look like' and are useful for organisations wanting to improve their competitive advantage by changing their current work practices to best practises. These techniques include the 'how-to' of implementing Japanese 5-S, visual communication, total productive maintenance, manufacturing cells, one piece flow, set-up reduction, inventory kanbans, kaizen, team building, team leadership and empowerment.

Schonberger (1986) does not present an explicit organisational model incorporating WCM in its totality, but rather presents several examples of how WCM organisations have organised to achieve the WCM elements described previously. Schonberger (1986) devotes each chapter to a different WCM element and ties it together at the end with a "task list" or "agenda" styled strategy. His key message is that WCM success is based on continual, rapid improvements by everyone in the organisation with the emphasis on making process and activities simpler, to prevent a collapse toward inaction. This theme ties up well with some of the findings but does not explain all of the findings at a more fundamental level. It needs to be fleshed out some more.

Furthermore, the findings suggest that LSAM have in the past or are still practicing the elements of WCM. The problem is that these activities are not organised cybernetically and thus the system has become dysfunctional in key areas. A systems thinking approach has proved useful in rescuing the system from its downward spiral. For this reason I have chosen to look at systemic and cybernetic models of organisation.

### 5.1 The Viable Systems Model (VSM) by Stafford Beer

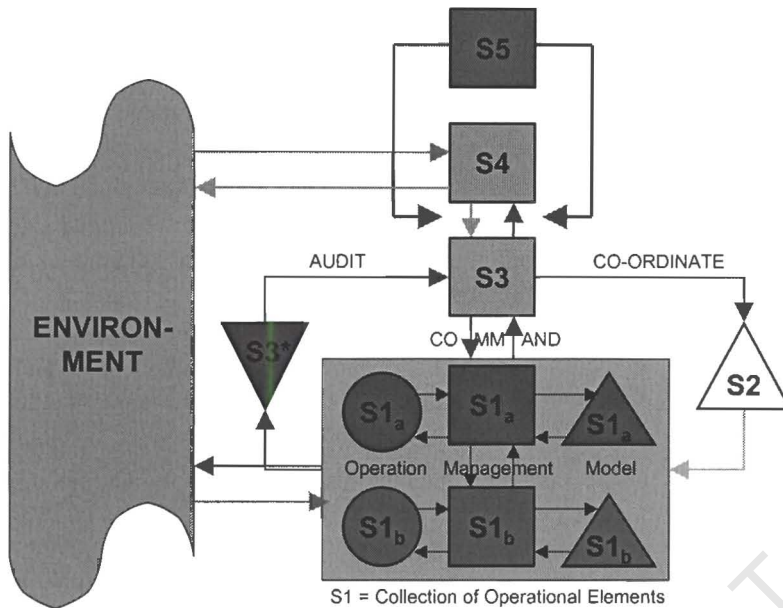
Stafford Beer (1972)<sup>40</sup> proposed a model that was designed to answer the question "How best to design an organisation to ensure viability?" After over twenty years of management experience and research he proposed a model based on cybernetic principals and laws (Clemson, 1984). The model, which is analogous to the human nervous system, is called the Viable System Model (VSM) and is depicted in the diagram overleaf.

The model is that of a complex system (in cybernetic terms) that has been organised into functional sub-systems. Every system exists by virtue of its purpose. The purpose of Beer's system is viability – sustainable survival. The

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<sup>40</sup> Beer, S. 1972. The Brain of the Firm. Penguin Press. London

functional subsystems represent the minimum requirements for overall system viability – if any one of the subsystems fails to deliver its required output then the entire system would collapse.



**Figure 5.1. Schematic of VSM at one level of recursion (Beer, 1972 in Clemson, 1984)**

The VSM comprises a collection of operational elements which exhausts basic activities required by the system (system one), and a meta-system (system two to five) comprising whatever else is needed to manage the collection of operational elements (Beer,1972) – or in strict cybernetic terms, to regulate the output from the operational elements. In the paradigm of systems thinking, it is a basic tenet that the organisation must respect a set of natural laws in order to be viable (sustainable) in the long term. This is the basis of cybernetics. Stafford Beer's Viable System framework sets out the fundamentals of such viability laws.

Beer states that, to be a viable social system, five particular functions are required as a minimum. These are:

- Implementation (System 1)
- Co-ordination (System 2)
- Control (System 3)
- Intelligence (System 4), and
- Policy (System 5).

These five functions are manifested as patterns of interaction. For an organisation to be viable, Schwaninger (1998)<sup>41</sup> explains that the enterprise must manifest all the VSM functions and associated interrelationships (their channels of communication). In addition, these channels must have sufficient capacity. Each unit must be autonomous and viable in its own right (the Viability Principle), in order for the system, as whole, to be viable. The VSM therefore exists at multiple levels of recursion, other than the original level of the 'system-in-focus'.

<sup>41</sup> Schwaninger, M. 1998. Stafford Beer (\*1926). OMDP98 class notes

At first glance it is difficult to grasp exactly what Beer intends to illustrate in the VSM. This is largely due to the tendency to interpret the VSM in terms of classical organisational hierarchy – structural organogram – rather than functional hierarchical processes. It is mainly people who practice the functions necessary for viability through interaction with one another or with technology. These functions should therefore be organised in such a way that viability is attained and maintained.

If we understand functions to be the *acts* between parts necessary for maintenance and survival of the whole, and structure as the *positioning* of these *acts* in a framework to promote viability, then the VSM is a functional framework illustrating how parts interact to achieve system viability.

These functions should be the output of the elements of the larger system, but the elements should themselves be viable autonomous systems. This recursive nature of the system is key in obtaining the correct level of autonomy and integration. The basic subsystems within the VSM and their functions are summarised below (see Clemson, 1984 for more detail):

#### **5.1.1.1 System One (Implementation)**

- Collection of manufacturing or service-provision cells.
- Produces goods and/or services with which the organisation is ultimately identified.

#### **5.1.1.2 System Two (Co-ordination)**

- System of rules and behaviour for co-ordinating parts of System One
- Dampens uncontrolled oscillations
- Communication and information channel
- Supports decentralised decision making

#### **5.1.1.3 System Three (Control)**

- Maintain homeostasis of organisation through the Command Channel
- Responsible for ensuring System One sub-systems produce goods complying with Policy (System Five).
- It is the channel for orders within the organisation
- Enhances performance of the whole by increasing synergy between parts
- Monitoring critical variables through System Two and System Three\* channels

#### **5.1.1.4 System Three \* (Audit)**

- Does not exist by itself; utilised by System One
- Infrequent detailed check on the normal reporting of System One
- Not an extra channel for delivering policy instructions

### 5.1.1.5 System Four (Intelligence)

- Creates an explicit model of the organisation
- Models the organisational environment
- Deals with inventing the future

### 5.1.1.6 System Five (Policy)

- Balances the relationship between Intelligence and Control
- Does not generate know-how or alternative courses of action
- Clarifies direction through policy
- Sets values
- Establishes organisational purpose and provides closure
- Designs conditions for effectiveness

## 5.2 The Logical Levels of Management Model

This model by Espejo and Schwaninger (1991)<sup>42</sup> also has a cybernetic basis. They acknowledge the VSM as '*the most advanced theory for assessing the viability of an organisation in (systemic) structural terms*' (Espejo and Schwaninger, 1991). However, they proceed to explain that a company can only survive if it is in possession of value potentials that are actualised; that is, converted into profits. This interesting statement suggests that there is a process stream involved in transforming a conceptualisation of 'value' (the intersection of a producer's offering with a buyer's willingness to pay for the offering), into bottom-line profit. Moreover, if that process is defective, the organisation is ultimately not viable.

Espejo and Schwaninger seem to be placing a proposed management structure onto the VSM functions so that certain management levels perform only certain of the VSM functions.

They describe three logical levels of management, broadly described as: Normative, Strategic, and Operational management (see diagram overleaf in figure 5.2).

The suggested VSM link (Ryan in OMDP98 lectures] to the logical levels of management, could be shown as:

- Normative = Policy (S5);
- Strategic = Co-ordination (S2), Control (S3), and Intelligence (S4);
- Operational = Operational (S1)

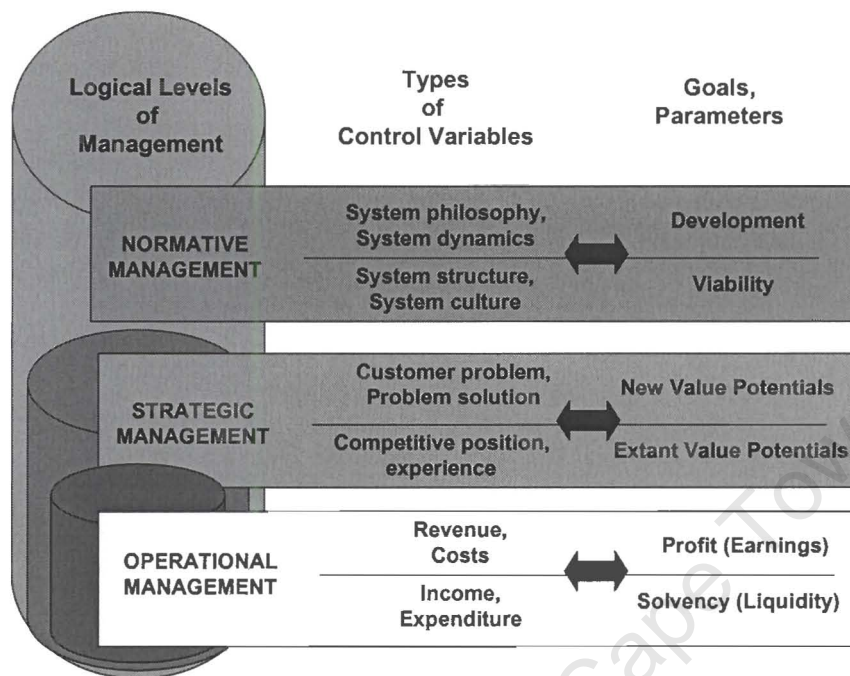
I prefer the following link, as it seems to be more in line with the goals pursued at each level:

- Normative = Policy (S5);
- Strategic = Intelligence (S4);
- Operational = Operational (S1), Co-ordination (S2), and Control (S3);

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<sup>42</sup> Espejo, R. and Schwaninger, M. 1991. Organisational Fitness: Corporate Effectiveness through Management Cybernetics. Chapter 1. Campus Verlag. Frankfurt/New York.

The value Espejo and Schwaninger add to the pure VSM theory relates to an understanding that each level of management must pursue different goals, using different pre-control variables as inputs. The bottom-line goal of profit - which is a *sine qua non* - is attained through the value chain. This is illustrated below.



**Figure 5.2. Three Logical Levels of Management (adapted from Espejo and Schwaninger (1991)).**

In conclusion, the three levels of management separate out conceptual managerial functions in terms of their objectives, whilst demonstrating their intrinsic interdependence. The business activities associated with the three levels of management are similar to those described in the context of the VSM functions.

### 5.3 The Circular Organisation Model

Russel Ackoff (1994), author of "The Democratic Corporation", was concerned with the structural mechanisms necessary for a social system to achieve its purpose. He described the viability of system in terms of the purpose of the system, the behaviour of the system parts in relation to the whole, and the mechanisms for interaction between the parts in achieving the purposes of the parts and that of the whole.

The behaviour of the system as a whole and its influence on the parts is clarified by conceptualisation of three categories of systems (Ackoff,1994), namely:

1. Mechanistic systems – where the interests and purposes of the parts are considered to be irrelevant. The only relevance of the parts is to serve the purpose of the whole.

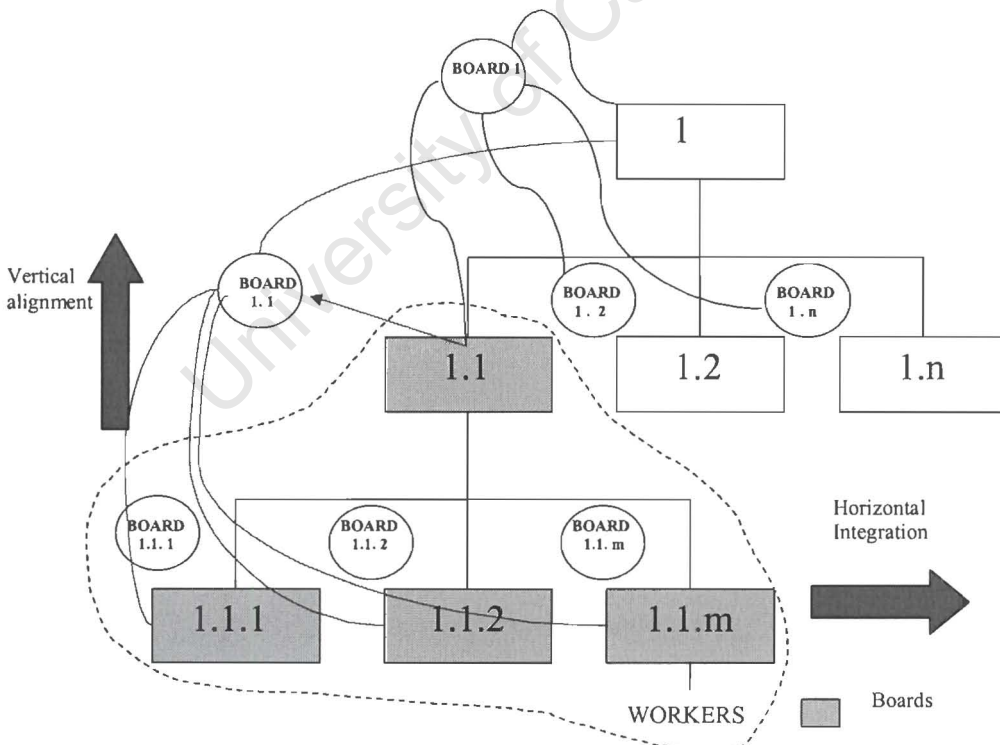
2. Organismic systems – where the parts do not have choice or purposes of their own, although they have the flexibility to pursue the objectives assigned to them in a variety of ways.
3. Social systems – democratic systems where both the systems and its parts have purposes and choices of their own. The system enables the parts to achieve things they would not be able to do by themselves.

In responding to unpredictable changes in a turbulent environment, Ackoff (1994) argues for the robustness of social systems and effectiveness in dealing with complexity. The means by which this robustness is achieved by a social system, is through the common purpose of development, i.e. ability and desire to satisfy one's own needs and legitimate desires and those of others (Ackoff, 1994).

Ackoff argues that in social (human) systems, the purpose of organising and hence organisation has to be for the development and growth of the system as a whole and that this can only be achieved through development of the parts.

Ackoff further recognises the self-organising tendency of systems, the requirement for both autonomy and integration, and the all-important cybernetic requirement of adequate feedback loops.

With these principles in mind, Ackoff proposed a model for organisational structure which unlike the VSM, is not function-based, but structure-based. The model is depicted schematically in figure 5.3 below.



**Figure 5.3. The Circular Organisation. Adapted from Ackoff (1994).**

The Circular Organisation is a model of an organisation where the viable functions are performed by teams of workers who are organised into 'boards' or who are at

least fully represented by 'boards'. Each 'board' represents either a particular operational/ business unit, or a particular management unit.

Vertical and horizontal integration is achieved by populating the various boards with fully active representatives from other boards at the same level and from the board immediately one level up.

Autonomy of operational or management units is achieved by empowering each 'board' to make business decisions that affect the outputs and functioning of that particular unit. The 'boards' are responsible for all management functions for the unit including team-on-one performance reviews especially for the unit manager.

The Circular Organisation is Ackoff's answer to the question: "In an environment of high variety and rapid change, such as the information age presents, how can we structure best for viability?"

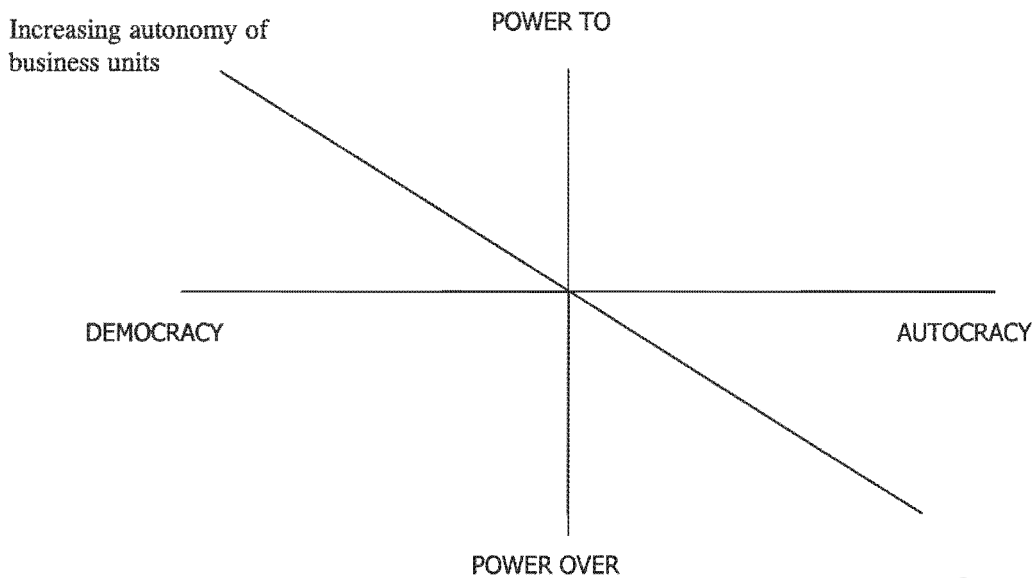
Organisations are made up of parts and organisational performance depends both on the interactions of these parts as well as the interaction of these parts with other systems in the environment. Ackoff (1994) identifies three types of systemic interaction:

1. Horizontal co-ordination – this occurs between parts on the same level in the organisation
2. Vertical Integration – this is interaction between parts at different levels in the organisation
3. Interaction of the parts with the environment e.g. customers, suppliers.

The Circular Organisation can thus also be seen as an answer to the question: "Given the need for the above systemic interactions, what formal organisational structures are required that can assure effective management?"

Organisations have already realised that in order to improve effectiveness they have to rely on participation in relevant decision making. This has resulted in improved communications through the organisation and, with increasing consultation, it is now recognised that without co-determination (consensus, vote in decision making) effective worker commitment is impossible. The need for individual autonomy and team autonomy is essential without sacrificing the purpose of the system as a whole. The Circular Organisation provides a management model for achieving this.

Managers cannot effectively implement their decisions in the current work environment unless the relationship between *power to* and *power over* is understood. Power over is the ability to get people to do things they do not want to do. Power to is the ability to get people to do voluntarily what one wants them to do (Ackoff, 1994). The need to support this in a structural manner is recognised and this is shown in Figure 5.4 below.



**Figure 5.4 Power over vs. Power to from The Democratic Organisation (Ackoff, 1994).**

Ackoff asserts that the more educated the workforce, the more negatively correlated are power to and power over. A structure that promotes viability is required to *regulate the tension* between the drive for individual entrepreneurial business intent (autonomy) and the need to maintain organisational cohesiveness. An analogy of this is the difference between healthy cells and cancerous cells in the body. Healthy cells produce organic growth that reinforces the community to which they belong, whereas cancerous cells make their decisions having lost their "social identity". The pattern of behaviour of the cancerous cells is counter to the well being of the larger organism.

This social identity of the system in the Circular Organisation is the result of a common vision of success by all in the system. Shared vision is the alignment of goals and purposes with one level up in the system/organisation and with one level down in the system/organisation. The result of such a model is a networked structure that promotes viability, rather than a strictly hierarchical structure. In a network structure authority comes from connection to the people around, rather than from the distance from those below.

The circular organisation is a democratic hierarchy. A democracy has three essential characteristics:

1. The absence of ultimate authority, the circularity of power
2. The ability of each member to participate directly in all decisions that affect him/her
3. The ability of members, individually or collectively, to make and implement decisions that affect no one other than the decision maker(s)

## 5.4 Discussion of the Key Model Elements

The key question in terms of this research has to be: "How useful are these models in explaining the phenomena at LSAM's northern plant?"

In answering this question I have taken each model in turn and tested the ease of using it as a diagnostic tool for the problems at LSAM, as well as the accuracy in terms of my findings.

At a systems thinking level, the key learnings from my action research were that without definitive regularly occurring acts that drive the key outputs for system survival, and without feedback loops to drive these acts, the system is dysfunctional. I also found that the structures through which the acts and feedback loops are manifested were either not in place or were in themselves dysfunctional.

### VSM as an adequate model

The VSM is a framework for systemic functionality. As such, it describes what functions are required for viability. It is thus more concerned with functional organisation and less concerned with the structure associated with this functional framework. In a WCM context where activity is an integral part of the structure, it becomes difficult to do a direct VSM diagnosis. Despite these difficulties, the VSM is able to predict the collapse of system three into system one (LSAM's level two management team in packaging), as well as the lack of the coordination function.

However, it is not easy to reconcile the lack in coordination, for example, with the breakdown in team processes unless both the VSM and the WCM strategy are very well understood. This is perhaps the downfall of the VSM – it is not easily understood at first. It therefore becomes less useful as a tool to first-line managers who wish to assess their current situation against a theoretical model.

Despite these remarks, if both WCM and the VSM are well understood then a clear link emerges between the two. Both WCM and the VSM are concerned with *what* are those things that we should be doing – although the two approaches operate at different planes.

If one were to use the VSM as a model for WCM organisation at shop floor level then one would have to go down one recursive level and assess the effectiveness of systems one to five within a system one. Reflection on the learnings from the action research report showed that the collection of manufacturing cells (system one) within LSAM packaging department lacked the very functions that the VSM espouses.

On the surface it therefore seems that the answer to LSAM's problems would be to apply the VSM as a model for improvement. However, I argue that within a shopfloor context such as experienced at LSAM, it is insufficient to state that a co-ordination (system 2), control (system 3), audit (system 3\*), intelligence (system 4) or policy (system 5) function is missing from the system and should thus be implemented. The overwhelming additional requirement was to know *how* to go about implementing for sustainability. The VSM is more concerned with *what* are those things that we should be doing than *how* do we implement what we should be doing. In addition, due to the complex nature of the VSM I would see it as a second phase diagnosis once a more fundamental cybernetic base has been established.

### **The Logical Levels of Management Model**

The Logical Levels of Management Model by Espejo and Schwaninger, is an extension of the VSM theme with more explicit focus areas for various levels of management. The usefulness of this model lies precisely in that it provides this managerial focus. Like the VSM, it focuses on *what* are those things that management should be doing. It does not describe *how* to organise to achieve these objectives. Although it is easier to understand than the VSM, it is too broad a model to be easily applied to a shopfloor situation within an operations management context.

### **The Circular Organisation Model**

The Circular Organisation proposed by Russel Ackoff is essentially a structural organisational model. It provides a framework for how to organise to achieve organisational objectives rather than what are the functions necessary to achieve the objectives. The model is useful in situations where vertical intergration is still absent. However, in a WCM organisation, the concept of team based management at all levels adequately addresses the vertical integration problem. The experience gained in the LSAM situation suggests that some of the problems existed due to a functionality problem within these team structures and not due to a lack of a circular organisation.

The above models have proven to be somewhat useful in explaining the LSAM problems, with the VSM being the most useful, but none of them are directly applicable in the situation encountered during this action research process. In the section that follows, a cybernetically based model for effective WCM organisation is proposed.

## 6 A CYBERNETIC FRAMEWORK FOR WCM

In this section I propose a model for WCM organisation. The model is based on the action research learnings presented earlier (see Appendix 2) and is useful in that it explains the problems and the evolved solutions that emerged during the LSAM action research process. The model is less concerned with organisation at a structural or functional level and is intended as a cybernetic basis for thinking about WCM systems, assuming that all the “practical/methodological” WCM elements are in place.

The model is intended to answer the question:

“ Given that we have implemented all the visible aspects of WCM – we have manufacturing cells, quality circles, problem solving routines, asset care processes, kanbans, JIT planning, kaizen processes, etc. – how do we ensure that we can do all these things sustainably in order to keep achieving good business results?”

**The key action research findings are recalled here for ease of reference:**

No matter how elaborate or simple the WCM systems that were implemented originally, these have not succeeded because of the absence of the following:

- Mature, empowered teams who see themselves as partners in the process – not just a group of people working in the same area.
- Teams who understand their systemic purpose as subsystems of the whole and understand how their interactions determine the achievement of their purpose.
- Clearly defined regularly occurring activities (ROA’s) for achieving desired outputs.
- Feedback loops for driving the occurrence of the ROA’s.
- Effective regulatory systems through which the feedback loops function.
- A living best practise system for capturing organisation learning that is understood by all and relevant to the system. Without learning the system collapses under environmental change.

The answer to the above question lies not in adding more techniques bearing a WCM label but in getting the organisation to be a sustainable living system capable of achieving the above. The secret to system longevity is cybernetically based.

In arriving at a model, I started out with the basic Input-Transformation-Output model for systems (class notes OMDP 1998). The inputs are those things that the system requires from its environment. The transformation is a combination of all the systemic interactions necessary to produce the desired outputs.

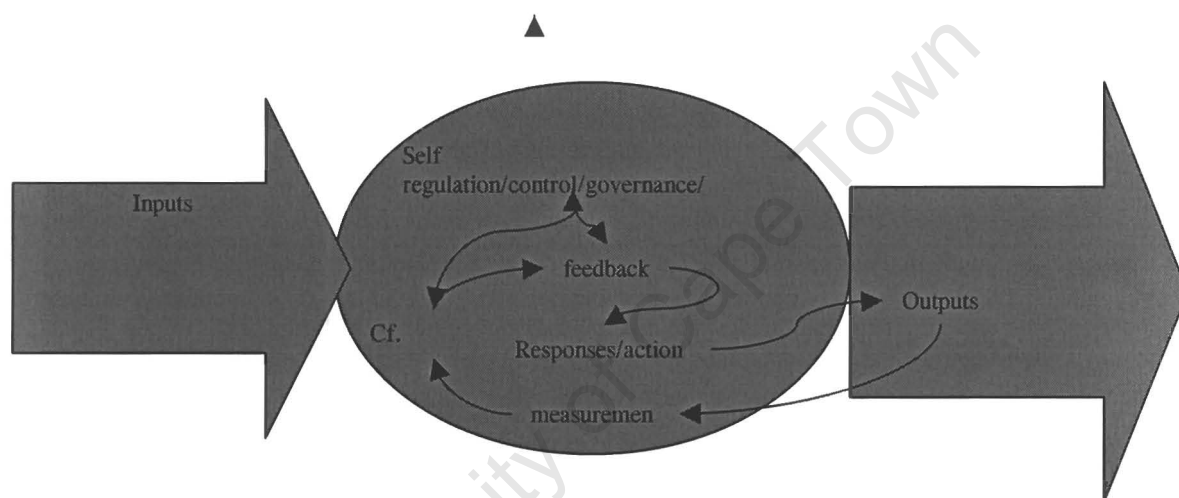


From my action research it was evident that the transformation step needed to be better defined to prevent a collapse of these key systems processes. Any system exists for a purpose. This purpose is translated into certain essential variables that have to be maintained for system survival. These are the outputs of the process.

At the heart of any cybernetic process is the regulation of the system to achieve these outputs all the time, everytime. Integral to this regulation are the responses or actions that have to keep happening – the regularly occurring activities that directly produce the system outputs.

From the feedback law of cybernetics we know that the only way of ensuring that the right responses happen is through feedback. And feedback systems in turn are the result of effective regulation and governance.

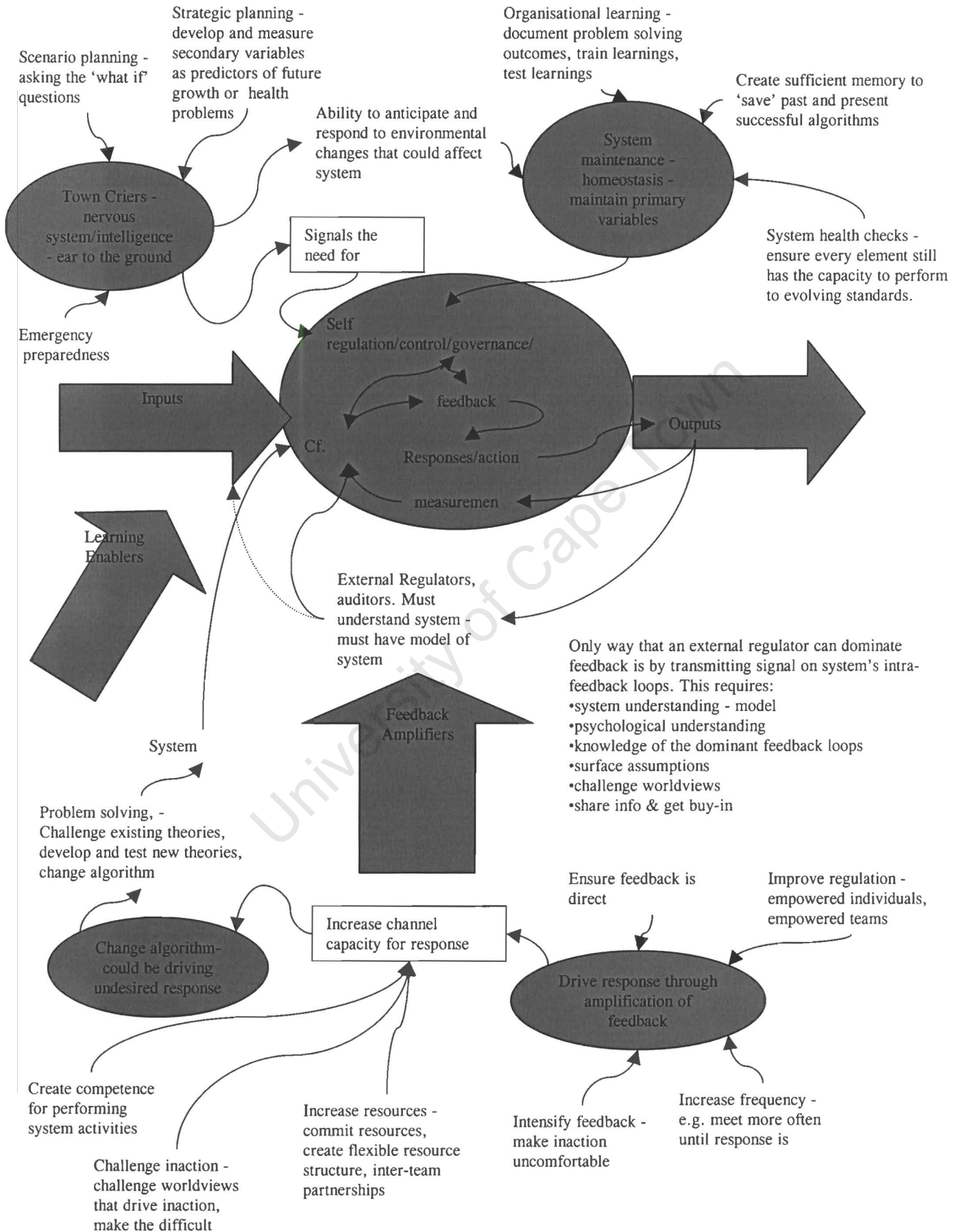
Combining these laws of cybernetics with the simple ITO model results in the model shown below.



This model is fine for static environmental conditions but could not predict or cope with changes imposed on it – e.g. changes in legislation that could affect our specifications and standards would not be picked up in a system such as this.

There is therefore a need to add a dynamic element to the basic system model. Taking into account the cybernetic laws for variety changes, I propose the complete model presented overleaf as a suitable model for system functionality even under changing conditions. I call it the Cybernetic Manufacturing Model.

# Cybernetic Manufacturing Model – a Model for effective WCM organisation



## **The Cybernetic Manufacturing Model**

Why is this model considered effective for dealing with the problems at LSAM?

The Cybernetic Manufacturing Model (CMM) stems directly from the first principles of cybernetics and systems thinking and therefore neatly packages the requirements for effective system creation and sustenance. It is akin to a roadmap for practicing first line managers, yet higher level management can use it as a framework for strategic conversation about the nature of WCM organisation design.

### **System Purpose**

It is suggested that the model be viewed from its basic building blocks. The essential starting point would be to define the purpose of the system as well as the specific outputs that characterise attainment of the purpose. Each output is translated into certain essential variables that have to be maintained for system survival. This defines in total what the system should achieve at all times.

At LSAM, such an explicit definition of system purpose was lacking within the shop floor level teams.

### **Transformation - Achieving the purpose**

The transformation building block is then defined. The transformation is a combination of all the systemic interactions necessary to produce the desired outputs. At the heart of any cybernetic transformation process is the regulation of the system to achieve the above outputs all the time, everytime. The regulation system is made up of the system management, the mental model of that system, the standards of what constitutes desired performance, the measurement system, and the all important feedback system. From the feedback law of cybernetics we know that the only way of ensuring that the right responses happen is through feedback. And feedback systems in turn are the result of effective regulation and governance. The other essential process in regulation is the response to the measured output. Each system functions according to a set of Regularly Occurring Activities that are essential to achieving the desired outputs. The ROA's together with the regulatory system that drives the ROA's together make up the transformation process.

In LSAM, the entire transformation process was defunct. Not only were the ROA's defined but there were insufficient feedback loops to drive the occurrence of ROA's. All in all regulation was poor.

### **Inputs and Changes**

In addition to the above basic building blocks, the system would not survive in a dynamic environment without evolving or self-reorganising in response to inputs from its environment. An open system is affected by and affects the environment it resides in. Inputs to the system are either governed by the system's own regulator or by an external regulator.

The internal self-regulation system defines and uses inputs that are directly essential in the transformation process for achieving the desired outputs.

Other inputs are those that are filtered through the system's intelligence as being relevant to the system's survival and hence the system should evolve to adapt to its new environment. This function is future focussed and encourages the system to remain one step ahead by building capability to respond if required in a future radically different environment. A further input is obtained from the system's health check – in cybernetic terms, the homeostasis function. This function also monitors the environment but with a view to maintaining the essential variables within certain defined critical parameters. The self-regulation function may re-organise the system so as to maintain the essential variables. Both these inputs discussed here are aimed at systemic learning and long-term environmental survival.

The other externally motivated inputs arise when third party or higher-level system regulators impose change upon the system. In a robust system, the only way to enforce change would be through amplified feedback in the system's own regulatory channels. This places the burden of indepth system understanding on the external regulator – without which change attempts are likely to fail.

At LSAM, not only did the system not learn from its own homeostatic processes, but externally imposed change (such as WCM implementation) was unsuccessful because the system's own self-regulating processes were not well defined and hence poorly understood.

The above discussion has therefore shown that all the problems highlighted during this study are explained by and can be resolved through the application of the Cybernetic Manufacturing Model.

## **7 CONCLUSION**

LSAM as a company has come a long way on the road to WCM. Several techniques have been introduced, with several years of hard work reflected in the best practise manuals. However, if the changes introduced are to be sustainable then the organisation itself needs to be organised cybernetically. Only once this has been achieved will the seemingly temporal WCM practises become permanent internal systemic constructs.

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**APPENDIX 1: ETHNOGRAPHIC RESEARCH JOURNAL**

**A CYBERNETIC APPROACH TO WORLD CLASS  
MANUFACTURING**

**BY LAUREEN VAN ASWEGEN**

**AUGUST 1999 – AUGUST 2000**

University of Cape Town

## **INTRODUCTION**

The ethnographic research journal is an essential tool in qualitative research. It is recommended in all the literature on qualitative research methods cited in the main research report and is used to record all the thoughts, insights, ideas and findings made by the researcher during the research process. It describes the actions taken throughout the process from data collection to final conclusions. It is a record of interim conclusions arrived at during data collection, the questions raised at each stage, the actions taken in response to these questions and the results of these actions. It also serves as a record of the events that occurred during the study that in the researcher's opinion could have affected the research study group and their behaviour. It is written from the researcher's perspective. This is essentially a diary of my experiences throughout the process – my story.

### **Context**

A year ago, I left a large parastatal organisation in the Nuclear Energy Industry to join a large manufacturing company in the Food and Beverage Industry. The change involved moving 1800km away from my hometown. The new position was that of departmental engineer in the production department of the new company. I had previously held the position of production co-ordinator. The roles and responsibilities of the two positions were not too different but there certainly were challenges not least of which was moving from an area of reasonable technological expertise to an area where the technology was new to me.

My plan was to learn as much as possible as quickly as possible so that I could add value through process improvements. My expectation was that of a world class organisation where the step changes had been made and hence my role as manager and team member would be that of directing the team towards further incremental improvement steps.

However, nothing could have prepared me for the chaos that I found. There was very little evidence that the packaging engineering group had been through a large-scale organisational change process to WCM principles. The challenge was to make a change in that direction.

This research project was designed to use action research and action learning principles to guide the group through a change process from where they were towards becoming a WCM group. At the same time ethnographic research techniques were used to understand the effects of a change management process on the team with the aim of understanding what change approach would best suit this team given that previous attempts had clearly failed.

I perceived my first step in this research process to be getting to grips with the situation in which I now found myself. I would therefore need to gather information about the system in its 'as found' condition. But how was I to know what the 'as found' condition was when I had changed the system by merely entering it? Comparing the behaviour and attitudes of those around me then and now reveals fairly large changes. At first their behaviour was characterised by suspicion, avoidance, lack of trust, distance, no confidence in my abilities, fear of my unknown character, unnatural efforts to look good and limited communication about their opinions regarding the organisation and the management team.

The team behaviour (compared to then) has changed considerably. They are now more trusting, appear to be more natural about their actions and are more open when expressing their opinions about the organisation and management, more open to change and the challenges of change.

Is this indicative of the 'natural' state of the system? Or is this a result of the changes imposed over the last twelve months? The bottom line is that I will never know what the 'as found' condition of the system was. For the purposes of this study I will define the 'as found' condition as the situational model I arrived at after the first month of ethnographic research. Each learning cycle then follows and a situational model of the system 'now' is presented.

This ethnographic research journal is a record of my journey through this process of change and learning. The journal starts off with rather detailed day by records, then moves to week-on-week summaries and finally month-on-month or significant-event summaries.

**Note: I have changed the names of the company, departments, people, places and business strategies to protect the image and intelligence of the company involved.**

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## **Entry to the System**

### **24 July 1999 - First contact**

Although I'm only due to start work next Monday 2 August 1999, DM has arranged for me to come up to do pre-employment medical examinations, get my security access card printed, choose a suitable guest house for the first month and meet with himself and the department maintenance planner who I would be working closely with. DM thought this was necessary since he would be away on my starting day. Due to the flight times booked for me I only arrived in PBG in the afternoon - in time for the medical, but since there was a farewell starting at 16:30, the meeting was postponed till this afternoon (Saturday, 24<sup>th</sup>). I was of course invited to join the farewell function for someone who had been with the company for several years. It was quite a 'lavish' affair with expensive gifts, formal speeches, lots to eat and naturally lots of home brewed product to drink. It was also a good opportunity for introductions to many of the staff from the production site, the depot next door and the regional office nearby. I tried my best to be as natural as possible and enjoyed the party but I got a rather icy reception from the packaging staff whom I met. This is rather worrying since they are mainly from the engineering department that I will be working in. The general response was along the lines of: "Are **YOU** the new packaging engineer!" I wonder what they expected, what had they hoped for?

The meeting with DM this afternoon went well. He explained how the department was structured organisationally and how this organisation structure fitted into that of the whole production department. He mentioned key people in the department and in the plant. We discussed my post graduate studies and ended up chatting about Peter Senge's work. I was surprised and pleased that DM was familiar with systems thinking principles. MP and his wife joined us later for supper.

In summary, my first introduction to this giant, world-renowned organisation has left me concerned over how I'm going to get along with the people I will be working with, and at the same time positive about my career growth in an environment where management understand systems thinking principles.

### **8 August 1999 - End of week one**

This has been an interesting week to say the least. My new manager (DM) was out of town on my first day at work, so I spent the day with PBS, the departmental secretary, filling in several take-on forms.

I spent a brief moment with DM on Tuesday morning and attended the daily packaging morning meeting where I was introduced to the level two team. The meeting started ten minutes late. The meeting was chaired by the morning shift line supervisor (SP1) who rattled off several performance parameters from the previous day's production run. He entertained no discussion and only paused when interrupted by DM who wanted to dwell on certain points. This happened everyday for the rest of the week.

On Tuesday afternoon I joined the full level-two team in the weekly manufacturing meeting where the previous week's performance is tracked against targets and year-to-date performance is tracked against year-end goals. The parameters discussed are tracked on control charts. The meeting started ten minutes late after DM went

to look for the attendees. The meeting lasted two and a half hours! Despite the apparent disorganisation in meetings, I would like to attend as many as possible to get exposed to the lingo, the issues at hand, see how people deal with issues raised, get a feel for the management processes in use, etc.

In between meetings, I spent most of the week sorting out administrative details around inclusion into the organisation so that I could be loaded onto the personnel database. There was no clarity or agreement between the key parties such as payroll, the HR community and security services on exactly what information was required, who should do what in which sequence, who I should get the information from etc. in order to complete the process smoothly. I spent most of the week between several buildings and offices being sent back and forth from one person to the next to complete each piece of the puzzle.

The time that I did spend in the packaging building was spent opposite PBS at her desk because there is no office for me. ACS, the previous packaging superintendent (I discovered that only registerable engineers are called by the term engineer) is still occupying the packaging engineer's office although he has been doing a different job for nearly two years now. He is very unhappy about having to move out. Of course I do not want to cause trouble and a new office will suite me better anyway. I asked if there was not another office available and DM said there are several but PM, the production manager, says that ACS has to move since the rule is that offices are owned by positions not individuals. ACS says he is not too perturbed, but he will have to find another office and move, which will take at least a week. He was not really prepared for my arrival. I am aware of the inconvenience that my entry into the system is causing and I feel that my new manager did not really make any effort in terms of preparation.

I'm really eager to start working, take responsibility, start working with my team, or at least find some place in the department where I fit in. I also need a place to organise myself, my thoughts, my approach, my plan etc. and sitting opposite the secretary in a walk-through office is not working.

I cannot go onto the plant because I don't have PPE and the secretary has no stock. DM is terribly busy with suppliers, senior management meetings, etc that I have hardly spent time with him. He only seems to be in the office from about 16:00 hours onward, which is about the time when everyone else leaves the office. I need to balance the need to spend time after hours with DM and the all-important house-hunting exercise that will occupy every evening and weekend for this first month at least.

Wednesday afternoon is time for another level two meeting - yet another meeting that started late with even DM being late. The meeting seemed to revolve around training issues. There was no set agenda and I could not find the purpose of the meeting simply by observing. The meeting was not as long as the manufacturing meeting yesterday but an hour is still a long meeting given that there is little clarity.

On Thursdays PM holds a special site-wide get-together (which I'll call a weekly general meeting - WGM - since the actual unique name could identify the plant) where everyone from senior management to shop floor level discuss issues of a general nature affecting the business. This is a good practice. However, only seventeen people attended. I asked about the attendance and it seems that only a

core few support these meetings. DM introduced me to everyone there. The meeting started seven minutes late and there were several stragglers.

At this stage I had largely completed all the administrative formalities and I felt the need to start focusing on the technical detail of the job. I forced an appointment with ACS so that I could get some direction about my role as the packaging engineer and about the engineering fraternity's role within LSAM in general. ACS was the last person to occupy the packaging engineer's position although he assures me that he is not an engineer; that is why the position was called Packaging Superintendent.

He was taken out of packaging nearly two years ago to work on special projects for production such as the implementation of the electronic business management system, SAP. He therefore does not have any recent packaging material for me but I am welcome to go through all his files in his office which contains a host of information from the time when he was in the position. He could not tell me much about the position either, except that it essentially entails looking after anything of an engineering nature within the packaging department. He did not have copies of the engineering manuals for the packaging plant in his office, but pointed me in the direction of the engineering manager's office.

The plant does not have an engineering manager at present. The previous engineering manager (EM) was transferred a few months ago to Central Office. ACS is currently the acting engineering manager. I found one engineering manual, the Engineering Standards, Procedures and Instructions manual (ESPI) in EM's office. It contained a few documents, but not what I was looking for.

As the week progressed I was also introduced to several people - fellow colleagues inside and outside the department and some other people whom I later discovered would be reporting to me. I 'discovered' that these people would be reporting to me through conversations with the department secretary and the previous packaging superintendent - they were not introduced as such by DM. I wondered about this, but with all the legwork during the week and DM always being extremely busy I assumed that he would be planning a formal meeting with the guys where I would be formally introduced.

On Friday ACS took me on a plant tour from the start of the packaging operation right through to the other side of the conveyor-bridge into the warehouse at the depot. It was great to be on the plant. I took copious notes of everything from machine names to process flow patterns from one machine to the next. Apart from an industry visit to a soft drink factory while still at school, I'd never been in a bottling hall before. The machines are fascinating - processing thousands of bottles per hour through various operations from cleaning to labelling and even packing and stacking. This has certainly been the highlight of my week.

Upon returning to the office, my first task was to find some material on the technical features of all the machines, but it is after four, and everyone has left for the pub.

In summary, at the end of the first week I'm left with the impression that this is going to be a technical adventure and I am looking forward to the challenge. I am also frustrated with the apparent lack of organisation - having no one to take over from, not being able to settle in, not being able to find adequate documentation. My feeling at this stage is that this place lacks procedural structure, has a general

unprofessional climate and is generally disorganised. I still have no office - there are no concrete plans for an office either. I have not been introduced to the team I am going to manage and I get the feeling that there is no urgency to do this either. The lack of punctuality at meetings is a particular sore point.

## **Early Impressions**

### **14 August 1999 - the learning curve begins**

I have devoted this second week to learning more about the plant as a whole from a technical and management point of view. The more I learn about the way things work around here the better chance I have of stumbling across the right people who may have the technical information I am after. I have decided to put the frustrations of last week behind me and to focus on absorbing as much as possible. I recognise that my observations of last week were prejudiced by my worldview of expecting a world-class work place – not that I know how this should look, but at this stage I think that it should at least match the structure and focus of the industry I left. I have also decided to be critically aware of my 'heavily regulated workplace' paradigm against which I am comparing everything I observe. My previous working environment, being in the nuclear industry, was regulated to regimented precision. Structure and bureaucracy regulated every activity – there was no feeling of 'looseness' like that, which I now experience. If I continue to filter my observations through this paradigm then I will not be able to gain a clear picture of the system as it is. Also, the less structured the environment the easier it is to change??

My first step was to set up a plan to meet with every department head as a start. DM has asked TC, the departmental training controller, to assist me in setting up induction appointments with the various departments I would have to interact with. I have completed the plan and have already spent time with the Utilities Superintendent, PA the production accountant, LM the QA Lab manager. Next week I will spend time with the beverage department, risk control section, human resources specialist, the rest of the QA department and the marketing, sales and distribution (MSD) department who do not form part of the production department. I wanted to use whatever came out of the discussions as focus for our department but also as ethnographic info for my research. There was thus a need to structure the 'interviews'. I also knew far too little to ask in-depth questions. I therefore asked the following open-ended questions of all the departmental reps and was careful not to lead responses:

- How does your department fit into the plant organisation?
- What is your departmental relationship to packaging?
- What are your expectations of the packaging engineering group?

My discussion with US gave me the impression that he is unhappy with the way that the plant is being managed. He raised several concerns that I recorded for analysis. The key beliefs that surfaced were:

- unfair expectations of his department by senior management
- lack of recognition of his efforts by senior management
- insufficient budget funds to manage his department effectively
- little support from pier managers whose departments he services

He complained about the natural resource consumption in packaging. He says that usages are supposed to improve with increased volume of product produced, and it has to a certain extent but Packaging are not managing their consumption. He says that when he raises the issue he gets no response from packaging. He raised similar concerns about the beverage department. He also mentioned that things are worse now than they were in the past. He says that staff have been taken out of the organisation but not replaced and that if this resource stripping continued then the plant would have to close down.

The Utilities level-one team members took me on a plant tour through the entire auxiliary plant sections. They struck me as high-spirited, competent individuals. Their level one SBU meeting at 07:30 in the morning started dead on time and was extremely well conducted with full participation from all. I'm not sure how much my presence affected their behaviour but the level of professionalism I observed is definitely a cut above the rest I have seen thus far.

PA, the production accountant, is an extremely bubbly, very enthusiastic person. He gave me a breakdown of the plant financial procedures and processes and has promised to provide me with all the assistance I will ever need on the financial side. His main gripe is that department managers have yet to learn that financial control is all about controlling 'usages'. He also warned that he would not be extending deadlines for departmental input into the budgeting process in November this year as he had to for the packaging department last year. He complained that DM was so late with his input that he (PA) had to work through the night to make the regional cut-off. He also believes that packaging finances are out of control, particularly on the maintenance budget. I promised to look into the matter.

My discussion with LM and my introduction to the lab was an interesting experience. LM believes that her department is understaffed and that the solution is a virtual lab where the line operators perform their own analytical services. QC's function will then become an assurance function only - auditing the virtual labs, setting standards etc. She says that the rest of the division is already moving that way so we are next in line. In any case, with the introduction of world-class manufacturing some time back, quality at source is already practised. LM also however complained about the current level of analytical functions performed by machine operators. The operators are not doing what's expected of them. I inquired about procedures and training, and she said that each department - in our case, TC (packaging training controller) - was responsible for achieving competence.

She took me through all the functions of the lab, the instrumentation, the systems for recording and reporting information, the nature and level of service provided, how SPC is achieved, the QA focus for the plant and she introduced me to her staff. My overall impression of LM's management of the lab is that she has her finger on every pulse in her department. Her staff come across as competent, hardworking, enthusiastic supporters of the team's goals. My impression is that they are more professional and organised than my own department but not quite as jacked up as the Utilities team.

As I progressed on my induction plan I was pointed in the direction of people who TC had not directly recommended but who provided me with valuable chunks of info, such as the engineering data capturing clerk, DC. Her function involves capturing maintenance work-order history onto the maintenance management system for the

whole of production. She is also the custodian of all safety inspection and testing records for all production departments (for NOSA audit purposes). DC is an exceptionally warm person. She took time out to explain the organogram of the plant to me - including key changes that had been made over time. She also solved the mystery of the engineering department's function.

As DC explained, the engineering manager is not responsible for engineering (in the classical sense) on site - they used to be. It was then decided a few years back that the engineering function would form part of the line function within each department. Hence each department manager will have an engineering group report into the line headed by an engineer. The engineering department then became a service department to the two main departments.

The engineering department is made up of the utilities group, the engineering stores group and the risk control group. The utilities group provides services such as compressed air, steam, electricity supply and distribution onto site, water supply and distribution, various gas supplies all of which are essential for the production of product, as well as effluent collection, treatment, monitoring and discharge. The stores department includes purchasing and procurement functions, and the risk control group includes general site services management.

DC is extremely happy working at LSAM. She has no kind words for the previous engineering manager. She believes that the best thing that has happened to the plant is his departure to central office. She is full of praise for the previous beverage engineering manager. The plant does not have a beverage engineering manager and has not had one since the previous incumbent left several months previously. I remember this coming up in the interview - two departments without an engineer. I made a mental note while listening to DC to have a career discussion with DM before I get too involved with things. DC was also concerned about the level of maintenance schedule adherence and the turnaround time in packaging. Often she has closed off work-orders that had been issued months previously. She was also concerned about safety schedules being missed during the year causing a mad rush before safety audits. She is concerned that not all of packaging work orders have been correctly captured on the new SAP system.

In summary, I have learned a lot about the regional organisational structure and have made contact with several key persons. I am however concerned that all our service providers that I have met so far have problems with us. I will ask DM what we are doing to improve our relationship with our service providers.

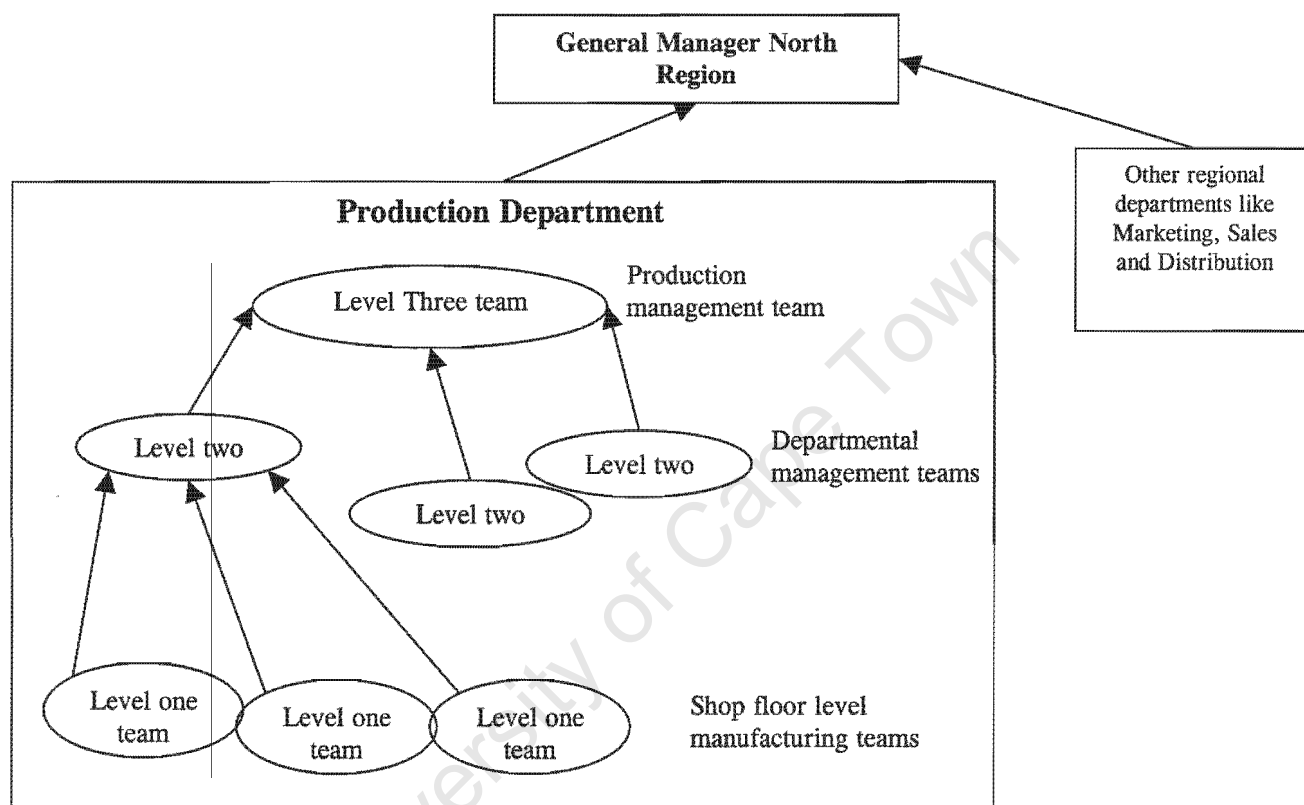
I also wonder about the impact on the business when key persons are not replaced - it appears that engineering skills in particular are rather thin. There appears to be concern over reduced staff numbers.

I have briefly mentioned my frustrations about not having an office to DM. There is talk of me sharing the planner's office until ACS moves out.

Meetings in packaging for this week have continued in a similar vane to last week. I am starting to get into the gist of the lingo and the focus areas for the team. This week's morning shift supervisor is not as 'brisk' as last weeks and tends to dwell on issues instead of brushing over them. This allows the meeting participants the opportunity to debate points unlike last week's steam rolling. The morning meetings are however lengthened by this process. The meeting is a report of the previous 24-hour packaging performance - in full, not by exception - and serves as a forum to

raise plant defects which the maintenance planner will later enter into the maintenance planning system. The afternoon meetings are still very long. The Tuesday meeting looks at performance for the last week, and the Thursday meeting's purpose still escapes me. Neither meeting has a set agenda. I will have to discuss these with DM.

In summary, I now have a picture of the organisation structure. There is a heavy emphasis on teamwork and team structures are reflected in the organisation chart. Teamwork is a key part of the WCM followed by LSAM.



I also noticed that key positions at level 2 and even level 3 remain unfilled for long periods of time. I need to speak to the relevant managers to get a feel for the impact of these functional gaps.

### 21 August 1999 - the gradient increases

This has been another interesting week of discovery. I have not met with all the departments I had planned but I did manage to spend some time with staff in my own department. I also met informally with the MSD managers at the pub after work and gained some valuable insights about their view of the production department. I also have a picture of the organisation structure of the plant as it currently operates which I observed is different from the officially recorded organogram in the production manager's boardroom.

I am also becoming increasingly impatient with my progress. It has been two weeks and I have yet to do anything concrete.

On the technical side, I am having great difficulty in finding engineering information about the plant I will be responsible for. Engineering documentation such as drawings, procedures, standards, guidelines etc. are very hard to come by. There used to be a library in the packaging department but it hasn't been used by anyone in years. I managed to get security to unlock the 'library' and found that apart from one cabinet with a few journals, it had largely become a storeroom for unused office furniture. I was told that the plant had a documentation controller, CD, whom I introduced myself to and discussed my observations with. CD told me that the packaging library was not well supported, and was difficult to manage because staff would borrow items but not return them. She had become very busy with Best Practice (BP) implementation and could not devote all her time to managing every item that came and went. When the material had nearly all vanished, the library system was discontinued.

CD has a very strong negative view of the packaging department and the plant management as a whole. Her sense that things were better in the past comes across very strongly. She was careful not to mention names. Beliefs that are evident from CD's narrative to me include the following:

- This place has gone downhill
- current management are poor organisers
- current management have no clue how to maintain standards
- this place used to be one of the best in the division in the past
- the people used to be wonderful to work with
- the staff had a pride in what they did
- the current staff members have no pride, no interest and do not care about the business the way previous people used to
- everyone knows what's expected of them in terms of BP but no one does what's expected because they do not care anymore
- workers have lost faith in management – they don't seem to know what they are doing

I heard the term BP mentioned by LM before and CD explained the acronym to me. Best Practice is the best identified method of doing something. For example, all the operator manuals with detailed work instructions for each machine is called a BP manual. The process was used for machine maintenance work instructions. CD kept these manuals locked in her office behind a class cage. She explained that these were controlled copies. She only keeps BP operator manuals. The maintenance BP manuals are kept in MP's (maintenance planner) office. There were no working copies available for me to use. The idea was to move away from a paper based system to an electronic one so that revisions and updates do not become an administrative nightmare. The electronic version should be on the regional 'Intranet' so that everyone has access to it, but CD has not managed to get it on the net. I also learnt from CD that the engineering manuals are kept in the central plant library in the engineering building.

*My discussion with CD worried me. She seemed extremely negative about the place. She also echoed a theme I had picked up last week – that things have deteriorated over time and that this is believed to be due to poor management practises.*

I decided to spend time with MP, the packaging maintenance planner/controller, to get closer to the engineering side of things. MP is an extremely busy man. Like DM,

he is always busy with suppliers or in the workshop or on the phone sourcing spares or setting up the maintenance plan in SAP. I discussed the engineering team, the functional roles and the maintenance cycle in use in the packaging plant. Like CD, MP is not happy with the current management practises. MP explained to me how he moved through the ranks from artisan level in utilities and beveraging and after being the engineering superintendent at a beverage plant in Tanzania has returned to LSAM north region as packaging maintenance planner. He explained in great detail how he ran the engineering group in Tanzania and how senior management were supportive of his work – unlike here. MP is convinced that the place will be closing down soon given that senior management have no interest in the successful running of the plant. Everything has deteriorated. There is no investment in the plant anymore. Previous management used to look after the plant and ensure that there were sufficient maintenance funds but in the last three years or so since he has last been here the level of deterioration is visible and the shop floor guys are extremely negative about the current management practises. MP used some rather colourful language which I won't transcribe here but which emphasised his level of frustration. I asked about the maintenance planning processes in use. MP was not very offay with the new SAP system and what he knew about it he did not like. He preferred the previous maintenance electronic system. He had only been back from Tanzania for four months and this whole business was still new to him. He does not believe that the SAP system was introduced very well – most of the guys cannot use the system and were probably not trained very well. Apart from his frustration with SAP, MP could not explain the maintenance planning cycle to me – there was no clear cut process or work flow from plant defect to correction and loop closure beyond the fix. Everything appeared to be by word of mouth and somehow everyone 'knew' what he or she had to do. I asked if he had discussed his frustrations with DM as department head, but he had very little faith in DM's ability to do anything. "Ag, he is all talk and no action!" was his comment.

*This is a concern – I'm sure it cannot be as loose as just described but I will have to get DM's point of view since he should be following the process anyway. I may even audit the process and see how it works in practise. Perhaps get closer to the artisans and ask them how they see it? I'm also concerned with his frustration and negativity towards senior management. I am particularly concerned about his external locus of control. For a level-two team member - and in particular as a member of my engineering team – this attitude was not good. I need someone who is willing to fight for what is right for the sake of the business instead of the passive acceptance that if things get bad enough the place will be closed down.*

MP introduced me to some of the engineering level one guys – they did not seem impressed to meet me at all. They were certainly not a happy bunch and seemed extremely distressed. The workshop was a reflection of their mood – I could not believe that this was a beverage factory when I looked at the state of the workshop – housekeeping was not a strong point. I wasn't going to get anything out of them so I decided to chat to them later preferably one on one. DM had not formally introduced me yet so they were probably surprised by my presence? I couldn't be sure and decided not to make too much of it.

The key belief themes surfaced from the discussion with MP are:

- unhappy with the current management practises
- Senior management were supportive of his work – unlike here.

- senior management have no interest in the successful running of the plant
- Everything has deteriorated
- There is no investment in the plant anymore
- insufficient maintenance funds
- the level of deterioration is visible
- feels that the shop floor guys are extremely negative about the current management practises high level of frustration
- does not fully understand SAP
- does not like the new SAP system – not as good as the previous one
- SAP not well introduced – lack of training on the new system
- has no model or process by which he runs maintenance
- has no faith in the departmental manager

At the end of the week I managed to spend some time with DM. I discussed my observations with him and my opinion that there was an apparent lack of structure in packaging. I mentioned the loose approach to maintenance planning and the fact the meetings did not seem to be working all that well. I also discussed the engineering team's 'sombre' outlook. DM found all of this extremely amusing. He said he was so glad that he finally found someone who agreed with him about the state of the plant. He said he wished he had a tape recorder because I was saying exactly what he had said when he arrived here from Gauteng a year and a half ago – only then it was much worse and he had managed to turn around the worst of it. We had a long chat about what the place was like when he first arrived and the measures he had taken to improve things. He also shared his opinion of the staff with me. We discussed the Best Practice strategy as well. He explained that it is part of the larger LSAM management philosophy of World Class Manufacturing. The company had gone through a comprehensive change process about eight or so years ago when the threat of losing market dominance in South Africa became an issue. The key elements are things like team accountability; quality at source, best operating practises, TPM, TQM, JIT etc. Has it been working? DM did not believe that it was working here – although he said they had it working well in the Gauteng region where he worked before. DM was extremely negative and phenomenally frustrated about the way things were going here in the North. He too held the opinion that the plant management had no clue and were "a complete bunch of wallies".

The key belief themes surfaced from my discussion with DM are:

- Does not know SAP PM very well
- Has no faith in SAP as a management system
- SAP is not delivering
- SAP not as good as Maximo
- Good old days
- Planner is not good at his job
- Maintenance planning poor
- Guys are lying about their inability to use SAP
- Resistance by shop floor to use SAP
- Maintenance problems are the result of poor planning
- Theory espoused: preventative maintenance
- Theory in use: breakdown maintenance
- Planner's work rate is low.

- Planner's methods not good
- Artisans prefer fixing to preventing failures
- Artisans do not know what an artisan's job actually entails
- Frustrated at low skills levels in general
- Shop floor staff hopeless
- Level two team hopeless
- Level three team has no clue
- Best supervisor is worse than worst supervisor at previous region
- Best artisan worse than worst artisan at previous region
- Has taken a step backwards by coming to this position although higher position than previously held
- Frustration at cost cutting by production manager
- Production manager does not understand the implications of cost cutting
- Production manager refuses to acknowledge problems at lower levels
- Standard of work is low
- BP is not working
- BP was not implemented properly
- Level three believes that BP is working but it is not
- No problem solving at level one
- Racism at level three
- When he got here things were ten times worse
- No one at this region understands the concept of teamwork
- Tried to implement team development efforts with level two but failed
- This level two team is more hopeless than the level one team at previous region
- The organisation structure is a total disaster
- Key positions were removed out of the organisation when people left instead of replacing them – cost driven
- Department manager had everyone in the department reporting directly to him
- The engineering team has had no manager for about two years
- Impossible to manage everyone and everything alone
- Has been denied the request for recruiting staff
- Has been working on new-look organisation
- Level three drive for total site reorganization according to BP II
- Recruitment and internal reorganization on hold until implementation of BP II
- Resources are critically low
- There was no SPC in QC
- Had to introduce proper control of quality parameters
- Figures on performance were incorrectly calculated giving falsely higher performances than actual by as much as two percent
- Maintenance times were 'stolen' for production
- Had to insist on and vigorously manage adequate time given for maintenance
- This region does not understand the value of maintenance
- Maintenance budget is hopelessly inadequate
- No problem solving was done
- The morning meetings were a fiasco before he (DM) got it right
- DM has had to personally run morning production meetings to get things going
- Engineering team does not identify with the department
- Engineering team used to be part of one site-wide engineering department
- Overall, this entire region is a disaster
- Has strong desire to leave this region
- Has actively made plans to leave (job applications elsewhere)
- Frustrated at low integrity of production manager

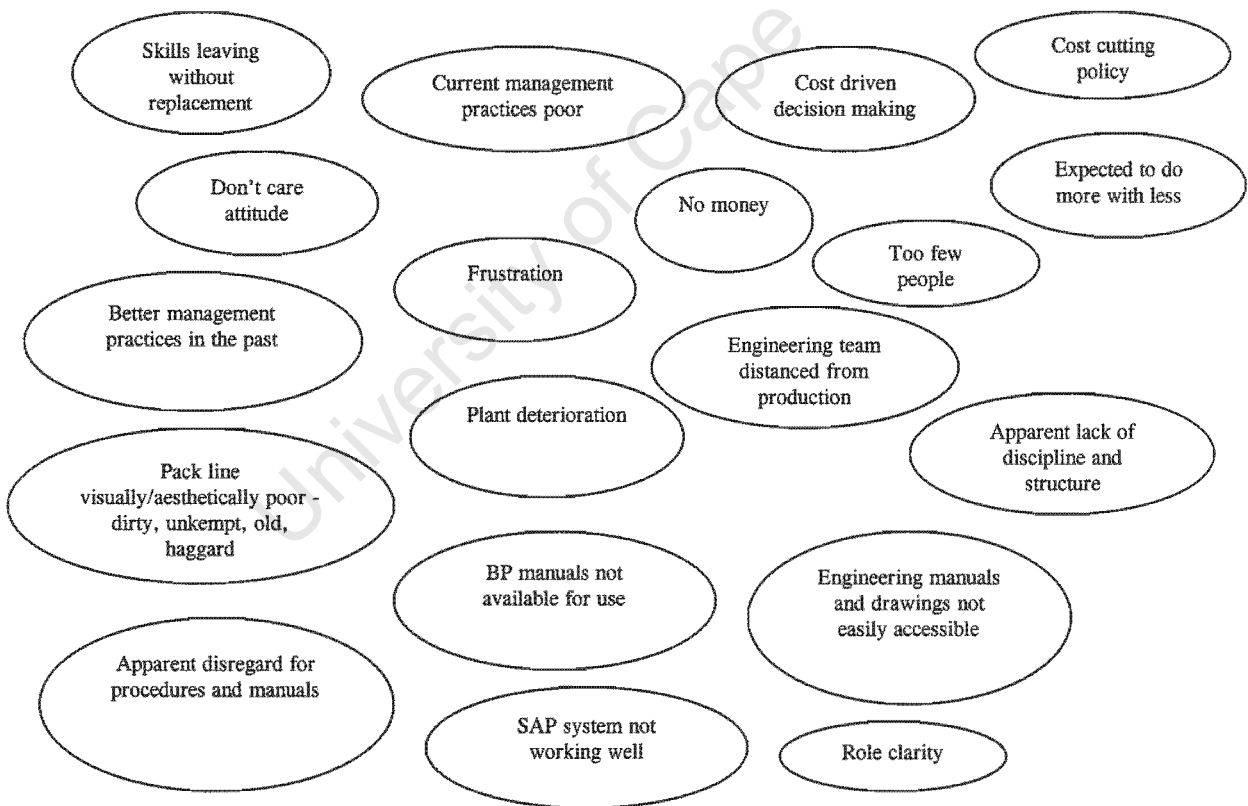
- Production manager does not realize how much he (DM) is doing
- Has relationship problem with the production manager
- Previous engineering manager has totally ruined this place
- Cost driven decisions made by previous engineering manager has caused numerous performance problems
- Most of the key machines are second hand
- Most key machines not designed for these circumstances
- Most key machines were thrown out by other companies and bought at a cheap price for use here
- No real engineering in this place
- Has been struggling unsuccessfully to get money for large projects
- Is pleased that he finally has support in the department for improving things
- Wants to get rid of non-performers but no senior support
- Level one are a mostly a bunch of 'sick lame and crazy' people
- SAP is a useless system
- SAP was an expensive waste of time by the company
- SAP is tedious
- Have no faith in SAP
- Does not know SAP PM system very well
- good old days of Maximo
- Guys are lying about not being trained
- Maintenance planning is a disaster
- The planner is incompetent
- the planner is a poor performer
- the planner has no clue of what his job entails
- threats to sort out planner
- no one knows what their role is
- neither level one nor level two has a clue as to what their work actually entails
- level two has no clue of teams or team functioning
- stores is a fup (mess)
- stores controller is a total fup (is hopeless)

Phew! I was exhausted after this discussion and worried about the fact that a number of people I had spoken to so far felt almost the same way about the place. I asked DM about the fact that I had not yet been introduced to the team I would be managing. DM explained that LSAM was going through a complete organisational restructuring towards the BPII (best practise phase two) structure. BPII will complete the WCM strategy embarked upon several years ago. BPII was aimed at getting the right processes and work practises in place and BPII was aimed at raising the average skills level of the company to comply comfortably with the BP standards. Since this would imply job loss (several unskilled/poorly skilled workers still at LSAM) the whole thing was still top secret. In order to be proactive about shaping the packaging group towards the BPII structure, DM was trying to split the engineering team in such a way that eventually all engineering staff would belong to the shift teams and not work from their 'Ivory Tower' outside of the production teams. DM has been trying for months now to get the production and engineering guys to work closer together and to see one another as part of the same team, but there is huge resistance to this. So, at this stage he is not sure whether he should introduce me to the engineering team as their manager since he does not want the team to form a department on their own anymore. My role as department engineer will be more of a level two team player directing engineering excellence and maintenance standards at

level one without necessarily having anyone report to me. The team will report to MP, the maintenance planner/controller until the transition to shift teams has been completed. At the same time he is carrying the burden of having everyone in the department reporting directly to him which is impossible to manage. We decided that we would give it some more time until the new structural changes could be finalised and everyone was involved and informed. Until then I would get on with the technical stuff.

In summary, this week has almost marked the end of my formal induction as per the initial plan. I still had to spend some time at central office and at another region to broaden my perspective of the LSAM company at national level but that will be done next month. I felt more comfortable about having at least a better understanding of my role although I wasn't sure what I was going to tell the engineering team given the confidentiality around BPII. At least I could introduce myself as a technical support manager of sorts able to assist and sort out engineering problems without necessarily having the team report to me.

A huge concern, however, was the degree of de-motivation and negativity that was surfaced this week. I collated the main themes but at this stage I cannot decide how they are linked together. I will work with the level one teams as from next week and get their input.



I also decided to come in the weekend and look more closely at plant performance data. I have noticed in the meetings that the figures don't look particularly bad but are there trends in performance that could give me a "factual" image of the plant? Does it seem to tie in with the beliefs and perceptions that I picked up over the past three weeks? Does it reflect my own observations of the place?

I looked at the maintenance spend versus budget – we were way overspent. Poor budgeting or is the plant really in need of extensive maintenance or poor cost control? I couldn't be sure. I struggled for hours to get through the SAP maze. Spares were being booked mainly against the general spend/consumables account and not per machine which made tracing of costs difficult. Conveyor maintenance appeared to be costing a fortune. We were buying more chain than budgeted for at a higher cost than budgeted for. Why? Higher wear than anticipated? Change in supplier? I would have to check with MP.

I then looked at the quality and machine reliability/availability numbers. Quality was generally OK – which tied in with DM's belief that his focus on quality and his introduction of SPC (statistical process control) into quality control has kept packaging performance up.

Machine performance appeared to be a problem. We certainly were not meeting targets on machine efficiency and our downtime appeared to be trending in the wrong direction compared to the previous three months. This explains why MP has been running around so much the last two weeks – there have been a number of breakdowns. Last week's total breakdown time was 22 hours! That's high – approximately 20% of running time. I wondered if this included the eight hours of maintenance and cleaning at the start of each week. I would have to check with DM.

## **28 August 1999 - Gathering More Data**

This week's events have left me with a rather unwarm feeling about the department and the plant as a whole. On the other hand, we are making progress at level two by virtue of having developed set agendas for our team meetings.

Mondays are maintenance days in packaging. The morning shift on the day is responsible for maintenance and cleaning and starting up the line for afternoon shift. I spent the morning on the plant introducing myself to several of the guys on the machines and speaking to the artisans and mechanics. There was no plan available so I had difficulty following exactly what work was required and how the teams were performing against plan. The supervisor on duty explained to me that his team (production) were responsible for cleaning the machines and performing autonomous maintenance on some of the machines – those that had been on the BP agenda. He did not see the need for a maintenance day plan although it worked well in the past when the previous planner was still here. I asked how the operators knew what maintenance would be performed on their machines on the day, and how he as a supervisor planned his cleaning schedules according to the maintenance workload. He felt that there was too little time on a maintenance day to perform corrective maintenance anyway and that rather than let the operators get in the way of the artisans and vice versa, only inspection or lubrication schedules were done on maintenance day. Most corrective work is done on weekends due to the time constraint.

I wondered how other plants who ran throughout weekends and who only had twelve hours maintenance and cleaning a week managed to cope if we couldn't cope. I ran the question past MP who was running around trying to get conveyor spares that should have been here but had not arrived. He said that the guys can't

understand the plan anyway and that everyone knows what they must do. He hands out the schedules on a Monday morning early and the guys get on with it – non-running schedules on the day and running schedules during the week. All big jobs are left for the weekend. I challenged him on the cost over overtime and the fact that other plants do not have the luxury of available weekends. He felt that other plants have abundant resources and that with our few resources we had no choice but to work on weekends when the shift artisans are available.

I spoke to some of the artisans about maintenance day planning. They did not appear to be very busy. SA1, the on-duty shift artisan, explained that the operators take hours to wash down their machines and that they hosed them (the artisans) and their tools if they tried to do work at the machines while cleaning was in progress. I found this hilarious! The obvious thing would be to challenge the operator about wetting him and then to work out some method of working together. SA1 was full of disdain for my suggestion. He challenged me to try to talk to “them”. He spoke about the operators in a derogatory tone. I suggested that a plan might help to get everyone to work together. He remembers plans being generated years ago but he doubts whether it is necessary since everyone ‘knows’ what they should be doing. What if weekends were not available for work? He believed the place would fall apart completely! Management had reduced the number of engineering staff to a point that if there were no weekend work then no maintenance would get done.

I introduced my self to the rest of the team as the week went by and made a point of getting round to everyone on the engineering team to get their opinions about the department and how things were working. I would have to catch the night shift artisan next week.

The following key belief themes were surfaced:

(M1)

- Age as a barrier to career development
- Mismanagement of career development programs in the past
- Work not interesting
- Not trusted with challenging work/responsibilities
- Used to be trusted with more responsibility
- Used to have coaching role
- No development opportunities
- Desire for development in challenging roles
- Desire for training as artisan
- Desire for machine shop training
- Promised development has not materialised
- Proud of working for LSAM
- Won't leave the company
- Team functioning OK
- No real change in team functioning over the past few years
- Team members very different from each other
- Acceptance of team climate/functioning
- Confidence in own abilities to perform current tasks
- Problem resolution by speaking/talking to team members
- Clear on duties/responsibilities
- Poor resource planning

- Poor time-for-tasks planning
- Accepts personal responsibility for machine downtime in his responsibility area
- Recording of downtime by operators not accurate
- Not clear on what's expected of him
- Resourcing too low for workload
- Goal setting poor or lacking

(DA1)

- Does not know what's expected of him
- Not clear on role/function/responsibility
- Management promises not fulfilled
- Lack of/ poor planning
- Organisation structure ill-defined
- Staff lying about workload – 'they' do nothing and 'we' have to do everything for 'them'
- Colour doesn't matter to me but these 'things' don't care about the place – 'they' want the place to close down so that 'they' can get a package
- Team not functioning – you can't work with 'them'
- It's not about colour or anything but I've tried and a person can't reason with 'them' – they just mess everything up
- Lack of interest by team members
- Lack of direct supervision
- Under utilisation of staff – some of us are doing everything and others are drinking tea in the workshop – you can't build a team like that
- Goal setting poor or lacking
- No team spirit – people here won't help each other even if you are struggling alone
- Organizing poor
- Communication poor
- Confidence in own abilities as organiser/planner
- Wants to develop in new technology areas
- Want to be involved with management processes/systems
- Poor/mismanagement
- Good old days
- Can't trust management anymore
- They promised me a position then took it away and gave it to someone else
- You can't work like that – with people stabbing you in the back
- Work practices poor – everyone does their own thing
- There are no more standards
- Management don't care about standards anymore

(M2)

- Not clear on expectations
- No individual goals
- Team functioning fine
- Measures performance by waiting for negative feedback
- Won't leave company
- Clear on role/responsibility
- Work is boring
- Development poorly managed by others
- Age limitation to development
- Team improving

- Team organizing poor
- Current team functioning poor
- Team generally OK
- Wants artisan development training
- Wants machine shop training

(DA2)

- Does not know what's expected of him
- Not clear on role/function/responsibility
- Management promises not fulfilled
- Lack of/ poor planning
- Organisation structure ill-defined
- Racism in the work place
- Team not functioning due to racism
- Cannot talk to operators
- Some people think they are better than others
- No management support for development
- Language is a huge barrier to teamwork
- Previous management did not encourage empowerment
- No team spirit
- Organizing poor
- Communication poor
- Not enough people for all the work
- Do not trust mechanics to do higher level work
- Wants further development in his area of plant
- Poor/mismanagement
- Not enough money to keep the plant running
- Management style is autocratic
- Operators have no idea how to run the line
- Too few people to do all the work
- Management never see the good in our work – always criticism
- Too much blame fixing
- Always negative motivation

(M3)

- Management not serious about development
- Not trusted with challenging work/responsibilities
- Lots of racism
- Artisans do not want to teach/help mechanics
- No development opportunities
- Is doing artisans work but is paid as mechanic
- Desire for training as artisan
- Team is not functioning well at all
- Not clear on duties/responsibilities
- Poor resource planning
- Poor time-for-tasks planning
- Resourcing too low for workload
- Goal setting poor or lacking
- Never enough money to fix the plant

(M4)

- no real problem with anything

- is happy with his work
- doesn't care much for teamwork, prefers to do his own thing
- Has no faith in management because they do not keep promises
- Otherwise, he just wants to keep doing what he's doing currently

(SA1)

- Does not enjoy working here anymore
- Things were much better in the past
- Too much politics in the workplace
- Communication is poor – they are always the last to know anything
- No training or development
- Totally under-resourced – used to have double the engineering staff before
- There's not enough money to fix everything
- Plant is going downhill
- Management don't care anymore
- No teamwork
- Only a few people are doing all the work and the rest are idle
- Can't talk to production staff – they don't understand you
- No standards in place – there used to be standards
- We all used to socialise after work but now I just go home
- The feeling isn't the same anymore
- Used to get recognition for good work – now just criticism
- Used to get free issues if we worked the weekend to say thank you – now you don't even get a thank you
- No one cares anymore

(SA2)

- Doesn't mind working here but it is not the same as before
- Things were much better in the past
- Somewhere along the line the management style changed
- Communication is poor – no one ever knows exactly what's going on
- Standards have dropped significantly
- Not enough people or money to keep the place maintained at the level required
- Extremely frustrating to have to make-a-plan with everything because there's no money
- One day the plant is going to give in completely and management will wish they listened to us
- Management don't care anymore – the new 'class' of managers are just in it for personal gain
- No teamwork
- I don't mind if everyone pulls their weight, but they don't
- Can't talk to production staff
- There are some of us who know the plant but the rest are just stuffing it up and they have no interest in learning either
- Management don't recognise our hard work – we should get medals for keeping the place going with the little money we have
- The managers here don't care about the place, they just stay here for one or two years to boost their careers and then they leave
- We have had more managers here in the last few years than I can count on one hand
- I don't care what colour a guy is – he must just do his work

I went to talk to MP about the emotions at shop floor. He confirmed that the guys were very de-motivated when he re-joined in April. Things were certainly better in the past. He admitted that there was a fair amount of racism at level one that was contributing to the lack of teamwork. As for the lack of standards, he said that there was very little he could do if management were not prepared to manage to the right standards.

I realised that MP disassociated himself with management although he was part of the level-2 management team. He saw himself as a fellow artisan and not as the driver of the standards, systems and procedures that should be evident in any maintenance environment. I would have to bear this in mind when implementing changes.

In summary, I have completed my aim of getting all the key players' perceptions on paper. I have also had time to take a long hard look at the way maintenance is conducted and it does not resemble the TPM practise of WCM. I checked out the gripes about no standards and found that there are BP manuals for nine out of the fourteen key machines but the last revision dates back to 1995. Only one of the manuals were complete in terms of all the BP elements, the rest had been signed off but not completed and details were sketchy. I started to collect maintenance work order schedules to check the standard of the work instructions. MP concedes that the guys did not use even the well-developed manuals. I enquired about updating the manuals with learnings concerning BP. This was not being done and as far as anyone could remember they were not updated at all since institution during BPI.

What is encouraging is that the guys have started to involve me in finding solutions to technical problems. We have had a number of breakdowns again this week and very little root cause determination is happening.

I really upset the supervisor in the morning meetings this week when I kept asking him what the on-shift investigation found the root cause of each breakdown to be. He believed that it is engineering's function to solve machine problems not the shift's function. He also pointed out that it was very frustrating having to run the plant with so many breakdowns and that the downtime gave him so much work that he cannot be expected to do engineering's work as well. He raised the point that his staff had been reporting problems to engineering but they never respond until there is a breakdown. I asked what process was used for reporting plant defects. All defect reporting was verbal – production do not use the SAP maintenance system to load defects since they perceive this to be engineering's function. This statement upset DM tremendously since he feels that 'to tell someone is to do nothing'. It is too easy to make your problems someone else's by simply relaying the message and hoping that some action will get taken. I asked the supervisor what follow-up mechanisms were in place to track the progress of verbally reported defects. He did not have time to keep checking on engineering. He has to run the plant and he is expected to meet reliability targets every week with a poor-performing plant. This leaves him no time to check on other people's work.

I found the working climate in packaging extremely hostile. No one made an effort to be polite in their speech to one another. Each statement was made in an almost attacking tone and everyone appeared to be on the defensive all the time. The seemingly 'dumb' questions that I was deliberately asking about how things worked around here was met with disdain, but everyone from DM down to the shop-floor

guys were always attacking one another with strong-willed statements. There was very little listening going on. No one was prepared to engage any one else's suggestions because 'that wouldn't work anyway'.

I realised that surfacing assumptions and sweeping in multiple perspectives to agree on the situation and to develop action plans was not going to be easy. I also wondered whether I would react in the same way had I not wanted to listen for the sake of gathering data? I wondered if DM had considered interviewing everyone to get their opinion but without telling them what he thought they were doing wrong – just listening for a change?

#### **4 September 1999 – time to pull things together**

I managed to get to talk to the shift artisan who was on night shift last week. His attitude was different to the rest. He had joined the company only nine months ago and shared his observations with me:

(SA3)

- No real problems
- Only with LSAM for a few months – almost a year
- One complaint is that they never trained me as they promised they would
- There is no career planning either
- I notice that the older guys don't accept you if you're new
- They don't help you much either – you must struggle on your own
- The guys don't work nicely as a team
- The guys don't want to work with mechanics or so – but I don't have a problem
- I also notice that things don't get done until it is an emergency or we have a breakdown
- I have been reporting plant defects for a long time but only when it breaks does it get fixed
- We used to have good maintenance planning where I come from but here everything is urgent – you can never plan to get spares on time either

Armed with what I had gathered last week I started filling my mental model about the situation.

From what I know at this stage I can come to no conclusion other than: this situation is a complete mess, which is perfect because according to Russell Ackoff, most management is about mess management so this will make a good research topic. I will somehow have to get a snapshot of what the situation is like now - but which angle to choose? This depends on the purpose and a key concept in action research is the ability to take purposeful action. So, if the key aim is to improve the situation – 'the mess' – then I must aim to study the mess in its entirety, i.e. I have to use a systems thinking approach – no reductionist snapshot will do – the dynamics of what is causing the complete mess must be described. But this is too broad...I do not want to spend years researching what the current reality is because by then the picture would have changed anyway. I need to narrow the mess down to a few key issues that can be addressed. What is the key symptom of this mess? If there was one thing that I could change what would I choose – what is the most burning issue? I decided for now that this would be my focus of inquiry – my first attempt at a research question.

This was not an easy question. I had gathered a lot of perception data but none of the numerical data tied in with the perceptions – or maybe it did but at this stage I couldn't see how. The one real gripe that I personally have right now is that on average over the last three weeks, there are four hours of downtime each day yet no one – not even the artisan who attends to problem and gets the plant going again – can tell me what the root cause of the problem can be.

I needed to pull together what I "knew" about the situation thus far. Based on the group work done during OMDP sessions I developed a methodology for 'taming the complexity'. Following my data analysis model I came up with the following ideas.

#### **Raw Data:**

- Everything in the last 23 pages.

#### **Common/clustered Themes (using Affinity diagram):**

- Lack of organisation, lack of structure, looseness
- Packaging department has poor reputation in the rest of the plant
- Key resources lost during staff reduction – no people
- Deterioration over time of plant condition
- Deterioration over time of plant performance
- Things were better in the past
- De-motivation, unhappiness
- Interpersonal hostility, discrimination of various forms, very little listening
- Maintenance planning poor
- Crisis management
- SAP not delivering – stumbling block instead of effective management tool
- Low skill levels
- Financial resources low – no money
- Machine performance low
- Plant downtime high
- Role clarity an issue
- Teamwork poor
- Poor management – ability, style and too high turnover
- Poor communication throughout
- Career development poorly managed
- Belief that WCM BP not working
- problem reporting poor
- problem solving poor

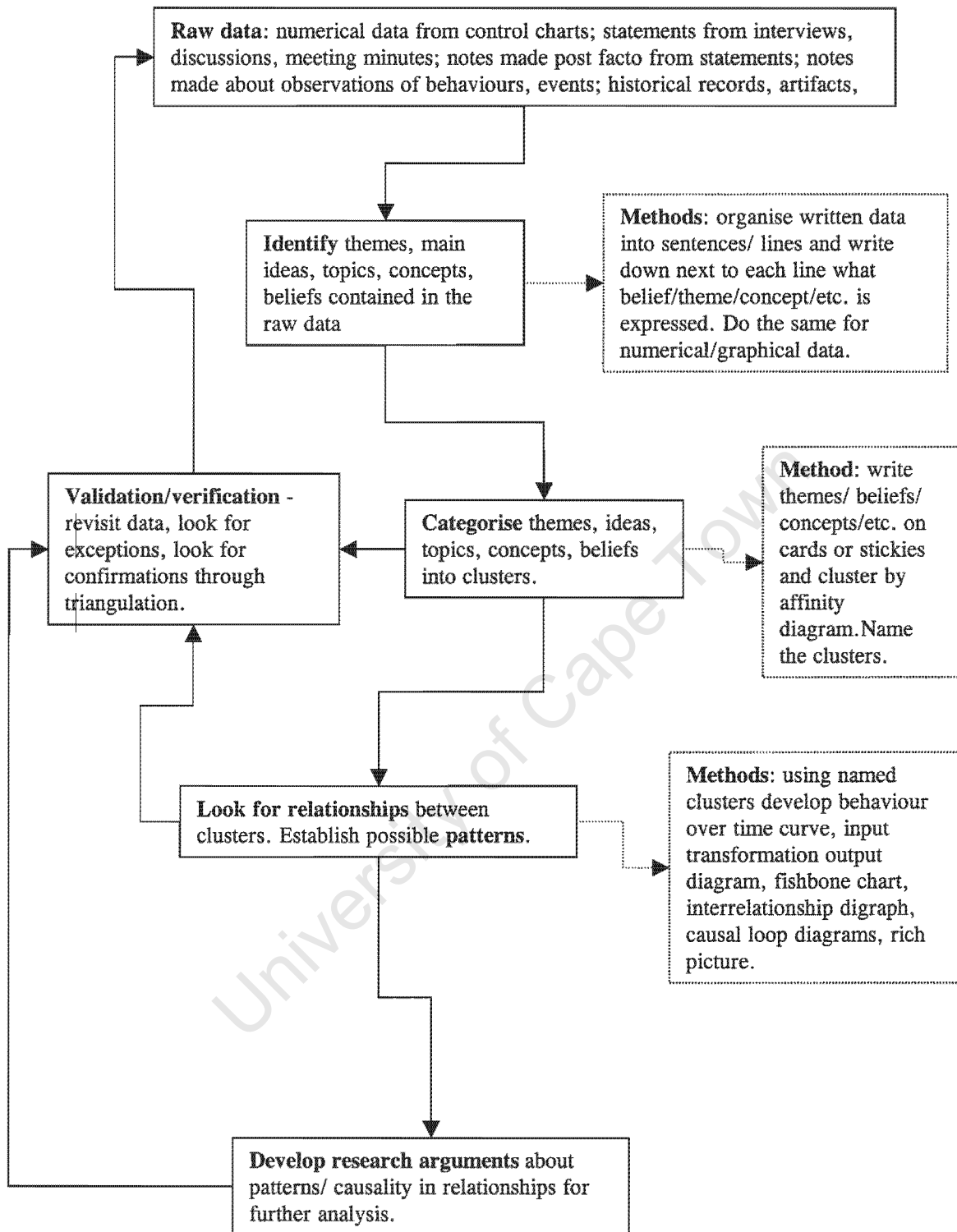
#### **Validation/verification**

To assist with this process I looked at actual performance data and company records as well as speaking to the QA manager and Production Manager.

Theme	Validity Comments
Lack of organisation, lack of structure, looseness	Expressed by all engineering staff except M4, expressed by DM as well but he believes things are better than when he arrived, certainly a personal opinion based on the prep for my arrival, the way my incorporation into the team was handled, the running of meetings, documentation control, witnessing of maintenance days.
Packaging department has poor reputation in the rest of the plant	Based on negative remarks by all other department managers and staff interviewed – no real way of validating. Exception was found in DM's interview – he feels that every other department is messing up.
Key resources lost during staff reduction – no people	Difficult to validate at this stage – according to QAM, the staff reduction was part of a deliberate restructuring in line with LSAM's WCM strategy. Huge perceptions by everyone in Packaging Engineering except M4 and SA3. SAP maintenance report for the current week's work indicates that the man-hours required are less than the actual available but the allocation is such that some guys are overloaded and some are virtually idle. This points to poor planning rather than under-resourcing? Also only based on current week.
Deterioration over time of plant condition	Common expression by most interviewed. DM agrees but blames previous managers. Plant is certainly visually in a poor state of maintenance but I do not have anything to compare with.
Deterioration over time of plant performance	Very strong perception at shop floor level. Data shows that performance has in fact been progressively dropping in the last three years. DM says it has in fact improved since he's been here but the figures in the past were not being reported accurately.
Things were better in the past	There is significant evidence that there were certain excellent practices in place in the past. The number of old pink forms for mod controls (latest date Feb 1998), failure analysis records (latest record Oct 1997), lock-out cards (plenty for 1998 but very sketchy for 1999), defect report cards (last date Dec 1998) I found in MP's office as well as colour coded maintenance plans per machine (Oct 1998). I cannot find records for the past year but that does not mean than these practices have died or does it?
De-motivation, unhappiness	This is a common perception from DM right down to every packaging engineering employee.
Interpersonal hostility, discrimination of various forms, very little listening	Personal observation of interactions between various staff members during meetings, etc., also born out in several interviews. Important

	exception to this was that three of the mechanics did not even mention this as an issue while all the other guys felt this was a particular issue.
Maintenance planning poor	Personally witnessed and validated by resource allocations in SAP as well as the general chaos that reigns on a maintenance day. All interviews confirmed this as a problem except M4.
Crisis management	Confirmed by all except M4 and also a particular issue for the production manager in his criticism of the department. Personally witnessed and experienced in the last month. Explains why everyone is always extremely busy.
SAP not delivering – stumbling block instead of effective management tool	No comments on this issue by the artisans and mechanics but both MP and DM have a problem with the system. I personally am still learning to use the system and it certainly has limitations compared to the system I was used to before joining LSAM. Difficult to validate at this stage.
Low skill levels	Important exceptions here. DM feels extremely strongly about the poor skill levels. The engineering staff on the other hand believes that they are doing extremely well but that they do need development that they have been promised but never materialised. Training records show that very little industry specific training has been done over the years. The artisans have base qualifications as tradesmen. The mechanics have no formal qualifications. I have observed some shoddy workmanship in the last month but I need more time to assess absolute skill deficiencies.
Financial resources low – no money	Financial report certainly shows that Pack Eng. is over budget. Due to too little funds or poor money management? I cannot tell – difficult to validate. The perceptions around this are however very strong throughout.
Machine performance low	Validated by performance data as well as perceptions throughout including concerns by senior management. Assuming the measures are valid.
Plant downtime high	Validated by performance data as well as perceptions throughout including concerns by senior management.
Role clarity an issue	Important exception here. The shift artisans and two of the mechanics were OK on this issue but the rest felt strongly about not knowing what their role is or what is expected of them. I could not find signed records of job descriptions for any of the engineering guys – even with the HRS. Validates that formal role clarification is an issue – but why the exception?

Teamwork poor	Everyone interviewed without exception mentioned poor teamwork as a concern. My personal observation was more around the interpersonal hostility. An important exception is the heavy emphasis placed on teams and teamwork as outlined in the WCM strategy. The organisational structure boasts a team-based organisation and the QAM and PM outlined the strong focus on team functioning by the introduction of a comprehensive program for developing teams called world-class team leadership training.
Poor management – ability, style and too high turnover	Strong feelings about this by all including DM. The important paradox here is that everyone in pack Eng. is referring to DM when they talk about poor management and DM in turn complains about the senior plant management team when he talks about poor management. I need to put more science into this evaluation.
Poor communication throughout	Strongly expressed by all except the mechanics and SA3. Personal observation that there is no forum for level 1 engineering team to get together to discuss things.
Career development poorly managed	There is a big drive towards competency acquisition on site – driven by the QAM. However, the records show that the very little development has been done with the Packaging engineering team. There certainly is no development plan in place for any of the guys.
Belief that WCM BP not working	This is extremely difficult to validate. PM feels that WCM and BP are firmly entrenched and that poor management in Packaging is preventing conformance to the BP standards. DM believes it was poorly implemented to start with. My personal observation is that there is no way this department can call itself world-class!
problem reporting poor	If one looks for the records of problem reports then this is easily validated, however this does consider verbal problem reports. Difficult to validate in its entirety but certainly an issue in the sense that the recognized systems for reporting problems are not working.
problem solving poor	This is a personal observation based on a month of involvement at a technical level in problem resolution. Validated by number of repeat failures, lack of failure analysis records, absence of problem solving teams, and general lack of understanding of what to do when a failure occurs. Confirmed by DM and TC's observations and attempts to get this working in the past.



## Why the exceptions?

I noticed that M4 differs with most of the major issues – why? I needed to understand why but this could take time. He wasn't very talkative during his interview. Everyone else came out and just off-loaded but not him. Could it be that he felt he couldn't trust me and decided to paint a rosy picture instead? He tends to struggle with English and Afrikaans so perhaps he just couldn't express himself fully? I noticed that he tends to move by himself and doesn't care much for groups. How does this help him to get by despite the issue raised by the others?

I also noticed that there were differences of opinions between the day and shift artisans, between the artisans and the mechanics, and the entire team versus DM. These exceptions raise new questions, which if answered can provide valuable insights.

## Patterns

In looking for an early picture of the current situation I need to find possible relationships between the clustered themes. Perhaps I need to look more closely at each of these groups first before trying to tie them together just yet? Or perhaps I should do an Interrelationship Digraph (ID) with these major clusters just to get a general picture considering that at this stage I do not understand the reasons for each of the themes anyway.

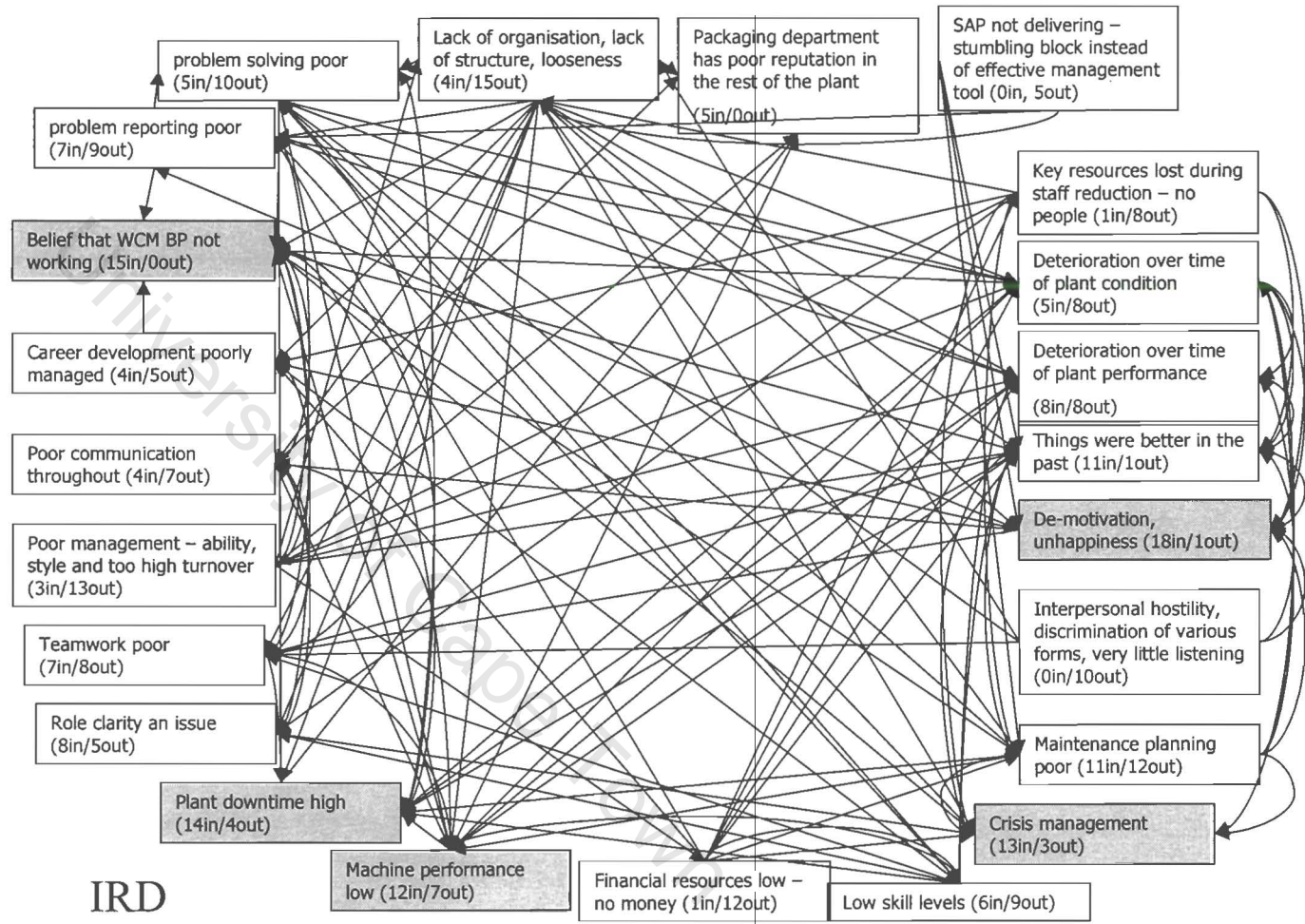
The main driver turned out to be "Lack of organisation, lack of structure, looseness" and the main outcome was "de-motivation, unhappiness". The key driver is usually a good goal subject while the key outcome is usually the best parameter to measure during the improvement program. This means that if the information I have gathered so far can be considered a meaningful snapshot of the situation, then if we could fix the "lack of organisation" then most of the issues would disappear. The ID also tells us that the key problem symptom is "de-motivation and unhappiness" which means that a key measure of success would be motivated and happy people. These two themes are too broad to be easily used and not easily measured. More refinement is necessary. I decided to look at the top five drivers and outcomes instead and analyse each in terms of the validity comments made earlier as well as the ease with which an intervention could be implemented around each theme.

### Top Five Drivers:

- Lack of organisation, lack of structure, looseness
- Poor management – ability, style and too high turnover
- Maintenance planning poor
- Financial resources low – no money
- problem solving poor

### Top Five Outcomes:

- De-motivation, unhappiness
- Belief that WCM BP not working
- Plant downtime high
- Crisis management
- Machine performance low



IRD

Key Driver

Key Outcome

## Analysis

Do the drivers explain the outcomes? Yes, as a combination they do. What does each entail?

I was rather surprised that "lack of organisation, etc." came out as a key driver although it was fairly evident and a commonly held perception. This is supposed to be a WCM organisation. How can there be a lack of structure? This is not going to be easy to tackle straight off. I need to do more digging into what the structure and systems are supposed to be, how they were implemented, how did the degeneration take place, and so on. Only then can I make it the subject of an intervention.

"Poor Management" – this came up throughout and was expressed strongly by all. What management though? Management of level 1, departmental management, plant management, divisional management? Is it the way that things are handled in general? This is linked to structure and organisation. This is not easy to target as an intervention goal. I need to understand what it is about process management that is not working.

"Maintenance Planning Poor" – this was shown to be valid and confirmed by all except M4. I need to find out why he is OK with the current level of maintenance planning. I also need to find out what it is about the maintenance planning that makes it a problem. However, it is a fairly precise process to analyse and correct and I am rather expert in all areas of maintenance engineering so this could be a good area to focus on.

"Financial resources low" – this is linked to maintenance planning in a way since the overspend in maintenance is particularly high and the guys complain bitterly that there is never enough money to do proper maintenance. This should be fairly well defined so I can spend time finding out whether the lack of money is due to poor budgeting, cost cutting after budgeting, price increases after budgeting or simply poor financial control. Once I have this information, an intervention should be easy.

"Problem solving poor" – this was validated as shown earlier. This is also a fairly well defined process and can be easily remedied once I know what it is about the problem solving that is not working.

What about the outcomes? Which of the key outcomes could be used as measures of success?

"De-motivation, unhappiness" and "Belief that WCM BP not working" are too tacit to make easy measures. They will have to be operationalised in terms of other measurable variables that in turn have to be tested thoroughly to ensure validity etc. Given that emotions and beliefs are not my specialty, this could be time consuming and rather complicated.

"Crisis management" is also a difficult parameter to use as a measure, however, it is easier to translate into a measurable variable since it is an action that can be witnessed and is linked to planning processes. I will have to find an operationalisation for it such as unplanned vs. planned jobs or emergency procurement, etc which will be useful in measuring success of interventions around improved maintenance planning.

"Plant Downtime High" and Machine performance low" are very easily measured and in fact are already used as performance indicators in the department. They are actual numbers which can be statistically evaluated and therefore make reliable and suitable measures of success.

Referring back to my first focus of inquiry: If there was one thing that I could change what would I choose – what is the most burning issue? My approach would therefore be to tackle problem solving, financial resources and maintenance planning as areas for improvement and measure the success in terms of reduced downtime, improved machine performance and a reduction in crisis management efforts. This was a tall order but manageable if I kept at it.

I decided to call the team together. This was going to be my first packaging engineering team meeting since I arrived a month ago. I could not believe how time has vanished. Between induction, meeting with and talking to everyone and getting an office, trying to decide my role in the department, and fighting fires everyday, a month has gone by!

I discussed my findings thus far with the team. They didn't agree that problem solving was an issue – they "knew" that the root cause to problems was no money. I showed the team the trend in downtime for August – it was going the wrong way. Something has changed. I pulled up the frequency reports – there was no set pattern in terms of time of day or machine area. Everything seemed to be going at once. I explained classical accident theory to the team (from nuclear days). Basically when lots of little failures occur that we cannot seem to control or establish root cause, then the 'safety nets' in the system are coming apart and a big accident is imminent. The team agreed that we seemed to be heading for a big break. But they have been seeing it coming for a long while. According to the team the root cause is 'no money' and 'no people'.

I asked how they knew this for sure – where was their analysis? I was careful not to disagree with them but I explained that since I was new in the business I needed to be taken down their 'ladder of inference'. I asked them to use the biggest contributor to downtime (crown machine) to explain to me how 'no money' or 'no people' was the root cause. The guys explained to me that crowns jamming in the crown can only be due to a worn crown chute that has to be replaced but management will not supply them with money to do this. I asked how they knew it was the crown chute for sure? They explained that it was old – nearly ten years old and therefore had to be replaced. I asked what the standard life expectancy was of a crown chute that operated for 112 hours a week? No one knew. I asked if other means of repair had been considered such as building up the material that had worn away or fitting a wear plate to protect the base material or perhaps smoothing the corrugations? No, these hadn't been tried but they 'knew' that these wouldn't work. We took three other examples and talked them through. None of the root causes were actually known and almost all of the cases were repeat failures.

We agreed that we would have to look at some system for identifying root cause to failures. The guys mentioned that they used to do FFA's (formal failure analyses) some time back but no one did it anymore. No one knew why we had stopped – it just stopped happening! The guys also had no faith in the system. Why not? They used to spend valuable time sitting in FFA's solving problems and coming up with

preventative and corrective actions which never got implemented because management have no trust in the shop floor decisions. So FFA's are pointless. (So that must be part of the reason why it stopped?)

We agreed to start on a clean slate. We agreed on time-based triggers for micro and macro-stops, and set a time when we would get together to solve these problems.

There were so many breakdowns that exceeded the 30 and 45 minute triggers that we were doing FFA's every day - booked the slot for one hour before the 09h00 morning meeting. DM supported it - when he arrived. His presence seemed to annoy the guys. I valued his comments because he was pushing for all the systemic things. The going was extremely tough. The guys had forgotten the process and tended to dwell on emotives rather than actuals. I trained the guys on one of the problem solving tools I had used before but the going was tough as they had used other tools before but could not quite remember how it worked anyway. I will have to find out what used to work here and why it is no more in use.

Within one week, we had generated so many gaps (things to do) that we were completely snowed under - not to mention all the other fire-fighting and divisional initiatives.

LSAM had decided to implement ISO14001 throughout its plants nationally and we were due for our first audit in one month and very little preparations had been made up to now. We were suddenly faced with having to do detailed environmental risk assessments and write procedures and train people - in fact we were not even sure what the first audit was going to assess. It seemed crisis management was the norm around here!

In summary, this week has proved to be a breakthrough in the sense that we as a team have agreed on a particular aspect of our business that is not working and we have started to take action. We still have not got the full picture, but we will get there. The action - FFA's - have also surfaced other issues that are part of the complex system structure that I have not yet uncovered.

### **11 September 1999 – Learning more about LSAM**

Then the big break happened! The computer touch panel on one of the key machines failed due to water ingress. We had no spares and eventually found one in Cape Town that arrived the next day. We stood for 27 hours on that breakdown and ended the week on 36 hours downtime. It was like Murphy's law. We had just started some action towards improvement and the big break happens.

It was an expensive event but extremely valuable in cementing the teams thinking around an urgency to find root cause. That big breakdown gave everyone a massive fright and woke everyone up to the fact that if we did not get our act together then we wouldn't make peak. The two weeks that followed we watched everything so closely that as soon as it purred we killed it - used weekends with the full maintenance team to tackle those problems we were aware of.

The FFA's were done religiously and many other things surfaced - production/engineering rivalry, racism, classism, etc. The amazing thing was that nearly all of the breakdowns (apart from the water in the touch panel) were directly

preventable by maintenance tasks and the guys knew about the problems for weeks before the failure. Many problems were also repeat failures that had happened in the past but the agreed preventative measures were never implemented. I also noticed that production input was not considered important when establishing root cause. The guys felt that 'they' don't know the machines that well anyway and as soon as a breakdown occurs the operator disappears to take a tea break instead of assisting with the problem. Very emotive stuff. There appeared to be deep-seated hostility between the operators and engineering guys.

We talked through many of the emotive issues openly and I encouraged guys to surface their assumptions. It was easy when the operators were not around, but no one was brave enough to talk openly when the operators joined us.

I toyed with the idea of sitting the team down and taking them through a formal systems thinking diagnosis but I'm not sure if that is the right thing to do. That could take weeks and if I don't develop the thinking then the process will be misunderstood. Perhaps I should just continue tackling parts of the system and eventually the whole will emerge? I'm not sure which approach is best right now but I'll stick with the parts for now as long as I can keep chipping away at a picture of the whole so that we are at least on the right track.

I know I have to go away for two weeks on training so I prepared MP to carry on with the FFA's in my absence.

### **25 September 1999 – Learning more about LSAM**

The past two weeks have been a period of rapid personal learning about the business within the division as a whole. I had sat down with DM to develop my personal development plan within the organisation. The first step was to get a broader insight into the rest of the company by going on training stints outside the region. These included a week with the Central Office Technical (COT) team at Central Office, and a week at another region (in Gauteng, ALB) where a line performance audit was conducted. This particular line at ALB was almost identical to ours, so the potential for comparison was huge. The aim of the audit was to assist the Department manager to find answers to the problem of poor line performance. ALB management had tried several interventions but for some unknown reason this particular line performed worse than the rest of the lines at ALB and was among the lowest performing lines of its kind in the Division.

The data that I gathered during these two weeks were invaluable to my own project despite the problems associated with being away from the team for two weeks at a crucial stage in the research. I recall here key learnings from the line performance audit.

The audit team comprised of divisional consultants from the COT packaging department. My own impressions after working with them for the week was that each consultant was a recognised leader in his own field and when together, they functioned as an effective unit to deliver whatever assignment had been given. LH, the divisional consultant on organisational development in packaging, led the audit team. His role on the audit team (apart from the co-ordination function) was to assess the management of human performance systems, management processes and other general systemic issues that could be related to poor line performance.

Each of the other consultants was a specialist in various technical aspects of pack line engineering and performance.

### **Day 1 ALB Audit**

The first morning at ALB was filled with introductions to the departmental management team. This was followed by a pre-audit session involving all the major players of the line staff that would be required to assist with data collection during the audit. Immediately following this session, the audit team sat down to develop their audit strategy: who would sit in on which meetings, what the main aim of each day would be, etc.

LH explained each auditor's role within the team so that I could structure my week according to where I felt I needed to spend more time. Although DM generally expected me to spend most of my time on the line with the technical gurus (and I suspect the COT team did as well), I elected to join as many meetings and interviews as possible. I also requested time with LH to gain insights into his approach to uncovering the systemic issues.

*Journal Note: I was pleasantly surprised to here the words "systemic issues" being thrown around the company. I heard DM use the phrase and now LH as well. I noticed however that both of them used the term 'systemic' when referring to management processes such as meetings, problem solving routines procedures etc, or when referring to management systems such as the plant maintenance system, performance management system, etc. I could not decide whether the word was used out of an appreciation for systems as embodied in the systems thinking paradigm, or whether it was used as an alternative abbreviation to the word system as in "I think that's a system error".*

Our first interaction with the ALB team in their 'natural' course of operations was to attend their daily production meeting.

*JN: Of course our observations about their 'natural' course of operations would have to take into account the fact that by entering the system we had changed it. Or, as Clemson explains, by the cybernetic laws of observation, the observer cannot be independent of the reality observed. The very process of observing influences the reality observed. The auditors did not explicitly articulate this in their findings.*

However, I could not measure the extent to which we influenced their otherwise normal process. If anything, I would have expected their behaviour to improve artificially because of the threat of being assessed. I could not validate this expectation through my observations. Although I had made a conscious decision not to cloud my observations with my experiences thus far by comparing to the North plant, I found myself doing it anyway. The similarities were overwhelming!

Observations of the production meeting:

- The meeting organisation was as haphazard as ours – late start because people arrived late, no apologies for late coming, no one too sure of who should actually be attending the meeting, therefore more time wasted waiting for people to arrive who never arrived in the end.

- The acting unit manager chaired the meeting. The unit manager was on leave during the entire audit on his line. *This would certainly be a barrier to gaining as much understanding as possible about the system. The audit team noted this point.*
- The other ALB attendees included the QC technician, the maintenance planner-controller for the line, the instrument technician and several other members of the day shift engineering/maintenance team. The shift supervisor and the shift artisan for the line were not present because of a problem on the line. *I use the term engineering and maintenance interchangeably because in this company the terms mean the same thing when referring to the team members.*
- Meeting venue extremely crowded. I did a quick count – even without us the venue would still be crowded.
- Meeting venue noisy – the door does not close properly so the noise from the line is audible above the speaker's voice.
- Several disturbances by people walking into and out of the meeting venue which also doubled as the tea room/relaxation area for the line operators. This was worsened by the fact that the meeting time at 10h00 clashed with the operators' tea break.
- The meeting agenda was not clear. It seems that the normal meeting attendees like the QC technician, who had to be called to the meeting for feedback, was expecting to be needed only later in the meeting and had therefore planned to arrive later. Consequently he did not have all his data ready for the meeting. *By normal attendees I'm implying that the acting unit manager does not normally attend this meeting. I discovered later on that he actually works in another area of the plant. I also wondered about the normal duration of this meeting if the QC technician was planning to arrive some time later.*
- In both the QC and engineering feedback the reporting was around nearly every data point on the previous day's log sheet. This made the meeting very long. In an attempt to keep the meeting short seemingly concerning events were glossed over where I felt these should perhaps have been given greater consideration.
- The maintenance controller did the maintenance feedback on planned maintenance issues. He said that he normally goes through every job card but to save time he will discuss the problems collectively as detailed in the SAP maintenance report. I wondered if he specially drew the report for this meeting because of the auditing or whether it was just a new initiative that coincided with our being there. In any event I noted it as a good practice since at our plant the use of SAP maintenance reports by the planner is non-existent.
- The chairman had prepared a gap list for discussion. He went through each outstanding gap. Feedback from the meeting participants was that nearly each gap on the list had been completed. *Since gaps reported as 'closed' were not discussed further, I wondered about loop closure.*
- The meeting ended nearly forty minutes after the scheduled start time.

*I wondered whether this unprofessional approach to meetings was a company 'thing'.*

The rest of my week on the audit served to confirm the lack of structure and co-ordination that was present on the first day. The line was in a shocking state – just like ours. Housekeeping was not good at all. The maintenance day did not go off well at all resulting in a late start-up. Training had been planned for many of the artisans so they only got back an hour before line start-up with plenty of maintenance still to do. The planner/controller was acutely aware of the maintenance day planning

problems and had already started working on a scheduling system for co-ordinating operator and engineering interface on machines. I noticed however, that the maintenance support structure was huge. There were an army of artisans compared to our situation and front and back end maintenance superintendents that supervised maintenance on the day. A good practise was the pre-maintenance-day planning session. This was unfortunately not followed up with a post-maintenance planning session to measure the effectiveness of the planning and execution.

My discussion with LH at the end of the week was extremely enlightening. I explained to him what I had found at my plant and how similar it was to the problems here. I also mentioned that there were some good practices that were not in place at our plant that I would like to take back with me. LH was astonished by my remarks. He and many of the other COT members actually hail from North Plant and were very surprised to hear that things were not going well. They explained to me how the WCM initiative was implemented at North and how well the best practise initiative (BPI) was working.

They also mentioned that WCM had been implemented in North plant six years ago and that in many cases we had been the forerunner in implementing the systems. Many other regions came to us to see how to implement and keep the system working.

*Thought: If this was the case four years ago, then what happened? Why the move from 'hero' to 'zero'? Why is there no evidence of the changes anywhere in the behaviour of the people?*

This puzzling discovery led me to a new attempt at a research question: What is it about the system that prevents it from sustaining change? I saw this as critical to my research because everything that I wanted to do from an action research perspective relied on the ability of the system to change and to be changed and to sustain change.

My thoughts around the approach then changed from diving headlong into 'classic' action research where the team analyses the situation in an attempt to develop an action plan, to one of observing the system to obtain answers to this question. This would involve interviews, artefact collection, record retrieval and behaviour over time analyses. I saw finding an answer to the 'change' question as the overall framework within which the performance issue still had to be resolved.

I couldn't wait to get back to the plant. I wanted to start a hunt for documents and information about what the system was like before.

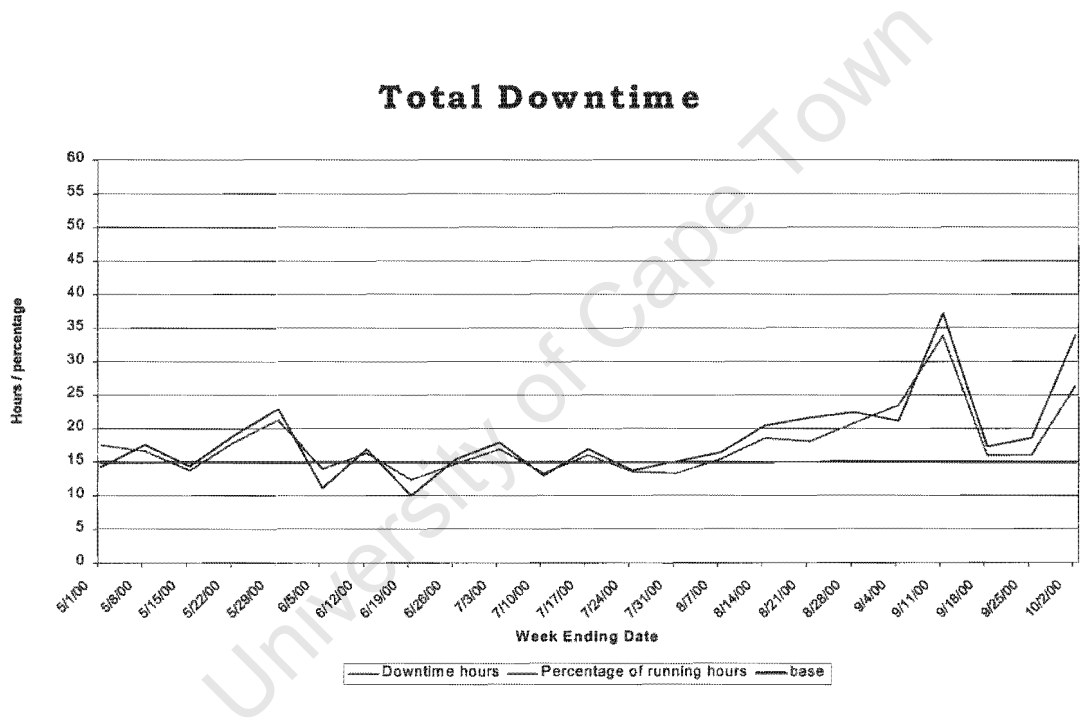
## **2 October 1999 – Crux time – innovate or die**

I was disappointed to find that not one of the FFA's scheduled for the past two weeks have been done. MP says that he was too busy fighting fires to sit in FFA sessions. I stressed the importance of finding root cause and implementing preventative measures or our breakdown rate in the long term would suffer. We were also due to ramp up for peak production this week, which meant an extra day of running from now until after New Year. With the millennium parties planned, the sale of our beverages was expected to be high and accordingly national planning increased our volume output.

All this extra activity meant that we would have no weekend hours for maintenance except Sundays which meant double time (costly) and since the key artisans are on shift they cannot be used continuously since they need a break to change shift cycle. So resources and time was against us for fixing all the things that needed fixing.

Then it happened again – another huge whack of downtime. This time a couple of areas contributed to the total downtime of 33 hours for the week. DM freaked out. How were we ever going to make reliability targets through peak if we kept on in this fashion!

This was it! No time to sit around and listen to emotive speeches any more. We had to act fast and effectively. I gathered the team. The morale was extremely low. I brought in key operators, the engineering guys, the supervisor and the planner. I prepared the guys for an intense session of open talking and downright to the point problem resolution. I stressed the need to focus on the plant problems and to find the best solution that would give us an immediate turn around.



We talked about the downtime. It was trending the wrong way and we totally out of control. We needed an immediate turnaround.

We talked in circles initially with no one really having a good idea of what the problems could be. I challenged the song: we've been saying this is an issue for months. I asked for proof: where is it written? Where has it been recorded on the system? Where is it in the minutes of the daily meetings? Where is the follow-up action?

I challenged the song: there is no money so it's pointless reporting things anyway. I pointed out how costly breakdowns were. We had no money to repair but we could afford to stand for 36 hours a week? I promised to support every person who spent money on genuine issues and who was willing to take the responsibility to motivate the expenditure. This caused huge problems. The guys wanted money to be

showered upon them but they did not want to have to explain why they spent the money. They did not want to accept accountability for their decisions. They did not want to entertain the idea of finding innovative ways to repair rather than simply replace. I used the analogy of a family budget situation. If for some reason you need to control expenses when times are tough, then you have to find ways of giving up the luxuries. You may have to make tough decisions like canceling holidays or buying a new car in favour of medical expenses, say. No one can spend more than what they have indefinitely. Yes, there is a need to control costs but no more than what is rational and I was willing to challenge senior management on irrational cost decisions. In the meanwhile we all have to take responsibility for cost control and tough decisions and find alternate ways of maintenance that is still effective.

At the end of the day we agreed on the following key issues:

- There was no system for highlighting problems, suggestions, etc to level 2. The current shift meeting minutes were written on flip charts but never reached the daily production meeting.
- The supervisors and several artisans had been logged out of SAP due to incorrect passwords or non-use of the system for more than one month (the system was designed to do this due to license costs).
- Defects were not being captured on SAP
- The planner would write things he remembered on his white board for planning
- No follow-ups were happening.
- The gap system was not working – not being used and due dates had elapsed a long time ago with no follow-up action.
- The operators and artisans had different ideas about what was wrong with the equipment.
- Many problems had been around for such a long time that the operators had given up reporting them (meanwhile secondary damage was occurring)
- **We currently have no clue what is about to fail next – this was key**
- If we had to, we could generate hundreds of gaps about the state of the plant – there is just so much wrong
- We have to replace the other day shift artisan who has been off sick with an unknown long-term illness
- There are too many schedules each week to check everything
- Root cause is difficult to establish because it is left up to the artisan who was not at the machine at the time of breakdown and who does not talk to the operator about his observations.
- There is a need for the engineering and production teams to get closer to one another to share concerns and work together.

The problem solving we were meant to do was not working for us. It was aimed at failure prevention but it had degenerated into emotive excuse-sessions for why breakdowns had occurred. We needed to find a quick to-the-point way of finding out what was going to fail next and why so that we could take steps to prevent it from happening. Then again, if the problem reporting was effective then we would be on top of things all the time and major interventions to try and find the problem would not be necessary.

We decided that our first action would be to conduct a situational analysis of what was happening right now. I drew up a plan for each day of the week specifying which machines would be inspected each day. The machines were split up into functional areas and each artisan and mechanic assigned an area. The task was to

conduct in-depth running inspections at each machine and to interview the operator about what he thought were the key issues. What was bothering him about the machine's performance compared to how it should be?

This caused great panic among the guys since they would actually have to talk to the operators. There was an extremely hostile relationship between the two groups. I couldn't believe the resistance but I insisted. I used the racing car analogy and asked the guys if they could imagine a F1 racing driver never taking to the engineering team about how the car handles at various speeds etc. Would such teams ever be successful?

The second action would be to load all the issues onto the SAP maintenance system and to discuss the priority areas with MP. He would then plan urgent repairs for the imminent potential failures and plan slightly later repairs for the less critical issues and so on until we get around to everything. Even if the list were incredibly long we would hire artisans from agencies if we had to assist with the load.

We had to contain the situation above all else.

We had to make problems solving easier. I promised to design an instrument for level 1 problem solving which I would coach the guys on. We agreed that we would carry on with the daily FFA's for all big failures as defined by our trigger standards since this would help reduce failures in the long run.

On the people management side of things, DM decided that since we were unlikely to restructure to BPII for a while still, that in the interim the engineering guys on day shift would report to me while the shift guys would report to MP. This would lighten the burden of the admin work for both MP and myself. Meanwhile, I had taken on the role of Pack Eng. manager anyway since all the people issues had been diverted my way for a while. I was dealing with all the development stuff in terms of getting the guys better equipped to deal with problems, and of course my actual technical involvement.

### **16 October 1999 – Many questions, few answers**

The past month has been characterised by milestones. The first was the acceptance by the team of the key issues that needed to be addressed in order to effect meaningful changes to the system. The second milestone was the development of an action plan to address the key issues. The third milestone was that we actually managed to start implementing the first steps in the plan. We were finally taking 'real' action!

Despite these successes there was still lots of hard work ahead in actually managing the implementation of the action steps. Although the entire team had agreed to the plan, there were still sceptics, and the fact that things were not going to change overnight was a threat to the momentum. There was also the frustration of doing things differently but coming up against unexpected obstacles. I encouraged the team as much as I could that the whole idea of learning from ones actions was only relevant when unexpected things happened during the course of taking action. It was therefore essential that these unexpected results were reported and documented so that we could change our theory of action and in doing so improve our understanding of the system. Luckily I had no problem in gaining feedback from

the sceptical 'loud ones'. They were so certain that things would not work that when they did not, they were the first to report these deviations. My problem was to get the same feedback on learnings from the 'quiet ones'. The one key change that we decided upon was that no one would be silent about little problems any more. Every observation was essential to the management of the system. Every deviation from expectation or anything that appeared to be trending towards the control limits would be reported. The reporting mechanisms were also agreed upon. This would eliminate the song 'this has been a problem for weeks now' when the problem becomes so big that it has high cost consequences.

We started increasing to peak running from the first week of October and by the third week of running high volumes almost every machine was breaking down. The reliability and efficiency figures did not change much since the overall factory hours had increased but the actual machine downtime was in the thirties and seemed to stay up there. Why? We didn't actually know what we were up against.

The situational analysis yielded a multitude of problems that were literally impossible to tackle at once. So the repairs continued but the fire fighting still had to be done since the plant was far from healthy. It would take time to get it all done.

There was just so much to do. The level one problem-solving tool was implemented but the effectiveness was low initially. I had to constantly coach the guys on filling in all the fields, on thinking beyond the fix, on generating all possible causes before diving into a solution. This was going to take time. This required effort – the guys did not want to write! They did not like the idea of having to report on what they found or what they did, etc. I explained how essential it was for organisational learning that we did this and the guys agreed in principle but it was a huge effort to actually do! The problem seemed to be that the artisan was left to fill out the FFA sheet instead of working together with the operator, shift supervisor and QC technician. They were constantly saying 'whose job is this' instead of lets form a strong team who can share equal accountabilities. All the problems eventually filtered up to level two and the daily FFA became the main forum for problem solving instead of problem solving at source.

I resolved to keep coaching the guys until they were able to do it by themselves. At least the issues raised were being addressed.

I also managed to look into the financial problems. Most of the problem seemed to stem from under-budgeting the previous year coupled with an extra-ordinary amount of corrective work that was not planned for. A huge problem was that the people spending the money – MP and all the artisans and mechanics – were unaware of the budgeted amounts or the current financial status. They are unable to pull SAP reports so they are not even monitoring the spending! I trained MP to pull cost centre reports and we agreed that I would make the reports available for all to review. I also realised that tracking spending per machine area was difficult because of the lack of disciplined cost allocations for drawing items out of stores or for buying from external suppliers. Most things were booked to consumables instead of to the machine in question. This makes it difficult to compare spending vs. budget – even if MP was able to track it. As for MP's external purchases – instead of generating purchase requisitions from the maintenance works order, he would make blank works orders from which to generate the purchases hence breaking the tracking chain.

I inquired as to why he did this and I found that most of the time there were no work orders in the system against which to purchase because the guys had not loaded the maintenance problems. I also found that there really was no effective spares management in his planning routine.

As a starting point we agreed on a strict procedure for drawing spares from the engineering stores including exactly which GL account numbers to use and which cost codes. Each person was given a copy of the process and codes including the stores controllers. I would have to work with MP on his spares planning as part of the maintenance planning improvements.

### **30 October 1999 – Still no real measurable changes**

The drawback with all the fixing was that we were massively overspent. This caught the eye of our Production Manager who jumped on DM to get costs in control. DM started scrutinizing each line item and demanding explanations for money spent. I kept assuring him that all the expenditure was necessary and that I agreed that we were overspent but the plant required attention. I nevertheless had to start exercising stricter control over expenditure.

We were also not showing any great improvement in downtime after a month of our fix-it-all campaign. The morale was low again and I had to keep close to the guys to ensure that they did not slip. The problem with maintenance is that you only see the benefits some time after a good maintenance program. Similarly there is also a time lag between not doing good maintenance and the effects of this. I used the example that you can ignore an oil warning light in your car for a long time before the engine finally goes. By the same token, once such a large failure has occurred, it takes time to establish the full extent of all the secondary damage and to restore the entire system.

We chatted about ways of reducing the cost of our repairs but the guys were extremely reluctant to find innovative ways of doing things. They felt that management did not trust their judgement of what was the best maintenance solution to a given problem. I soon fell into the trap of challenging the guys on expenses that I felt could have been spent otherwise. DM was doing the same thing and so was MP. The pressure was on and the level-one team sensed that cost savings would have to be made despite our repair initiative. The guys slowly started withdrawing from their active roles.

Very soon, only two people MP and I, and mostly one (myself) was taking all the A's (accountability) to get things done. The guys were waiting for level two to solve the problems. Our job jar was getting increasingly heavy especially with lack of root info (level 1 FFA forms were incomplete and not all the actual info was around and often the persons involved were on shift and could not attend the daily FFA's). This, coupled with fact that I was caught up in ISO preparation and was hardly around, and the fact that the A's generated were not being implemented rendered FFA's useless. The corrective actions generated during FFA's were not being done due to schedules not getting done in favour of fixing - fixing not getting done waiting for spares -spares not arriving waiting for release because too expensive.

I was too busy trying to find answers to the question of what had gone wrong to land us in this mess in the first place given that we were supposedly one of the best

plants. I was also caught up in ISO, budgeting and the day to day engineering problems I couldn't see what happening around me. By the time I took a long hard look, we were nearly back into the old routine that we had before. Source problem reporting was low again, guys were trying to save money by not reacting to problems. Guys were waiting for MP to do all the spares research and procurement which was taking time. The situation was slipping and our initial energy was waning.

At this stage of the game I was also asked to run the SAPHR implementation for our department which was turning out to be a huge responsibility and given that the next NOSA audit was only a month or so away I had to shift my focus to get ready. The budgeting process was also turning into a nightmare with very little info around and having to chase suppliers for budget quotations.

I needed to re-focus. I ran some reports on our maintenance effort. Many of our preventative maintenance schedules were marked "not done-no time". I challenged MP on this and he reminded me that we were running with fewer resources than we needed to cover all the tasks. Many of our downtime incidents were actually micro-stops related to machine set-up – an activity that gets done on maintenance days. With the emphasis on repairs, the guys were not getting around to the PM schedules. This was a disaster!! I reminded MP that it was his responsibility to ensure that the maintenance plan was set out in such a way as to facilitate all the PM schedules as well as the critical repairs. That was exactly why I was spending tons of money on overtime. I asked MP to show me how his resource plan was overloaded to justify the PM schedules not getting done due to lack of resources. He did not have a plan! He had no idea how to develop a plan!

He allocated jobs according to his perception of the guys' abilities. The mechanics worked only on the conveyors. The artisans worked only on the key machines with one artisan (acting instrument technician) only working on electronic devices. All electrical schedules were allocated to the mechanic who had recently passed his electrical trade test. I pulled reports on maintenance man-hours as captured by DC, the maintenance data-capturing clerk. Two of the mechanics were completely overloaded with tasks that could easily be incorporated into the operator's autonomous maintenance schedules. The electrical guy was allocated more than twenty hours of schedules in an eight-hour maintenance window. The acting instrument technician was underutilized according to the info on the system and one of the mechanics was taking hours to complete schedules that were actually allocated much shorter times in SAP.

There was something drastically wrong with our maintenance planning or lack thereof and there appeared to be problems with the schedules themselves.

I recalled that this issue (schedule quality) was actually raised during several of the FFA sessions. I pulled the gap list and looked at the outstanding actions – most of them were still outstanding. I pulled out the situational analysis forms – these were tracking OK but still many outstanding. I pulled the defect notification list and was pleased to see that the guys were using the correct systems to report although reporting was slacking off. I pulled the backlog list and found that most of the notifications had not even been turned into corrective maintenance (CM) schedules. It suddenly dawned on me! We were no longer tracking our gap closure. There was nothing driving our defect rate down because we were not generating sufficient CM's to keep up with the reporting. The maintenance planning was centered on flavour-

of-the-week issues. The person who shouted the loudest got their spares ordered or their CM loaded, etc. MP was completely out of his depth. He could not cope with all the notifications that had been generated and all the spares requirements that went with it.

I pulled reports on work arising from PMs. This is a measure of how effective the maintenance program is from an RCM (reliability centered maintenance) or TPM (total productive maintenance) position. If our PM's are effective then they will have a frequency high enough to detect a potential failure before it occurs with sufficient time to plan and procure spares for the restoration task. On the other hand the frequency will be low enough to prevent multiple inspections of the same kind before the potential failure is found. The reports told a shocking story. Several PMs were done several times over without generating corrective work. The frequency was probably too high generating lots of unnecessary work? Several breakdowns occurred after PMs on the same machines. The PM standards were not very good or our maintenance quality is poor – due to rushed jobs, poor performance or lack of competence. Several CMs were generated independently of the PMs. The PMs show that things are OK but some time later someone reports a problem on the very machine which means our PM frequency in this case is too low or PM and/or maintenance quality is questionable. All in all, we were actually completely out of control with our maintenance program. We had no idea how effective it was because there was no system in place to constantly interrogate the system and drive our workload towards a fully planned and integrated system.

We were preaching TPM but practicing breakdown maintenance! I discussed the issues with MP and DM. MP was not too sure what I meant and I could see that he actually did not understand the essence of RCM or TPM. He also had no idea how to set up a maintenance-planning schedule and he also was unable to pull maintenance reports in SAP. I would have to look seriously coaching MP. The joke is that I encountered SAP for the first time when I joined LSAM. The system we used at the time I left the nuclear industry was powerful but the trend was also towards implementing SAP, which was in progress when I left. So I had to learn to use the system in the last two months – why has MP not done the same?

We chatted about the issue and MP admitted to me that he doesn't have enough time to focus on his own work and developing his own skills because he constantly has to help the level one guys get through their work load. If he's not helping them then he constantly has to check on them to ensure they are doing the right things. But the real draw back has been all the breakdowns and the fact that he is spending several hours on the shop floor. I could sympathise with this since I was also involved with all the breakdowns trying to ensure that root cause is established – trying to cement the RCA behaviour into the guys at shop floor.

We agreed that maintenance planning was essential to the maintenance effort and that none of our attempts to get out of this mess was going to work without an organised, structured way forward. Maintenance planning was a key part of such an approach.

I looked back at our plan: Implement effective problem solving routines (September), examine maintenance planning process and implement improvements (October), and establish cause for financial problems and implement improvements (September – October). We hadn't met our deadlines on any of the areas and there

were no measurable signs of success. Somehow, I don't think it is because we haven't met our deadlines but because the problem is far more complex than simply these three areas of intervention. Problem reporting, for example, turned out to be as much of a problem and as key as problem solving yet we hadn't set it out as an action item up front. It seemed to come out in the wash. Yet reflecting back on the initial interrelationship digraph, I found that problem reporting was (in retrospect) fairly high up on the driver list although not making the top five. I realised at this stage that we had taken too simplistic a view. Yes, we needed to focus on those key things that would give us leverage, but it seems we haven't found them yet. I needed to take a new look at all the data I had gathered since implementing the first round of changes. It was time to reframe and start a new iteration.

### **13 November 1999 – Getting the planning right**

The last two weeks has whizzed by as quickly as the last two months with ISO 14001, CAPIN budgeting and SAPHR being the key plant focus areas. In terms of the team's progress we have now run two maintenance days according to a scheduled project plan. The effort from my side has been enormous. I have had to teach MP how to download from SAP into MS Project, how to use MS project as a scheduler and in particular how to do resource smoothing in Project. It also meant having to create a template for the machine cleaning and autonomous maintenance into which each maintenance day's planned maintenance gets incorporated.

The biggest effort was motivating to get Project onto MP's PC. Each user has to pay due to the licensing costs and we hadn't budgeted for it. Only certain approved people therefore have it. It took a fair amount of drama and persuasion to convince IT that a planner cannot plan without a scheduling tool! Of course it would have helped if SAP could generate Gantt charts then there would be no need to go to all the effort of downloading into another application, but as IT explained we never bought that version/facility.

I discussed the issue with the central office SAP-maintenance systems guys and they disagreed with the need to produce a plan for maintenance days. No one understands it anyway and it becomes a useless exercise!!! Perhaps they were right but even the least educated person at the nuclear installation could read a bar chart plan – that was the only way we did maintenance, testing, operating, etc. In fact we had plans for each and every single day's activities – running or non-running and it was produced in twelve weekly cycles. I could see that this was going to be hard for me. The culture of working to a plan was not evident in LSAM and I would have to work very hard to bat this one.

Anyway, it's still early days and I'm not sure how sustainable it's going to be. I decided to call the guys together to ask them how it was going with the planning. The general feeling was that the plan at least gives them some guidance as to who's working where but the plan comes out too late for them to give their input. That was a good point. Until now, with all the effort required to coach MP and download etc and get my own work done, we were only managing to get the plan out on Friday afternoon which left very little time for any input and revisions.

The guys also felt that the plan was done in too much isolation. In the past, they also worked from bar chart plans but they actually got together as a team early in the week to discuss what had to be done and who wanted to do it – as opposed to

MP deciding who should do what. The plan would then follow from this discussion, would be reviewed and implemented. Why did we stop? No one knew. They showed me plans (hand drawn bar charts) that had been done about four years previously gathering dust on a shelf. *Why, the collapse of previously good systems???*

I also proposed a post-maintenance day meeting to gauge our performance with a view to learning from our inadequacies so that we could continuously improve. So it was settled: planning meeting, MP develops plan, everyone reviews plan, implement and reflect. I liked it. It was like a PDCA cycle applied to maintenance! And it didn't come from me – it came from the guys themselves. I did however insist that the line supervisor be involved with maintenance planning. The guys had to learn to work together more closely.

### **30 November 1999 – Budgeting Blues**

Apart from the pressures of peak, ISO implementation, SAPHR implementation and the struggle to keep the team focussed on doing the right things right, there was also the annual budgeting process.

Firstly, my involvement in the budgeting process was not evident until it was almost too late. DM had promised to take me through the process during October, but this never happened for whatever reason - I was too busy with what I thought was important, he was too busy with whatever he does – the story of our lives.

I promised myself that it would be different next time around. We would start the budgeting process as early as the start of the new financial year. Once again I had ideas about how this could work from learning after 'rushed' budgeting where I had worked before, but I was careful not to pre-empt the teams own design around how we could improve the process. I noted this down as something to raise in the next team meeting.

At this late stage I involved MP, one artisan and two mechanics who were available on the two days to help me confirm prices. I based the budget on the actuals for the year as well as what our situational analyses and RCA's suggested we needed to do during the coming year to get the plant in good shape again.

I presented my budget and the findings with regard to the poor performing line to DM. He pulled out the previous three years maintenance budget and showed me how repeated requests had been made for the same repairs I was now requesting, but they were never granted due to budget cuts. DM held firmly that maintenance was the first area that had to cough up when budget cuts had to be made. There was one particularly urgent request – massive refurbishment of the pasteuriser – that I was very worried about having denied. There were actually several, but the one machine that probably was not going to make it for another year was the pasteuriser. The problem was not new: DM's predecessor and DM himself had been budgeting for repairs to the machine but all they could do was patchwork due to cost cutting. DM felt very strongly about the fact that the management decisions of the past were coming to haunt us in our maintenance effort. Decisions made in the interests of cost saving without looking at the whole picture has landed us in this mess.

Then came the meeting with the production manager (PM) to explain why the exorbitant budget for maintenance.

Since I had done my homework, I was convinced that there would be no question about whether or not the money was required. PM would agree and he would present the budget requirements of the department to the General Manager of the region, GM. I explained (using the data I had gathered so far) that the general level of machine performance throughout the pack line was poor. Key machines required repairs (or replacement) at a cost way outside of the operating budget. Several other machines were operating in a degraded mode thus causing micro-stops and reducing product quality. DM further explained our joint theory that the maintenance practices in the past had been poor, with too little money spent on resolving problems when they occurred and hence the degradation in the equipment.

PM disagreed emphatically that the problems currently experienced were rooted in decisions made in the past. "It is not valid to base your argument for more maintenance money on poor maintenance management in the past. This place has a history of excellent maintenance management practices. I cannot and will not bat that wicket with GM. There has to be a more scientific reason for the problems you are experiencing."

I decided silently (and I was convinced so did DM) that PM took this as a personal attack on the previous engineering manager. So, I changed tactic slightly. At this stage I was willing to forego the theory in order to get the money so I insisted that no matter how we have arrived at the present condition, we still had the problems and needed money for the repairs.

PM then questioned the fact that we have a preventative maintenance system that should warn us long in advance of machine failures - especially huge ones like these. Why has this not been reported before? Why did our maintenance system not highlight these problems? I immediately launched into a presentation of my findings on the inadequacies of our maintenance management system in use. I suggested that our preventative maintenance program was not working and that the entire program was currently under review. PM was astounded by this claim. There was no way that the TPM program could be inadequate. The system was well designed and after implementation has been working for years. How can there suddenly be a problem with the system? It worked before, why was it not working now? (Obviously an attack on packaging management again). No, this will not work as an argument for obtaining more money. Devastated at this flat denial I started citing evidence that I had found that supports my position on the current maintenance practices. PM listened to this and finally conceded that if there were inadequacies and I was determined to link these to our current situation then I would have to provide proof that I have an action plan to address these problems. This action plan should be ready for the budget presentation to GM or this argument should not be brought up at all. Relating the current position to poor maintenance management decisions in the past should certainly not be mentioned at all.

Still on the question of why this had not been reported before, DM promptly revealed a document of Maintenance Risks that he had prepared before the previous year's budgeting process. The same machines in question were also on this list with the costs of repair roughly the same as that requested now - proving that the requests had been made before. (DM later showed me similar Maintenance Risk documents

that had been prepared by his predecessor two years previously with many of the same machines currently in question.) PM then raised the fact that DM knew that money had been made available for risk items. I then discovered that PM had decided last year (and presumably the previous year) that these would not form part of the operating budget but that he (PM) would obtain a special budget from GM for extra-ordinary maintenance, which he did.) Why was this money not used for its intended purpose? Why had DM not requested this money during the previous financial year – especially if the matter was that serious? (This was news, why indeed?) They then entered into a debate about how DM had tried on several occasions to get money but the funds were never made available. He then used operating maintenance funds to effect partial repairs to keep the plant running but this was never replenished by PM from the extra-ordinary maintenance budget and hence the overspend on this year's operating budget. PM could not recall any such requests and he would now have to explain to GM why he never used the money that was allocated and it was now too late. The debate was going nowhere so PM stopped the discussion and redirected the topic of conversation back to the issue at hand: how are you going to justify the budget you have proposed?

DM was livid and I had a couple of questions about what had just transpired. This was a snapshot of the system reality that I had not seen before. It raised questions about espoused theories and theories in use as it related to the relationship between PM and DM. It also struck me that I had never heard PM's side of the story. All my current ideas about the relationship between DM and PM, about PM as a manager and his interest or apathy toward our departmental problems were informed by the opinions of DM, colleagues and employees.

We worked through other ideas in order to arrive at a plausible theory (that GM would buy) that would explain the current maintenance dilemma. We eventually settled on the following:

For each machine, identify what is principally wrong – what is it that needs money to correct. How much money is required? Take these items out of the requested budget and list separately – in essence an updated report on Maintenance Risks. PM warned that we should be absolutely certain about the risk of failure we attach to each machine. If we claim that a particular machine will not even make it through peak and we are not given the money, the worst thing we want is for the machine to last for another year without failing. If this happens then any subsequent requests of a similar nature will be met with suspicion. *(Now this is a weird way of managing risk. Does that mean that one should always understate the problem in the hope that the occurrence of the problem itself will command consideration? This is exactly what level one does to get attention aimed where they want it. Is the aim of preventative maintenance not to take action when there are signs of a potential failure in an effort to prevent the failure? This raised more questions about espoused theories and theories in use).*

### **The Budget Presentation**

PM had taken leave from the day before the budget presentation to the end of the following week. This meant that QM (acting production manager) would be presenting the production budget requirements to GM and his team. DM interpreted PM's absence as an attempt by PM to get out of having to justify the increased budget requirements of production as a whole, not to mention the huge budget

required for the maintenance risks. DM was however pleased that PM would not be there because this gave us the opportunity to present the issues to GM ourselves. At least this way he could be sure that the right level of fighting went into the request.

Accounting manager, finance manager, accountant and GM sat across the table from us (DM, QM, PA and myself). QM was acting for PM and it was therefore his task to present the overall production budget with the support of PA (production accountant) who presented the 'heads budget' and year-to-date figures on profit and productivity. QM also presented the QA budget in some detail. The beverage and site engineering departments were not represented. This annoyed DM because he believed it limited our chances of getting what we wanted if the rest of the production team were not prepared to fight.

After QM and PA had presented, GM asked some question about the figures presented. What happened to the one million rand saving you are supposed to show in going from three by eight to two by eight? QM and PA both jumped in to provide explanations - each explanation being questioned by NB's calculator. Several explanations flowed but no right answer. GM was not impressed. We would have to go away and find a one million rand saving in the production heads budget essentially. GM explained that the only reason he was given extra money for the production budget last year was because of the increased production costs associated with the move from two by eight to three by eight. Now that we were going back to two by eight, the board would logically expect him to show that saving on the new budget.

DM and I offered explanations about the production plans for the new financial year that included large amounts of overtime due to peak production demands. QM also highlighted genuine budgeting mistakes that had been made previously with regards to extra heads in the organisation that had not previously been accounted for. QM responded to this revelation with huge disgust. How could we possibly have left heads off the budget? Did we need these heads at all? Were there any vacancies that we could live with to show a budget saving? GM and the accountants debated this for some time (*At this stage I tried hard not to throw a knowing glance at DM considering his poverty organisation model explained previously*). Are there any management trainees that we could move to the regional office budget? There were possibilities here – PA to follow up.

*Thoughts: This discussion raised several questions. How was it possible to go back to the same production cost targets of two years ago? What about inflation, increased prices of materials, increases in salaries and wages? What sort of management tries to live without key positions being filled to save on the budget? Moving trainees out of the production budget into the regional HR budget would make the production figures look better but the regional HR figures look worse – and it all comes out of the same regional budget anyway! Why bother?*

GM had made notes during the presentation. His next question was on the exorbitant amount of moneys paid by the production site to the local municipality for services (water, electricity, effluent treatment, waste removal, etc). He was perturbed by the fact that no one in production had made the effort to challenge the local authorities on this issue. He asked that I pay the local council a visit to discuss the issue. I should ask EM, our new engineering manager, to accompany me as this was an engineering issue. Our essential stance should be that this company plays a

pivotal role in the city's social and economic survival, and that considering our enormous contribution, the local council cannot afford to jeopardise our profit margin by charging such exorbitant service fees.

*I wondered why the GM of a region would challenge something like municipal service charges. Was he simply intent on picking holes in our entire presentation or did he have genuine cause to believe that there was massive unnecessary overspending? Was DM's theories about 'penny-wise pound-foolish' management in production perhaps driven by the GM? So much for DM's theory about GM not knowing about how cash-strapped management approach of PM.*

The next question centred on the poor productivity figures of the current financial year. Whatever happened from now on in had to be aimed at least turning the negative productivity to a positive figure. The discussion that followed highlighted several areas in the department's business that was considered unnecessary spending such as extra heads being carried. DM explained that we have two persons on our books that we know will not be here for much longer both due to incapacity. One was terminally ill and had not been at work for nearly six months although he was receiving his normal salary every month. The other case still awaited outstanding medical reports to prove that the incumbent was incapable of performing his normal duties. In the latter case, the incumbent had not been performing in his role for nearly a year but was still being paid at that level with all the perks of the position. Whatever happened, the money paid out would have to be reclaimed before the end of the financial year. DM agreed that the benefit funds administrator would be approached for guidance on how to reclaim the money in both instances from the appropriate insurance funds.

*By now I was wondering if we even stood a chance or if we should rather, like *beveraging and Engineering*, remain silent and gracefully accept the inevitable.*

It was our turn next. DM flashed up the requested budget, gave some background to the problems, flashed up the Risk report and presented our action plans for eliminating the problems we believed gave rise to the maintenance situation we now find ourselves in. DM also presented the maintenance budget history over the past four financial years showing that the real budget value (including inflation) had decreased from F97 to F00. GM listened while the other three started punching away at their calculators. GM asked several questions for clarity, which I gladly answered and DM would repeat and add to the explanations provided. DM flashed up my slide on year-end forecast. This resurfaced the topic of spending between now and financial year-end. I carefully explained the need for maintenance expenditure on non-scheduled maintenance and risk items that I envisaged we had no option but to spend before financial year-end. I had prepared the forecast report per machine and gave details around priorities.

The issue raised questions about maintenance spend versus maintenance budget. We mentioned that the extra maintenance load brought about by the three-by-eight operation mode had stretched the available maintenance budget even more. Unlike the case with the heads budgets, extra load on machines in one year increases the required maintenance effort during the next year. The savings equation does not work here. All the accountants agreed with this theory. A general discussion then ensued about the dilemma of being the flex plant and how the move to three-by-eight for only one year had done more harm than good. (*I wondered at this stage*

*whether the picture would have looked this bleak had the line actually performed better than it had.)*

Still on the issue of overspending, DM again referred to the slide on the declining maintenance budget. There was acknowledgement from GM and the accountants but there was no real reaction and no discussion ensued.

*More questions were raised here. Why the subject avoidance, I wondered. Could it be that GM is aware of the low-budget problem and expects us to work around it? Is he aware of the implications of cutting maintenance budgets below that which is required? Or does he honestly believe that the budget is adequate but poorly managed? If this is news to him then is his lack of reaction due to our understating the problem? Could it be that our dilemma is tiny in comparison to the needs of the rest of the region?*

GM then inquired about the crisis surrounding risk items. We explained that the problems were known for some time now and that funds had been requested in the past but not awarded and that the issues have now become urgent. Neither of us mentioned our theories on past maintenance management practices. We repeated we had found some deficiencies in our management systems that we planned to address as per our action plan. GM acknowledged that he was aware of some of the bigger machine problems but did not realise the gravity of the situation as presented here. However, he made it quite clear that the likelihood of being granted the money requested was very low. At best we could aim for addressing the most critical issue.

This was undoubtedly the pasteuriser, but the other problems were only slightly less critical. We discussed the technical detail of the problems surrounding the pasteuriser and the various expert opinions as per the COT report. He suggested that leaving the pasteuriser in a Risk list would not guarantee the funds. The best option would be to place the requested amount under the Capital Investment budget since it would most likely receive attention there. This meant applying for CAPIN to do maintenance, which is of course a no-no. GM suggested that we called it a major refurbishment or total removal of a large part of the machine for replacement with a new part. DM suggested that we could even include some of the design changes we had been investigating to improve performance and quality so that it seems more like a Capital Project than a maintenance effort. It would then be OK to call it CAPIN. DM also carefully positioned his desire to rather replace the machine than refurbish. He expressed his belief that the machine was past its useful life because it was 'scrapped' by an overseas pack line before the decision was made to purchase it for this region. (This was the first mention of poor decision making in the past but GM did not react to it.) Everyone agreed that the likelihood of approval for replacement was extremely remote.

*This discussion left me with a number of questions. If the money is going to be spent anyway, why call it something it is not? Why disguise the real issue? Was GM party to the 'cost cutting policy'? Is the extra-ordinary or risk maintenance budget real or does it just exist to entice managers to give up fighting for the extra operating budget in exchange for the existence of a 'special' fund elsewhere?*

As for the routine or operating maintenance budget, it was also unlikely with the reduced volumes that we would be awarded the full amount requested. We would

have to make do with whatever the final figure would be and structure our maintenance plans for the new financial year around that figure. I commented to GM that the budget had been very precisely calculated and had already been reduced to the bare minimum required. If it were to be reduced any further, then I could not guarantee coming in on budget. GM's comment: If you can't come in on budget then you're not a good manger.

And that was that! The discussion was ended, as the Depot team had scheduled their budget presentation directly after ours and we had already gone over time.

As we walked back, DM and I exchanged views about how we thought the presentation went. DM was satisfied that at least LM was now aware of our situation especially the key maintenance threats. He was still unhappy that the issue of poor management of production funds especially as it relates to the misuse of the extraordinary maintenance fund by PM had not been addressed adequately, but he had already decided to schedule a private meeting with GM to take up the issue.

*I was left with more questions than answers. There was nothing that came out of the morning's events that confirmed any of DM's theories about the relationship between PM and GM. The theory that GM was unaware of the internal ramifications of the financial management issues in production was also not confirmed. If anything, I was left with several doubts as to GM's supposed innocence in the poor maintenance management decisions of the past. I also wonder about the funny games senior managers are playing, when simple face-the-facts and let's plan to get it resolved is probably the approach that is needed. The let's-pretend-it's-not-a-problem approach was certainly worrying.*

*Nevertheless, I decided that tackling the entire region's problems was not within my means and certainly not a priority. My focus had to more parochial – I needed to concentrate on the group's progress. I would only consider the macro picture in as far as it influenced the group's working environment.*

I called the guys together to discuss the budget proposals for the coming financial year, particularly with the aim to prepare the team for the budget cuts which may come. There was huge unhappiness about the potential cuts. Why bother to plan for maintenance at all if the money will not be made available for it? The usual, "no money, no people, management lack of interest in the plant" theme surfaced again. I encouraged the team to keep reporting the defects. That was key. We could always haggle for money to do repairs as long as the reports were there as proof that we have problems. I went through the whole family budgeting metaphor again. Certain sacrifices have to be made when times are tough. This frees up money for the really critical stuff. We would have to look for cost-effective alternatives to our usual repair schemes, waste less by trying to reuse spares in less critical equipment, etc.

This was not well received at all – it required effort on the part of everyone. More importantly and fundamental to long term savings was the need to drive down breakdowns – spot potential failures, eliminate them and of course the all important root cause analysis so that all other drivers for the same problem can be eliminated.

## 11 December 1999 - Work Patterns

This week's figures are a huge breakthrough. For the first time we are actually able to claim a genuine downward trend in breakdown frequency and lost time. This is good not only from a performance-measure point of view but also from a morale-boost point of view. What is worrying, however, is that there is still so much to do that is not getting done now during peak due to no maintenance time. We are producing so much volume or better said, our volume quota each week is so high that all lost time has to be made up for by running into the last remaining free day. We are currently running six days a week – Sunday to Friday with preventative maintenance and cleaning planned for Sunday. This leaves only Saturday for the packaging engineering team to do all corrective maintenance. If we have a bad run, then we run into the Saturday, which limits the maintenance hours. We also only have four artisans, three of whom are on shift. So only one of these three are available for Saturday maintenance. The guys can also not work continuously without a day off so there are only effectively only two artisans available for maintenance. This excludes NA who just joined us a week ago as a replacement artisan for one of our vacancies. This means our maintenance resource planning has to be super slick.

I decided to spend some time with MP to ensure that he is meeting the requirements. I noticed that the mechanics were still confined exclusively to conveyor maintenance, that all the 'big' jobs were still retained for certain artisans and that the new artisan was being used as a spanner boy! Sure he needs to learn the ropes and he is on training with the machine operators, but he is a qualified millwright who should be able to maintain standard equipment and should know when to ask for help and where to find it. There was another dynamic developing here. I noticed that there was a huge resistance by the older white guys to mentor NA. The younger guys and the black guys welcomed him with open arms and were eager to show him the ropes. The others instead treated him like a new army-recruit on initiation. When challenged about this the older hands told me that they were treated like that when they were apprentices – that's the way it works. I mentioned that NA was not an apprentice but a qualified artisan who was their equal and needed guidance and support, not orders and instructions. This caused great unhappiness. They felt that they had worked hard to gather the knowledge they had and they were not about to give it away for nothing – NA had to "prove" himself before he would be worthy of their assistance. They were also worried about the fact that he was an affirmative action candidate who probably got the job because of his skin colour rather than his abilities because "they" are generally not good at engineering type of work.

This racial tension sparked old debates among the team members and the atmosphere become so tense that the guys nearly came to blows. It took some very hard, direct management to get the guys to quickly realise that racial discrimination in the workplace is a dismissable offence and that disciplinary action would be taken. We also talked openly about the issues and agreed that unless we worked together as a complete team, not just with certain individuals, we would not achieve success. Although everyone agreed, I could see that I wasn't able to change their minds about NA. The expectations were clear – they would have to come to terms with it. I discussed the issue with DM. In particular I found it difficult to accept that so much residual racism remained after years of LSAM deliberately guiding the transformation in the workplace long before other organisations started. DM was also concerned

about this. He claimed that racism was evident up to level three management. He also mentioned that in the Gauteng region where he worked previously, they had special workshops on diversity management to assist with the transformation. He wasn't sure if anything like that had been done here. I made a note to speak to the HRS about it.

I encouraged MP to plan responsible tasks for NA as well as for ME, our electrical mechanic who has good potential to develop into an artisan. In the planning meeting I voiced my concern about the split of jobs and everyone agreed that they were willing to do work in all areas depending on the need. The guys certainly were capable and wanted to be trusted with the responsibility.

There was also the matter of too many jobs being carried over to January (after peak) because the time and resources were limited. I am not convinced that the decision to do now rather than later is being given the weight it deserves. I discussed my concern with MP. He mentioned that he could only trust certain guys with the bigger jobs and that time was also an issue. We went through the backlog list. There certainly were jobs too big to handle now, but there were also jobs that could be performed provided were planned and prepared well for them. I voiced my concern in this week's planning meeting. It is imperative that we do as much as we possibly can in the time available to prevent failures. At this rate we are going to get to the last week in December and suddenly the threads we are keeping the plant together with are going to come apart. Yes, we are working our fingers off the bone, but that's what peak is all about. Everyone agreed that instead of brushing things off until next year they would make more meaningful judgements about the true consequence of things left undone.

Despite this resolve from the team I was concerned at the length of the backlog list. There was just so much to do. So many of the jobs could be done but the spares were not available. Why not? Here the guys came out vociferously. They had lists of defects that they had reported as we agreed to a few weeks back but their requests were not being looked at by MP who was supposed to organise the spares. MP claimed he is too busy with all the plant problems to sit on the phone all day sourcing spares. He had also placed several orders with the OEM's who were just too slow in getting things to us. Most of them are based in Germany and the lead times are excessive. Other high-cost spares were sitting on SAP as purchase requests but had not been approved by DM because there were no funds. I mentioned the fact that the delivery bay was filled with spares that just never got onto the plant. These, the guys told me, were incorrect spares that had to be returned. Where were the return-to-supplier documents? No one knew – in fact all this money was lying around eventually to get tossed away as redundant. The guys had 'told' MP about it but he had forgotten – or rather he was too busy with everything else to still handle incorrect spares.

Why was the quality check on the spares not done? This would highlight problems immediately while the supplier's delivery van was still on site. I found that the supplier would drop things off and some time later, MP would sign off a whole lot of delivery notes from the week's or month's deliveries. The main supplier of general engineering spares was so well known at the plant and his relationship so good with the company that if we later found things to be wrong or missing, he would trust our call and re-supply with or without delivery note clearance. Typically mistakes are only found on weekends, after the machine is stripped and the spare is required. It then

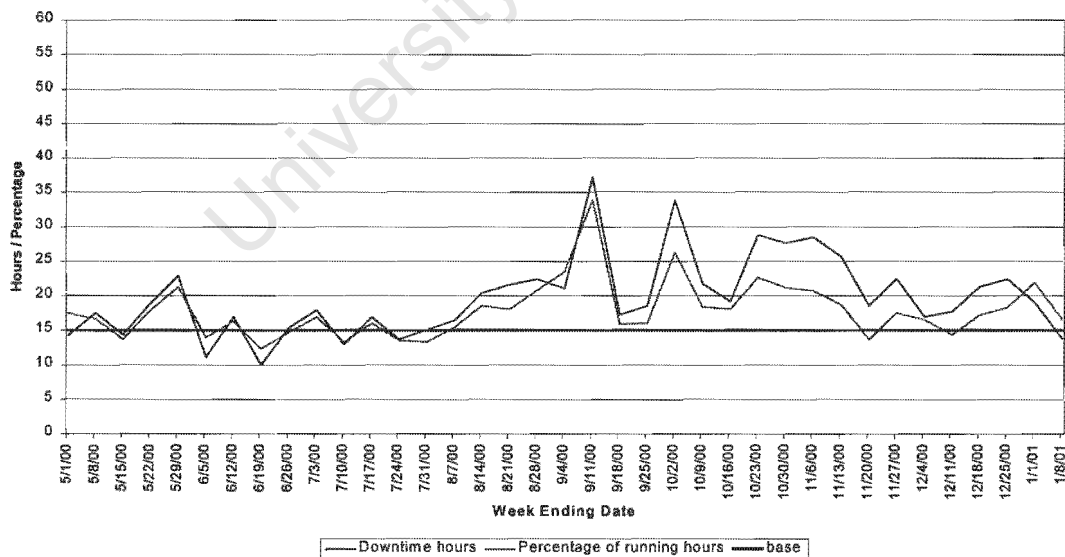
becomes a huge struggle to get spares and so paper work is bypassed, the supplier delivers without an order and without taking the incorrect part away. MP would then have to retro-correct the paperwork in the new week – when he and the supplier can get together to agree on what transpired.

This is a complete fiasco. I promised to call in the general supplier (PS) for a meeting to discuss the spares management. In the meanwhile we all agreed that the person who will be doing the work must identify spares. The onus to research spares quality standards (size, make, strength, etc) lies with the person requesting the spare and not with MP. MP will assist as needed. The person requesting the spare will do the QC on delivery – not MP. There is too little responsibility at source. I joked that at this rate MP would be making up little spares kits and delivering them at the exact spot on the plant for each person where it was needed. Planning, including spares planning was everybody's collective task. Once again, if we tackled this as a team we could become much better at it and always ensure that we have the right spare at the right time.

### December month-end

The breakdown rate was starting to abate. We were actually showing some improvement, but at a huge cost. Morale was still generally low but at least the guys were pulling together more than before and they were actually speaking to each other without yelling. The artisans were also more amenable to assisting the mechanics, and the engineering guys in general were engaging the operators more and more in maintenance issues. The racial tension still seemed rife and the reluctance to engage in open honest communication was still a problem.

### Total Downtime



I met with PS (main spares supplier) this week and got him to agree to the team's requirements in terms of lead times, quality of spares, QC on delivery, adherence to LSAM's procedures on purchasing records and most importantly that he needed to deal with all the guys and not just MP. We are all his customers, not just MP. The guy who is doing the work is the most important customer to satisfy. We also agreed strict deadlines for the outstanding spares deliveries.

The backlog seems longer than ever before. These last two weeks have been a phenomenal scramble to get everything ready for Y2K contingencies as well as finishing all the required volume for the festive holidays. The guys are extremely tired after hardly any time off in three months and the December holiday period has played havoc with spares from some of our suppliers. All in all we are heading for huge problems if we do not ensure our planning readiness to do the work as soon as the idle time hits us in two weeks time.

Of particular concern was that the concentrated effort on problem highlighting and immediate action to eliminate was starting to wane as poor spares planning and general lack of urgency started to settle in. The lethargy of the holiday season coupled with over-tired minds and bodies proved to be a formidable action damper. Harnessing and channelling the problem reporting at source had proved to be a huge success. The guys were no more just "telling someone" about their problems but there was a recognised channel for filtering such information. DM had always complained that verbal reporting was a sign of laziness – "to tell someone is to do nothing". He wanted the person reporting the problem to also take accountability for ensuring that the problem gets corrected. We were not yet as far as we could be in terms of getting each operator to use formal computer systems for problem reporting, but the SBU minutes and supervisor/shift artisan SAP notifications were improving in quality.

I have also had some time to do in-depth failure analysis on several of our larger breakdowns as well as those that were difficult to problem solve earlier. Through literature searches I have found that several of our problems stem from uncontrolled modifications that were done by maintenance personnel over the years. By questioning the guys I have found that this often happened when the correct spares were unavailable or the quick fix to a problem unintentionally became the permanent fix. I explained that this was dangerous to the health of the plant since the maintenance basis was set up with the original plant in mind. Several of the changes may well have been well-intended and engineered properly could actually yield a better solution. However, uncontrolled modifications were a nightmare for the learning organisation.

Month-end financial reports are also cause for concern. It is evident that DM is coming under increasing pressure to contain costs. He was running cost reports on a daily basis and challenging each line item. Many of these referred to maintenance spending. I challenged PM (production manager) on the cost cutting policy. He explained that the region was in a particularly bad financial position and that big "lumps" were going to fly if the region did not at least come closer to the budgeted target than it currently was. This was serious. We'd all have to find ways of producing savings every month from now until financial year-end (end of March). What's more is sales are not what was expected for the millennium celebrations etc. In fact, sales have been worse this December than last year. We could see some serious budget cutting early next week for the last profit quarter.

## **22 January 2000 – Bad timing, Bad News**

We survived the Y2K changeover without any drama. We also managed to keep plant ticking over through December peak and early January. The bad news, however, is that we are losing a drastic amount of volume which is expected to be

more or less permanent until further notice. The poor sales pattern is expected to continue. A direct result was a re-look at the current budget until financial year-end in March, which saw our non-scheduled maintenance spend removed from the budget.

This is a huge problem for us. All the work planned for off-peak would have to be re-looked at with a view to selecting only the absolutely most critical items for attention. The problem, however, is that the secondary damage of keeping the plant limping for that long is going to prove to be fatal.

We managed to get some pasteuriser and packer/unpacker spares. But, this proved to be too little too late. This week we sustained multiple breakdowns on the pasteuriser. This was really bad timing considering we were planning to repair this weekend. The repair itself was only temporary until we can get our millions in the new financial year (hopefully) to effect a proper engineering solution. But, before we could get there, the balancing chains snapped and with the load a couple of fish plates cracked and broke right through - phenomenal stress. The guys were actually happy that this had happened so that management could wake up to the fact that this machine was in serious need of a total rebuild.

The need for the packer and unpacker annual overalls were starting to show - massive problems plus the bottle washer started showing massive signs of wanting attention. How are we going to keep the plant together and still save all this money? In retrospect we should have had the plant in ship shape before peak but then we did not even know where our problems were.

We are going to suffer huge financial pressure as the last quarter of the financial year faces us with massive overspending that would have been forgiven by a good peak but now has to be recovered.

### **19 February 2000 – Innovate or Die**

I have sat down with the team and despite the breakdowns, patchwork and low morale we managed to come up with innovative ways to keep the plant maintained but at a reduced cost. All overtime was heavily questioned. Yes, we had big jobs but we needed to break the bigger jobs into smaller parts that could be tackled on a maintenance day or during the odd idle day rather than over two full weekend days. I also noticed that the defect reports were slowing down so that our backlog report was starting to look artificially better. The guys have lapsed back into not reporting based on the 'no-money syndrome'. I tried to encourage the guys not to lose their faith in the maintenance system. We had to keep doing all the right things that we agreed to do because this will ensure a healthy plant in the long term. I also had to admit that with no response to problems the plant health couldn't be ensured.

The morale is extremely low. I find that I have to go back to the family budget analogy from time to time - creativity has to show. We have identified the satellite stores and repair items as sources of income if these were returned to stores or the supplier. I started getting our regular suppliers on board to assist us with buy now pay later schemes, as well as to buy stock back from us.

As if this is not enough, the financial pressure made worse by the volume drop has meant that we had to get rid of the third shift. However, we had just too much volume to run 2x8 only including startup and shutdown time. Also, the daily start-up and shutdown was proving to be extremely costly not to mention the machine stresses involved. The unions flatly refused to engage in two by twelve configurations - started lengthy negotiations that ended up in disputes and all sorts of industrial drama. In the meanwhile we have to run the extra few hours without extra people- overtime costs are increasing. The required savings for the last quarter were not going to survive these overtime costs.

DM could find little alternative but to get the engineering guys involved. He proposed that the daily run-out and startup be done on morning shift when the day shift engineering guys were available. This new running pattern would start next week and run for a month to allow all the stake holders involved, particularly the unions, the opportunity to evaluate various shift configuration options other than the twelve hours shift they refused to work.

This sparked huge debate among the engineering guys. We certainly were not enough to man all the machines and some of them were not proficient at running the machines. We talked about it in an honest and open manner. Having been used to the action learning process so far, engaging alternative ideas, etc., we decided as a team to find a better alternative or at best make this proposal work. We had to run for one month with engineering team running the line for the extra four hours a day. The real issues started to emerge: we don't do operating – that's not our work. There were also other issues that could be considered an advantage. Currently, with the run-out happening after afternoon shift and the start-up happening in the morning before morning shift, the plant was idle at night for about four hours. This time would now be available during daylight hours so that we would effectively have four hours of maintenance time per day – apart from the saving in overtime.

We held a planning meeting to see how we could get everything done that we needed to without losing sight of the all important systemic loops such as the daily feedback meetings, the FFA's etc. The guys moaned like hell - there was a huge internal struggle between the 'it will never work' guys and the 'let's try and see' guys and no one was going to do the menial tasks – so I elected to do the menial tasks. We eventually came up with a rather challenging plan of who would do what. The guys were still bitterly unhappy but elected to try the plan for one month.

## **2 April 2000 – On budget but worse for wear.**

What a month this has been. We came in on budget at the end of the year but everything was falling apart. To make matters worse, we hardly spent time on the plant given our new careers as machine operators.

The time between the last week in February and the last week in March has been ...well, I'm not sure how to describe it. More than ever before I wish I were a behavioral psychologist, given the dynamics of the team member interactions I witnessed. The guys were so sorry for themselves at having to work the plant that they actually started working as a team. Partnerships were forming. However, no sooner had they formed partnerships than they nearly came to blows because each person believed he was working harder than any other was in the team. Apart from that, the guys refused flatly to do jobs like packing crates since this was beneath

them. Our plant does not have an automatic crate accumulator so we have to use labour to do this.

So, I locked up office for six hours each day for a month to pack crates and relieve at the packer and unpacker. MP assisted as glass handler. This not only shocked the guys but also made them more open to the idea that when the chips are down everyone's effort is absolutely essential. This also raised the issue that the rest of the level-two team was only making a token appearance every now and again. The guys interpreted this as no interest on the part of management.

There were other good things that came from this experience. The line was in a pathetic state – worse than any of us actually knew. The operators had stopped complaining and started living with several defects by 'work-around' tactics, some of which were actually causing more damage. Since we were less experienced in these 'work-arounds', we found it extremely difficult to operate the line as is. It was good that the engineering guys had to battle with the machines first hand like the operators would have to. The resolve to maintain the line better and be more attuned with the operators and their problems were a strong realization for the team. By the same token, the guys blamed 'no money' for the state of the line and this demotivated the guys even more. This swing in moods was rather interesting to experience – one day the guys would be positive to get things done, and the next extremely depressed and angry at management and the operators for allowing the plant to deteriorate to this extent.

In retrospect, apart from the awareness it created, it was not a good plan and certainly was not sustainable. We got very little maintenance done but at least we gathered major intelligence about what was wrong with the machines. The FFA's fell flat (no time) but we insisted on daily engineering meetings to keep track of our findings and ensure it got into the maintenance planning system, gap system etc. It was also a hugely stressful time. My own involvement in level two and three activities continued. I spent time in the office after line start-up until 23.00 at night to catch up with project work that could not be done during the day. The guys were exhausted from trying to do schedules and run the line under poor machine conditions. Struggling on the line meant that it took us longer than usual to run-out and start-up with the result that that was largely all we managed to do each day. The poor line conditions and lack of experience also meant that we were running around between one end of the machine to jams elsewhere, to sticky controls elsewhere, etc. This was extremely exhausting and frustrating. I found myself giving the guys time off on a Friday afternoon to show appreciation and empathy with their effort. Emotions ran high on several occasions. The guys nearly came to blows - not everyone was pulling their weight - not everyone arrived on time for shift hand-over - racism etc. The team dynamic actually once again highlighted something I had noticed before but had not fully comprehended. The guys were unable to communicate effectively, respectfully and on-the-level. Open honest communication was something I highlighted and encouraged as a team from day one. But when it came to individual team members communicating with each other, there was high drama. They could not talk to each other when they were unhappy. They did it in such an aggressive manner that it sparked fights and did nothing to relieve the tension until I stepped in and threatened to 'bliksem' everyone. I realized that the guys were not skilled at all in conflict management. If the guys suspected that something, which was agreed upon, was not done by one of the team members, they would immediately attack that person without even inquiring as to what had

happened. Otherwise, they would inquire in such a hostile manner that whoever it was immediately got their backs up.

Apart from the interaction and team relationships, the strain on the entire maintenance and engineering effort was starting to show. The breakdown rate was going the wrong way. We were not doing the high-cost maintenance due to budget constraints and we were not performing most of the other backlog items because we were so tied up. Maintenance planning was at best of a poor quality if done at all, since MP was on the line helping us to keep things going.

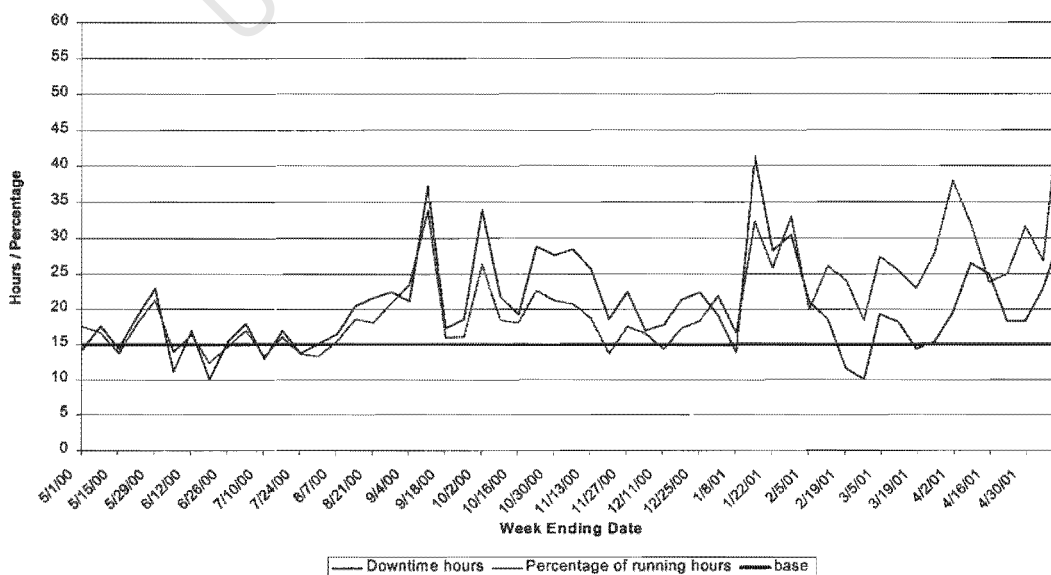
It reached a point where we were so behind with what we wanted to do that we had to make a call as to how we were going to proceed from here on in. Luckily the market came to our rescue. We had reached end of financial year and with Easter peak looming we saw an increase in volume demand hence back to three by eight (with temps).

We sent a clear message to the unions that we were not going to play games while the plant suffered. In any event we could not continue with this fiasco any longer and decided that after April peak we would go back to staggered (2x8) shifts with overtime. The medium to long term effect on the plant reliability is not worth it. It helped that we had a shop steward in our team who had lived through the current crisis and saw the deterioration in the plant first hand as a result of the decisions that had been taken. He was also being developed for future promotion so it was good to have him on the bargaining team.

### 7 May 2000 – Reflections

We survived the Easter peak but only because we spent more money this month than the whole of the last quarter! We were defeating the budgeting process but with the lengthy maintenance drought we had no choice. The plant is in exceptionally poor shape. We have also drawn up a plan of how we are to tackle the rest of our big problem areas.

### Total Downtime



The downtime is still going the wrong way but with the injection of funds as a concerted effort to keep doing the right things we will be able to turn the trend around. But were we still doing the right things? We never quite recovered our systemic loops after the engineering-staggered shift fiasco.

There were also signs that the guys were not doing all the actions we had agreed upon over the last seven months. There were also several things happening at once as usual. There was the ISO final accreditation audit looming, bottle washer trial coming up, just couldn't keep up with simultaneous reliability problems, quality problems, material wastage problems. We seemed to have lost focus. This last week was a particularly bad week where everything went wrong but not one precursor was raised at the usual morning meeting - in fact it had become a burden with the staggered shifts to have a meeting in the middle of the morning. Communication at level one had broken down completely. The supervisors were unaware of maintenance issues and the engineering staff were oblivious to operator concerns. I couldn't believe this. We needed to regain channels of communication urgently. I gathered some the guys together. What was going on? I withdraw to catch up on my plant-wide projects and the systems we agreed upon fall apart? This sparked a huge row about information transfer and partnering between production and engineering and it seemed we were back again where we were months ago.

Why were we not communicating? The guys felt that the morning meetings were not working so they stopped attending. Why are the meetings not working? The meetings are a waste of time. The supervisors felt that they had to do loads of meeting prep just to present to a group of people that were not going to do anything anyway. The supervisor was referring to the daily morning production meeting between level one and members of level two. The problem was that we at level two had decided that the accountability had to be pushed down to level one in order to empower them. So instead of running off with 'A's, or throwing personal resources at it - we were asking the following questions of level one whenever a problem was raised for level two's attention: So what are you doing about it? What level of problem solving have you done? What has it told you?

The guys felt we were leaving them to run the whole place and do everything while level two just sat by and watched. In many respects that is what was happening. I found more and more that I was the only one actively working with level one getting processes in place, etc. TC had retreated due to illness. MP was becoming increasingly despondent over his pay dispute with DM. ET had retreated into his training program and RMC saw himself as more of an individual contributor than team member. There was no more level two team as such. I worked with the guys while DM backed it up with ounces of pressure by way of feedback -other divisional drivers were taking loads of time like ISO accreditation which we decided to do without external assistance as a cost saver - good for the short term but long term effects?

I found myself going through an emotional roller coaster period with the guys where I had to fight to get things working - why? We had worked together so well for a long while. Why was our effort not sustainable? A series of other things happened that raised the question of why things collapse when not tracked by key people - system ownership. We discussed several factors as a team that could lead to the fall

of seemingly good processes. The guys raised several good practices that just stopped happening. I asked them to list these:

- Things were managed differently in the past by LvdM
- JA used to have a good system for managing repair items
- DG used to have a good system for managing shop floor standards
- There used to be a performance management system by PM (then)
- When JA was here the operators used to do their own lubrications
- LvdM and DG trained all the operators on conveyor maintenance
- The operators used to have all their own tools which LvdM kept in his office for maintenance days
- We used to have a system for recording the internals of all components overhauled when PdW was here
- The fast moving spares used to be in a shadow cabinet when DG and LvdM were here
- We used to have a good FFA system when PdW was here
- When PM was here we had to report efficiencies every hour on the hour
- We used to have a shift cabinet for power tools that worked well to control usage
- DG designed a system for pressure cleaning of the conveyors but then the project was stopped
- We used to have a colour coded lubrication system for the operators when PdW was still here
- JA used to have a good system for maintenance planning
- JA used to produce colour coded bar charts for each machine for maintenance day

What happened to change all of this? Did anyone discontinue all these seemingly good practices? No, what happened was that these people have all left! The 'systems' and methods used previously were all owned by the system proponents. These were people who believed in the methods sufficiently to make it work. However, the actors in the system never adopted these methods or practices as their own. When these key proponents left the system, the methods ceased to exist.

The guys admitted that although they believed in some of these systems and disagreed with others, they adopted the methods because they had to. When these people left it wasn't easy to keep things happening anymore because everyone just did their own thing and the systems they did not like could just be ignored.

This was an interesting point. Had the team been stronger and more cohesive, they would have kept the systems that worked, but without this feedback loop – without someone to say: "Why have you not done it this way?" there is no feedback loop – whether the person be the leader or a fellow team member!

However, having someone constantly there to remind people what they ought to be doing goes against the very principals of WCM we are trying to establish. I battled with this thought for a while – we want our people to be able to live the systems without having to rely on a champion to remind them what to do but we also want a feedback loop in place that ensures the outcomes. How do we achieve this? Do we turn the team members themselves into champions? I tackled DM on the issue. His thoughts were valid but still too high level for my liking. He feels that only when the team is strong enough to function independently of any leader or champion, and

only when the team believes sufficiently in the systems they use will they continue to live the systems long after the system proponents have left.

I agreed, but there has to be more. I wasn't here in the past to witness systemic collapses. I am making the assumption that when key people left, the system fell apart. But I had witnessed this one. What have I learnt? Let me think. I have learnt that a routine activity or process (like FFA's, maintenance planning meetings, problem reporting structures and weekly financial control meetings etc.) is exactly that – routine! That is where the success lies – in the repetitive nature of such processes with continuous improvements of course. When this routine is broken (such as a whole month of shift work instead of normal activities), it becomes almost impossible to return to the routine management and control structures without huge intervention by some "champion". In world class teams, the team leader will play this role. I realised for the first time that the engineering team at level 1 never really had a proper team leader. Ideally MP should play this role, but he certainly saw himself as a technical contributor rather than a team leader.

I decided to get the team's view on the matter. I challenged the team on why it was that we always had to re-implement systems that were working before. What was it that erased peoples memories? Why don't we just keep doing what it is we have to do? That way we will ensure achievement of our desired outcomes. We debated the issue for a while and some interesting comments came out. It revolved around role clarity and clarity of expectations. It also revolved around communication channels. MP summed it up well – "If someone will at least keep us informed of what's going on then at least by common sense we will know what to do". He was referring to changes in processes being implemented without communication and thus resistance to the changes. He continued – "If we only knew exactly what was required then we would focus our attention there. There's so much to do that we all just do what we can – and the rest kind-of happens when it's urgent". DA's comment about team partnerships was valid: "We're not working as a team should. We all know what we should be doing but only some of us are doing it – the rest are just loafing." What happens when people do not deliver? Well, the general feeling was that it is management's duty to track individual performance not fellow team members. But, they also felt it was more a case of not being clear on what to do rather than poor performance.

I needed to think this through. *Our system for managing our regularly occurring activities was flawed – it only contained feedback loops for the absolute here-and-now routines. For example, we operated our machines to produce the volume per the weekly production plan. If we failed to do this, immediate feedback triggers and responses ensured that we at least made reliability. We sampled and analyzed according to a weekly quality plan, which if not followed would immediately be raised so that results could be obtained for the various reports requiring it. We had now reached a stage where we were producing a reasonably good weekly maintenance plan and feedback meetings were in place to ensure that whatever could not be done was highlighted, reassessed and re-planned.*

*That was it – and sometimes even that was a struggle. The reality is that there are thousands of other regularly occurring acts that are necessary for system survival besides these three of production, quality and engineering. These other activities include all of the actions necessary for ensuring the long-term viability of the system, including the plant itself, the people and the profitability of the operation. Activities such as problem solving, actions from RCA, loop closure after changes, capturing*

*vital information into the various planning systems, actions from performance monitoring meetings, people development, team development, reports, spares management, correcting/updating work instructions, quality assurance activities such as audits, actions around managing OHSE, analysis, interpretation and trending of data, implementation of new projects and processes, and so on and so on depending on how many problems there are and how many issues are raised in the various meetings/discussions/informal queries/formal requests from COT etc.*

Why do we have no feedback system for managing these actions? Actually, we do. We have a 'gap' system that is not used very much or better said our usage is limited to loading new 'gaps'. We rarely manage by it. We all keep our own "to-do" lists outside of the 'gap' list anyway. I went through the various gap lists on site – there's one for ISO implementation (the only one that's actually worked), one for OHS issues, our own departmental lists per team, etc. Even these gaps listed did not represent the regularly occurring activities that are needed for improvement. What is it that we ought to be doing? Of course, this was contained in our BP manuals – well, actually not. Our BP manuals contained all the activities around production, quality and maintenance. There's some stuff on problem solving and team dynamics but we use such different systems nowadays and the manuals have never been updated. Some positions have competency standards but these too are high level documents – not activity based. We have goals on the board that we review six-monthly but we do not work with these goals in mind.

So, in short, we have no documented best practice about our roles as individuals, as teams, and no documented work practice or activity clarity codes about what it is that we ought to be doing as world class teams. We also do not have an activity management system that drives actions or task completion.

We had to rediscover the purpose of what we were on about - it wasn't to please anyone else but to achieve our own purposes. We discussed the purpose of getting together at all to do things like morning meetings, FFA meetings, etc. What did we wish to achieve? What mechanism could make this possible? How would we measure progress and what feedback mechanism would we use to ensure continuance? We agreed to abandon every system that was being done because we had to but rather introduce things that we felt needed to be done in order to achieve a specific aim. Based on this criteria we agreed that the usual morning meeting would cease with immediate effect to give way to a combined SBU forum that was owned by level one for achieving the aims of level one. Level two members like MP, who was integral to the day to day functioning from a maintenance perspective, would have to be there. I would sit in from time to time when required so too other level two members. The timing would be a problem for incorporating the whole team but we could work around that by splitting the team into a start-up and maintenance team. These would be followed up by a weekly review of where we were and any major issues would filter up to level two in the weekly level two meetings. We got that underway immediately. It was excellent in filtering immediate problems and finding immediate solutions and taking instant steps. We revised the agenda - most of the elements remained but there was greater belief in it because it was theirs and not DMs. Repeat problems had to be problem-solved – we agreed that this continued. Specific 'A's would be allocated each day and these would be recorded in the minutes under 'actions'. Notifications would be raised where necessary and feedback on previous actions would be recorded. Outstanding actions would remain on the agenda until

resolved. Less pressing issues would be planned for later attention and recorded via the electronic maintenance and gap systems.

This was rather a breakthrough. We had to stumble a bit to figure out what our barriers to change were. Everything had gone so smoothly in terms of the team adopting all the new principles over the last few months that I had failed to realise that I was driving the team through the process. This very act was providing adequate feedback but I was not allowing for self-regulation. When self-regulation did occur, the feedback loops I had established were not sustained. The team had to set up their own mechanisms for feedback.

I was finally getting to the bottom of one of my key research questions: Why the inertia to adopt the new WCM system? The answer was simply that we had ill-defined structures for governing our regularly occurring activities including poor role clarity surround whom or what team should be doing what and even poorer control on corrective action management. Finally, we also had very poor feedback systems for driving the right behaviour.

It is time to start sketching a picture of where we have come from and where we find ourselves now. What are the issues and how do they interrelate? We have tackled certain segments of the overall problem as we saw fit at the time. We are now attempting RCA, fixing our most pressing problems before they become breakdowns, engaging the operators in our RCA, interrogating our schedules for effectiveness and approaching maintenance planning in a structured, holistic approach. We also know that the WCM collapse is largely due to management turnover coupled with poor team dynamics, no documented work practices, no activity management and therefore no systemic feedback. But is this going to get us where we want to be? What have these interventions got to do with the overall problem in packaging? What is the overall problem in packaging?

Although I am now confident that we are much closer to the heart of the problem, I don't think we've answered that question yet in its entirety. I will have to make time to start pulling things together. I need to start looking for patterns in the themes that have emerged so far and see how that points to the uncovering of the actual research question.

I set about fleshing out all the perceptions, events, records, data, etc and organised the information into causal loop diagrams (CLDs). The diagrams on the following few pages present the patterns that have emerged from the learning thus far.

There were masses of information – more than I imagined I had gathered. I organised the data into causal "stories" first and then into CLDs showing the reinforcing and balancing loops. The modification control loop was left as a causal "story" because I had not yet worked on the modification process specifically to improve so I had no evidence of the apparent causal relationships. There were several main loops that I could identify at this stage. They all have elements (shown in shaded blocks) which link them or are at least common in all of them. Looking at the CLDs, it is now clear that these shaded elements tend to be key drivers or outcomes of the various natural systems that abound in the department. These CLDs reflect the departmental activity model or stated differently, the actual (underlying, unintentional) management system for the department. These are the things that

are driving the behavior, good or otherwise, that I have come to see over the past few months.

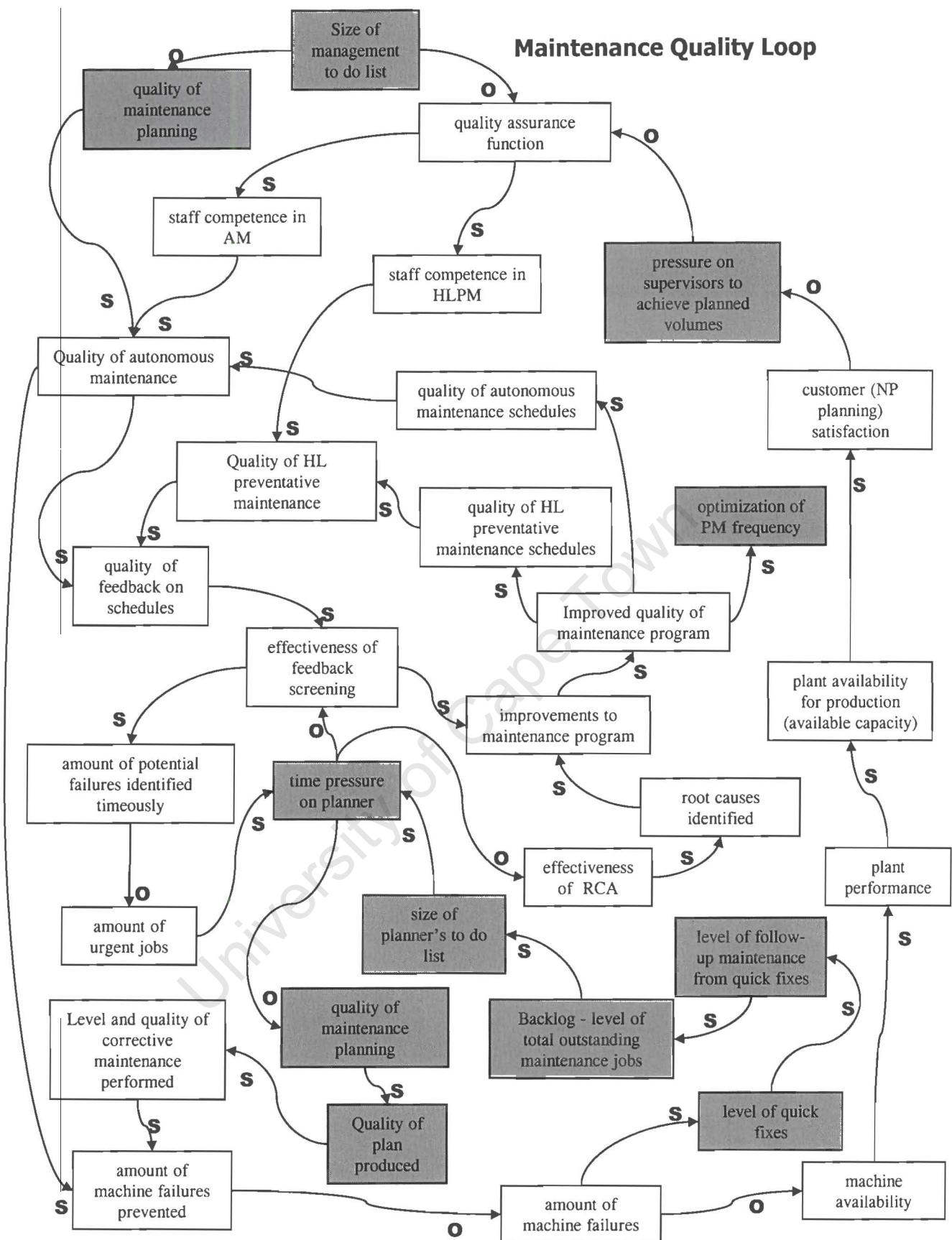
I would have to look critically at the leverage areas. There were just so many. I decided to discuss my findings with the team, DM, central office guys, whoever could have a meaningful contribution.

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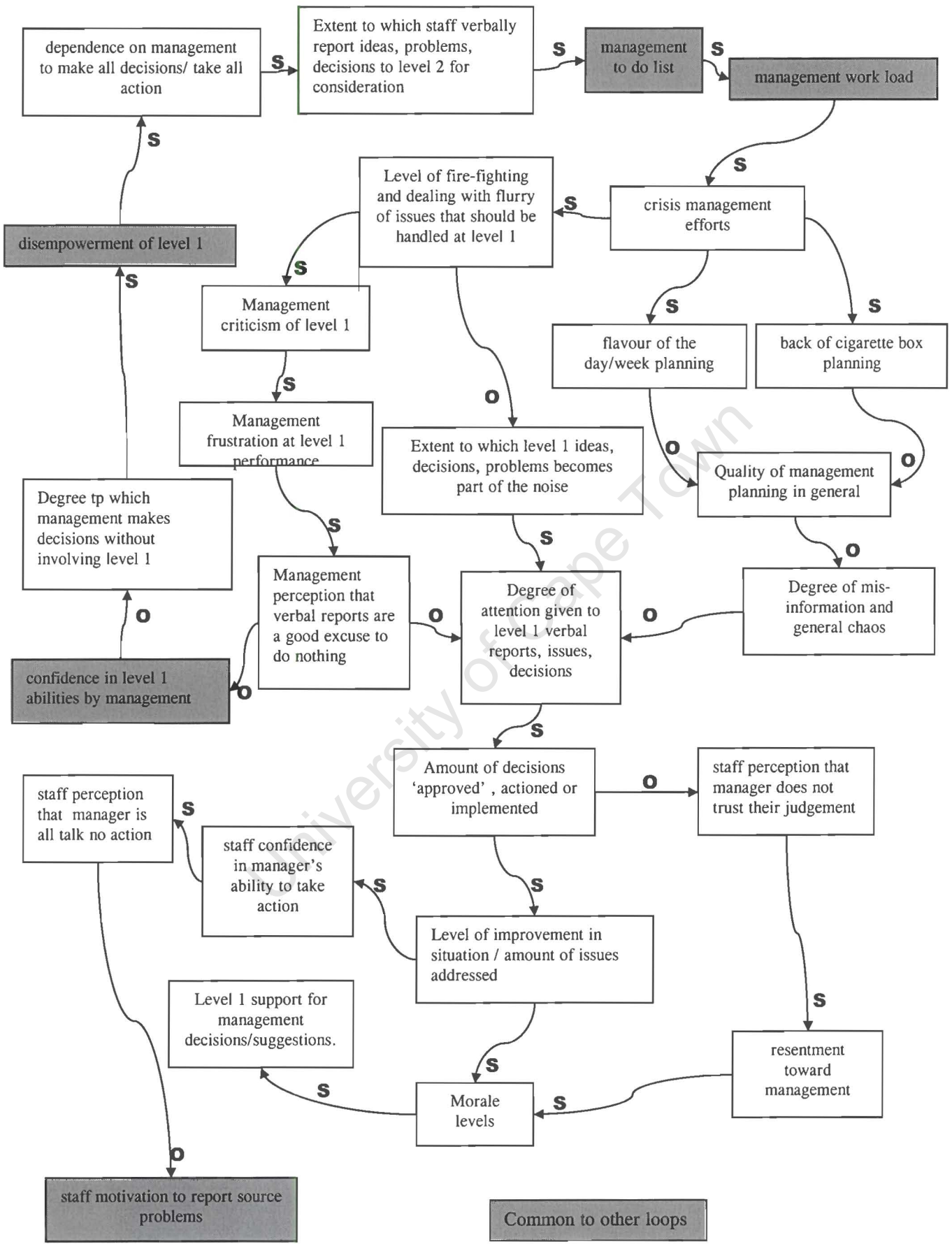
# Maintenance Quality Loop



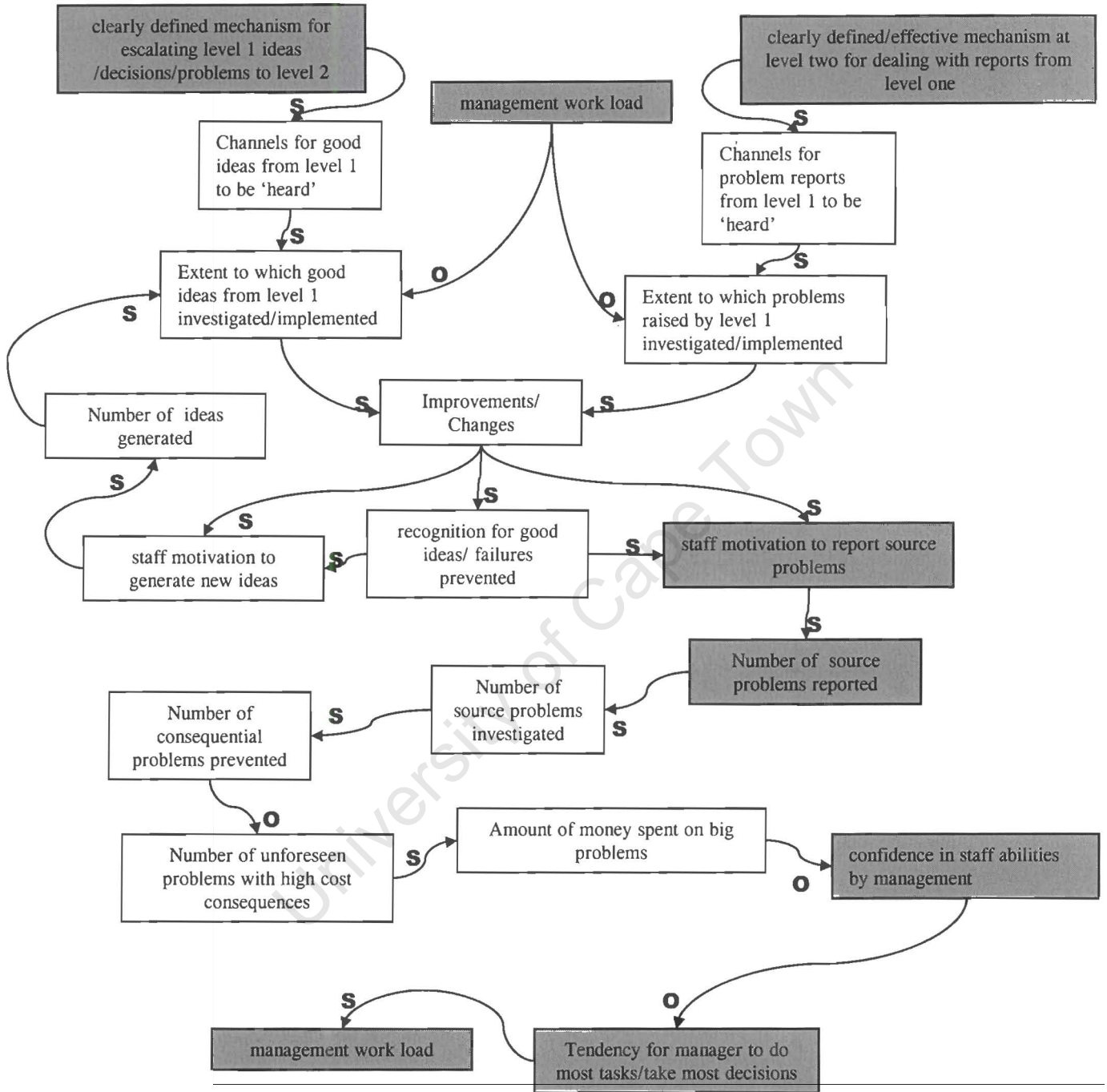
Common to other loops



# Reporting Loop 'to tell someone is to do nothing'



## Reporting Loop continued 'to tell someone is to do nothing'

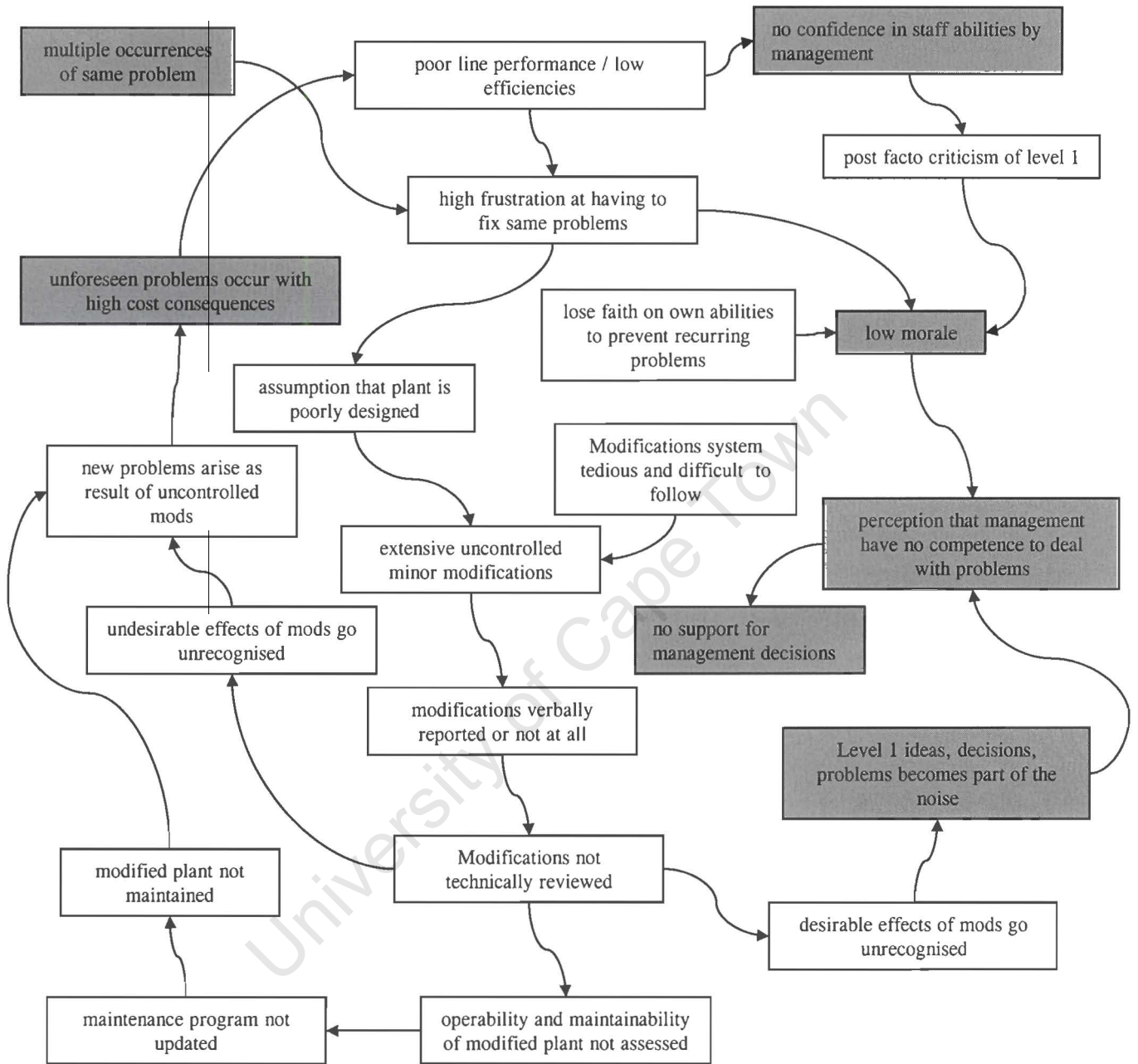


Common to other loops





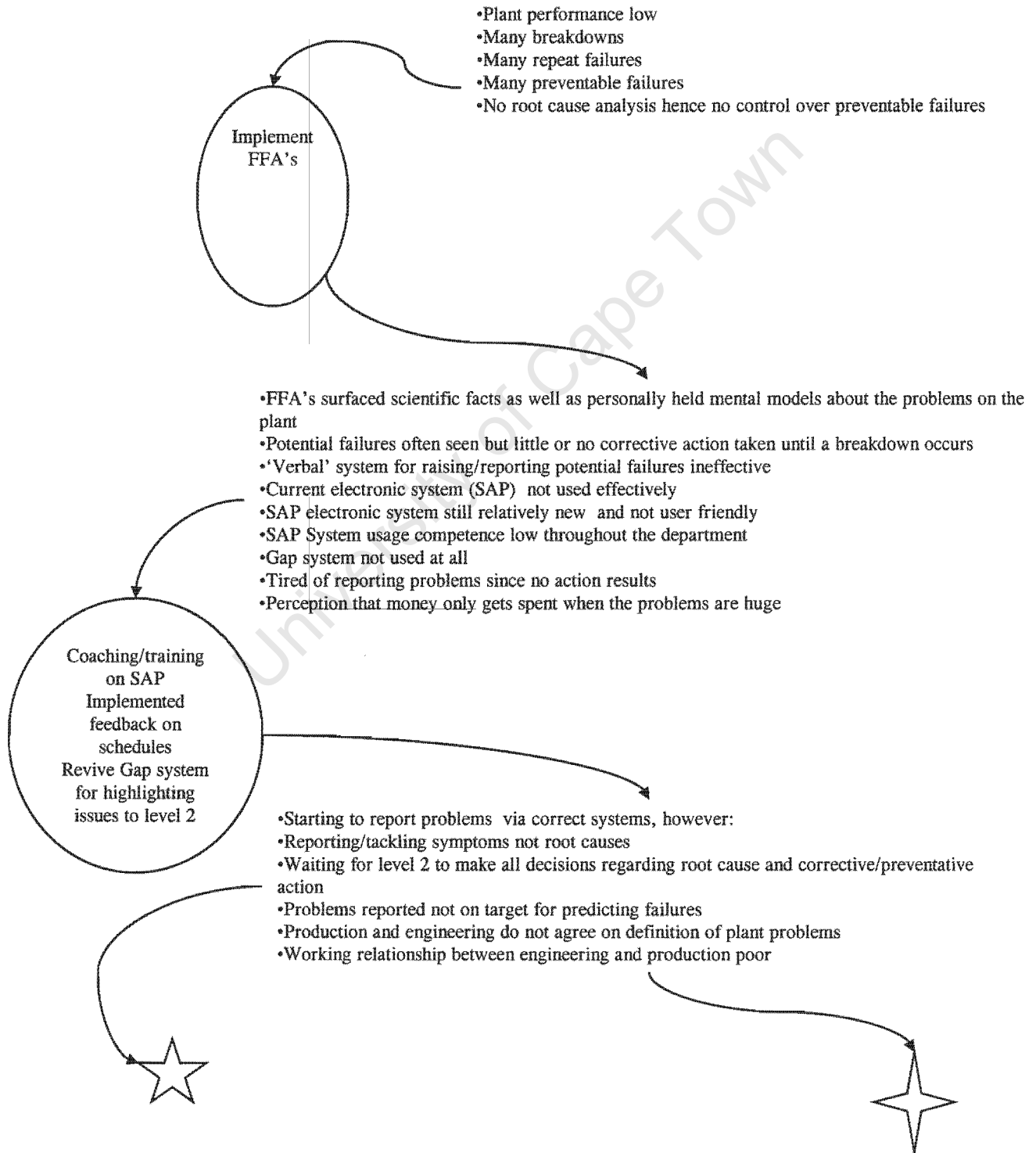
## Modification Control



Common to other loops

## 28 May 2000 – From reflections to new actions

May has been a horrible month from a breakdown point of view but a phenomenal month from a system management point of view. Just by sketching the system and the action steps taken thus far, I have been able to reflect on a bigger scale than before. Previously, I had been reflecting after each action step but this was the first time after several interventions that I could see the complete picture. It was like a macro loop outside of the micro loops. I sketched where we had come from as an overview to the internal dynamics indicated by the CLDs.



Conducted Situational Analysis  
Implemented level 1 RCA tool  
Focus on quality of feedback on PMs

Looking back, all the above was done in an attempt to isolate the problem - not fix it. Focus on finding our problems through root cause analysis, reporting of problems at source, working together to find our problems. But, there was a lack of purposeful, meaningful action lack of structured maintenance management processes (random events that happen to coincide like Brownian motion)

Maintenance planning process interrogated and formalised  
Modification control tightened  
Focus on PM quality into frequency, standards, etc.  
Revision of TPM system

- We were not solving any problems, just defining them
- Focus on CMs (fixing) only, PMs not being done
- Resource planning poor
- Planner competence an issue
- PMs not always effective in identifying potential failures/predicting failures
- Best Practice not reviewed - organisational learning form maintenance PMs ineffective
- Modification control poor

Interactive maintenance planning involving level 1 directly in planning decisions  
Focus on team development towards empowerment at

- Planning more structured and delivering better results
- Planner overloaded with level 1 involvement
- Resources in engineering a limiting factor
- Costs control at level 1 non-existent
- Spares management limiting engineering performance
- Level 1 decision making happening at level 2
- Bias for action at level 1 extremely low (in preparing for NOSA audit but especially in team based activities)

- Serious cost cutting prevents critical repairs
- Breakdown rate high again
- Had to find innovative inexpensive solutions to problems
- Repair/replace model challenged
- Workshop repair maintenance planning system non-existent
- Level 1 involvement and decision making in spares procurement non-existent
- Level 1 decision making happening at level 2

Innovations for plant maintenance  
 Replace/repair model challenged  
 Level 1 responsibilities wrt spares procurement agreed

Excellent systems of the past failed when system proponents left the system!!

- Even less time for maintenance given new shift configuration
- Breakdown rate continues to sore
- Morale extremely low
- Personal involvement triggered partnerships necessary for team development
- Closeness to plant extremely valuable in appreciating real-time problems
- However, time does not allow for the normal systemic activities
- No integration between the groups -lack of synergy - huge polarization

Cement partnerships - team development priority  
 Set sight s on planning for the new financial year by reviewing performance and progress  
 Motivation as key driver for success  
 Continue building level 1 empowerment in everyday decision

Partnerships are key to team success  
 Personal autonomy is key to team empowerment  
 Role clarity key to achieving desired outputs

- Team development program off the ground
- Degree of accountability at level 1 increasing
- Relationship between engineering and production scarred due to shift configuration planning
- Morning meeting at level 2 has become obsolete - level 2 dysfunctional but also a good opportunity to establish level 1 routine
- Individuals start pulling team together

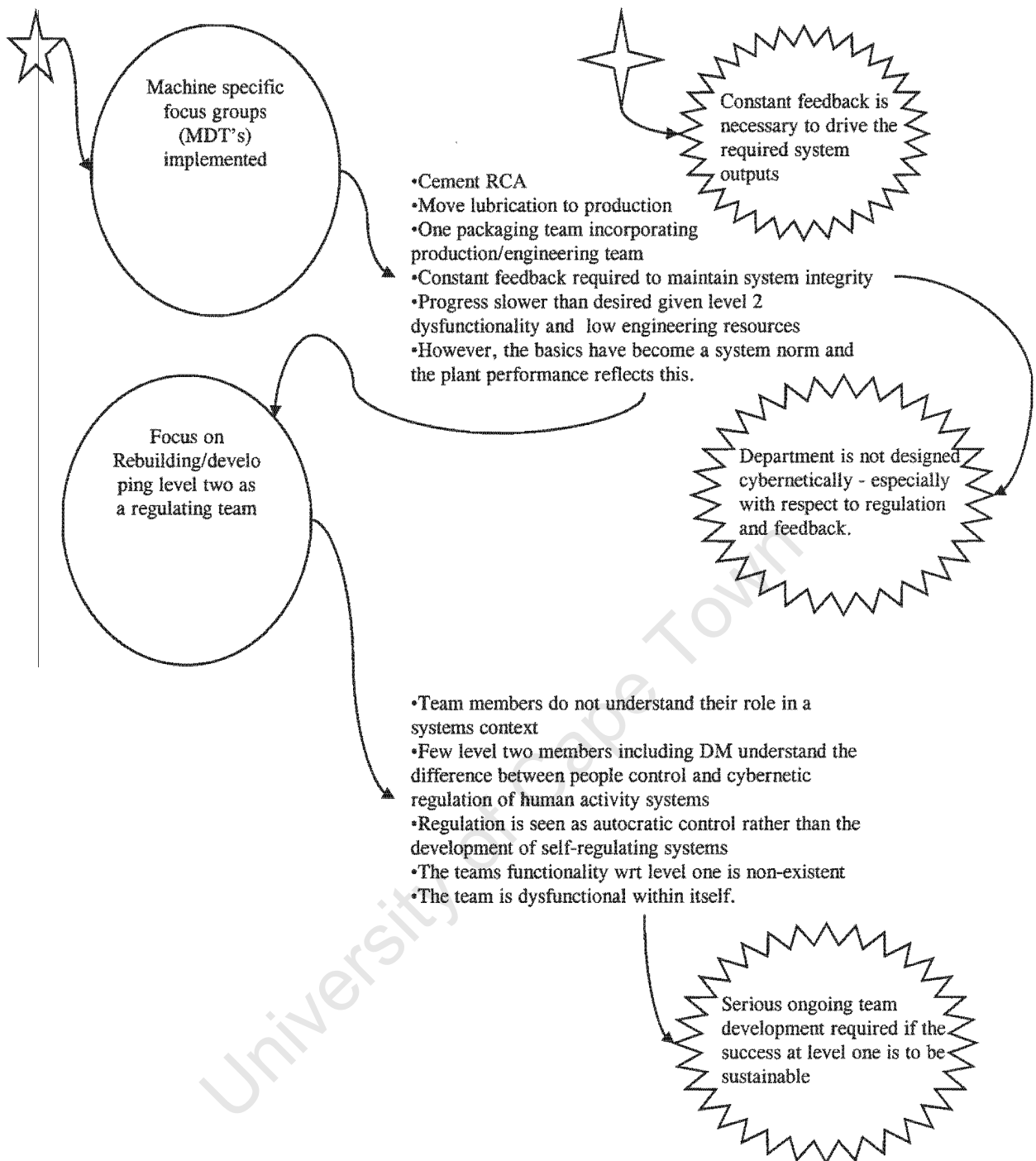
One combined daily performance review meeting for the newly formed manufacturing team involving both engineering and production at level 1  
 Level 1 RCA tool revisited  
 Repair plan for NFY

- Critical repairs effected
- Breakdown rate still high as expected
- Focus on documentation of best practice/PM revisions still outstanding
- Gaps raised months previously still not closed
- Decisions taken in previous meetings still not implemented
- Communication throughout the department poor - mixed, confusing and not OTL
- Reports not forthcoming
- Too much required , no structured way of getting the result
- No effective feedback loop driving the desired outcomes

I also added another micro loop from the learning of our newly formed level one structures. The proliferation of defect reports from age-old problems to new ones soon landed us in a catch-up mode. There were only so many problems for the few of us to tackle and the problems varied from long term engineering modifications to day-to-day immediately resolvable issues. We were soon so snowed under that we trying to focus everywhere while missing most of the easy to handle things. Feedback control wasn't good enough anymore. We also needed feed forward control. This marked the establishment of the machine focus groups. We split the plant up into focal areas and agreed to meet weekly to bring 'big' problems to the meeting for discussion - yet another meeting? The team felt strongly that despite the fact that it was another meeting, it was essential to limit the focus in daily meetings to here and now events and to carry the longer-term issues to another forum. Also, this forum would be a combined level one and two effort.

However, the problems at level two were starting to show. The level two members do not support the machine focus meetings. There is less and less level two involvement at FFA's. I have spoken to all the guys but everyone appears to be too busy with their own individual contributions. We hardly have level two meetings anymore and those that we do have are poorly attended. Apart from myself there is no real input from level two as the management or regulation team into level one. I have spoken to several of the team members about this including DM. DM agrees that the level two team is dysfunctional and some serious effort will have to be put into resurrecting the team. There is also general confusion as to what our role as system regulatory body should be. DM disagrees with control and regulation of the system by level two since the level one team should be self-empowered. I agree with this but even in autonomous subsystems do you need a regulatory function which is largely a result of self-regulation by the team with a sort of quality assurance management function to ensure systemic loops remain active. Level two should be constantly assessing the health of the systemic structures at level one to ensure the regularly occurring acts that should occur are in fact happening. They also need to create the environment for the things that are essential to systemic interaction such as: adequate communication channels, environment for OTL between individuals and teams, development of individuals and teams, adequate and timely information concerning big picture direction, balancing the tensions between level one teams to ensure interaction loops remain in tact, etc. apart from the all important task of moulding self-regulatory feedback loops to ensure the desired outputs at all times.

This is still going to take a while to get the team to think systemically. The addition to the action learning cycles is shown overleaf.



The importance of this integrated picture of our system and the interrelated dynamics as displayed in the CLDs has cemented the need for the changes thus far. The team could now see how overarching need for team development, partnerships and self-regulation. It is actually amazing to see the guys starting to run with the systems by themselves – running the daily meetings as we agreed, providing meaningful feedback into the maintenance and costing systems, and even the level 1 problem solving has visibly improved.

May month also saw the launch of operator training on a new lubrication scheme - machines that were not previously completed in terms of autonomous maintenance BP1. The main driver was to allow artisans time to do other more skilled maintenance tasks. In general there is a positive feeling of resurgence, individual

and team maturity is starting to show. There is far more communication on an ad hoc basis between meetings - issues getting carried over rather than dumped on the next person. Although there is still only a core of people doing this, accountability sharing is starting to take place. For me the biggest breakthrough was the team's ability to continue driving the systems even though I wasn't there- that was the start of success - the start of ownership. What made the 'core' different? Why were a few people taking charge?

I tried to analyse the behaviour of the team. I've said this several times since becoming involved with people management even at my previous employ: "I wish I had studied psychology!" I'm not sure what exactly it was – and I don't believe it was one particular factor – but all the one-on-one counseling, the motivating, the harsh management at times, the open forum debates, and even the head-on clashes, have all contributed in some way. It may even have been the month when engineering had to run the line alongside production. I noticed that the one big change that had taken place was the start of the formulation of new partnerships. DA, who was the one person who as chief racist point blankly refused to work with the black guys, was actually now engaging them openly about all sorts of issues. He had refused to attend meetings because "they" did not speak his language and now things had improved to the point where he was one of the key system proponents in meetings. The artisans and the shift supervisors had visibly changed their hostility toward one another and were able to engage freely in meetings and other forums – each tolerant of the other's view. The engineering guys were starting to actively coach the operators more and more, and the operators were more willing to accept such teaching. The guys were now able and quite happy to organise around non-routine operations such as early starts or late finishes without me having to mediate.

The positive spin-off is proving to be enormous! I now sit in a machine focus meeting and an artisan and shift supervisor will jointly agree to tackle something. Previously the "iron curtains" between production and engineering prevented even such a thought from being born. This seems like a small breakthrough but the result is that we are now finally able to get more done, more effectively. Operators and artisans tackle problems on the line together whereas previously as soon as a problem occurred, the artisan was called to attend to it while the operator took a tea break. The whole element of partnering efforts to achieve a joint purpose is coming through.

It is not yet happening throughout level 1 but I believe that if we continue to support this behaviour then it can only spread and improve in intensity.

The learning here as I had realized before but couldn't say with certainty until now, was that WCM was a non-starter without real partnerships – not just effective teamwork, but partnerships in teamwork. So where did we go wrong in the past? It is difficult to say but the change from a traditional factory setup to a manufacturing team type structure was effected by formulating "teams". When I arrived here these "teams" were really only work groups - people working together – not "teams". They were not (and still are not) an empowered effective system with a common purpose, understanding of what each member must do to collectively achieve this purpose, and with the understanding of how to regulate their system to achieve the desired outputs. The starting point to achieving this has to be the formulation of partnerships within the team and between interacting teams.

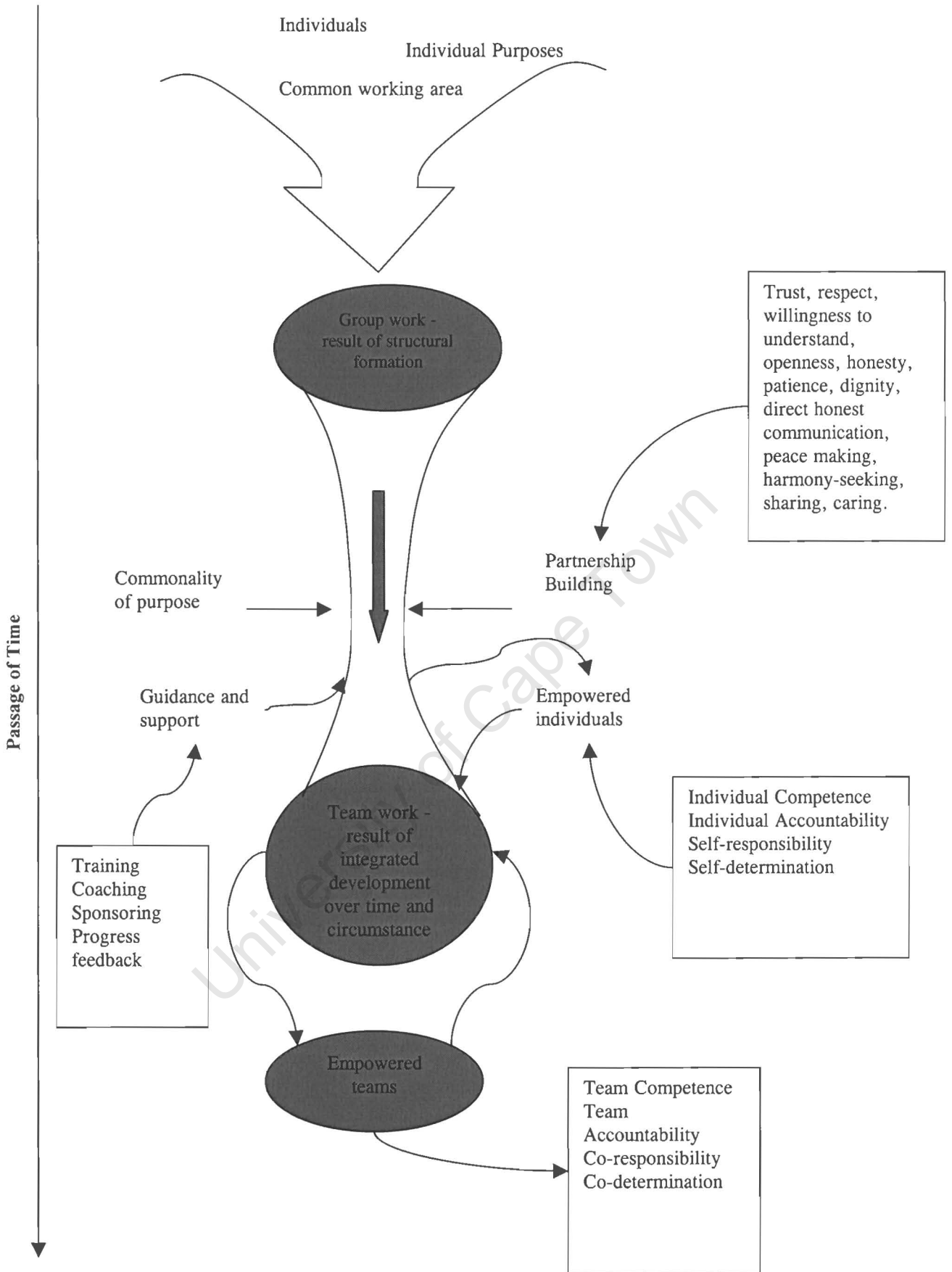
One of the key requirements then for WCM is to eliminate the barriers that lead to the formation of partnerships.

The other thing that I noticed was that certain members were more willing, more confident and more at ease with accepting responsibility – the kind that comes with decision making. Everyone wanted to be involved in decision making but few of the guys were willing or able to handle the consequences of the decisions they had made. I noticed that particularly among the engineering guys and less so with the shift supervisors, that they needed some reassurance that they would not be held accountable if their decisions did not work out. This was also changing as the guys got more and more used to the notion of action learning. I tried as far as possible to encourage the guys that to make an informed decision and to be wrong was better than to make a rash decision and come off OK due to luck. The most important part of decision making was to be able to think through the reasons for the decision and the potential consequences.

But this requires competence and I noticed that as the ego of a potentially wrong decision started to abate, the sheer inability to make a call came to the fore. People development was a serious issue – and one that this region of LSAM is particularly poor at. We have several guys that are barely literate and others who were on adult development programs ten years ago and have not been looked at since.

The key factors are thus related to the strength of the individuals, which drives team strength, and a strong team in turn develops individuals to be stronger. Intensive coaching, guidance, support and training also needed particularly in the establishment phase and of course time and experiential circumstance are all the factors that can guide a team from a group of individuals to a strong, mature, empowered team.

I think that a reasonable framework for thinking about effective work-teams in a WCM context would be as shown overleaf. From what I observe, a couple of thoughts around what empowerment actually means in a useful pragmatic sense have emerged as shown on the pages that follow.



## Empowerment in individuals



### Competence

Knowledge and skills to perform required tasks to the required standard and the ability to transform those skills in situ when faced with new challenges and the ability to problem solve around one's immediate area of competence and

### Accountability

The ability to take ownership of an issue as though you have a vested interest in it. Coupled with the ability to see-it-through to the end - whatever the outcome and the ability to accept the consequences of ones actions without looking for someone else to shoulder the load when things don't go well but rather to learn from the situation and put in place whatever is necessary to prevent a re-occurrence of a failure.

### Self-

### responsibility

The desire to be in control of and take charge of all that happens in one's life and the desire to react positively to those things that do not go according to plan by taking real steps to learn out of the situation. The essential attitude must be that personal choice has resulted in the outcome and not 'some force' has done it to me. Internal locus of control vs external dependency.

### Self-

### determination

Proper selfishness. The desire and will to succeed. The desire for constant personal development and growth and the disciplined determination to excel in every aspect of one's life

## Empowered teams

### **Team Competence**

The knowledge and skills to accomplish team goals in a way that transcends any collective effort but is rather a cohesive effort. Where cross-functionality is the norm and no one person is confined to one area of skill application. The ability to re-organize in order to face new challenges. The ability to generate evolving competence through combined problem solving.

### **Team Accountability**

The ability to take ownership of issues, processes, outcomes, problems and solutions in a way that allows continued learning, growth and development. The ability to keep track of an issue until closure has been reached and a sustainable outcome has ensued. The ability to formulate and implement action plans and achieve success through interdependency of team members. This stems from individual accountability in support for the team goals by each team member.

### **Co-Responsibility**

The desire to be in control of and take charge of all that happens and the desire to react positively to those things that do not go according to plan by taking real steps to learn out of the situation. The ability to address team member weaknesses and strengths in an open and honest manner that does not protect individual egos but rather protects the team's integrity. This stems from mutual trust, understanding and genuine partnering that arises out of the attitude that the team cannot succeed without each individual's input and that the team has a responsibility toward each individual in turn.

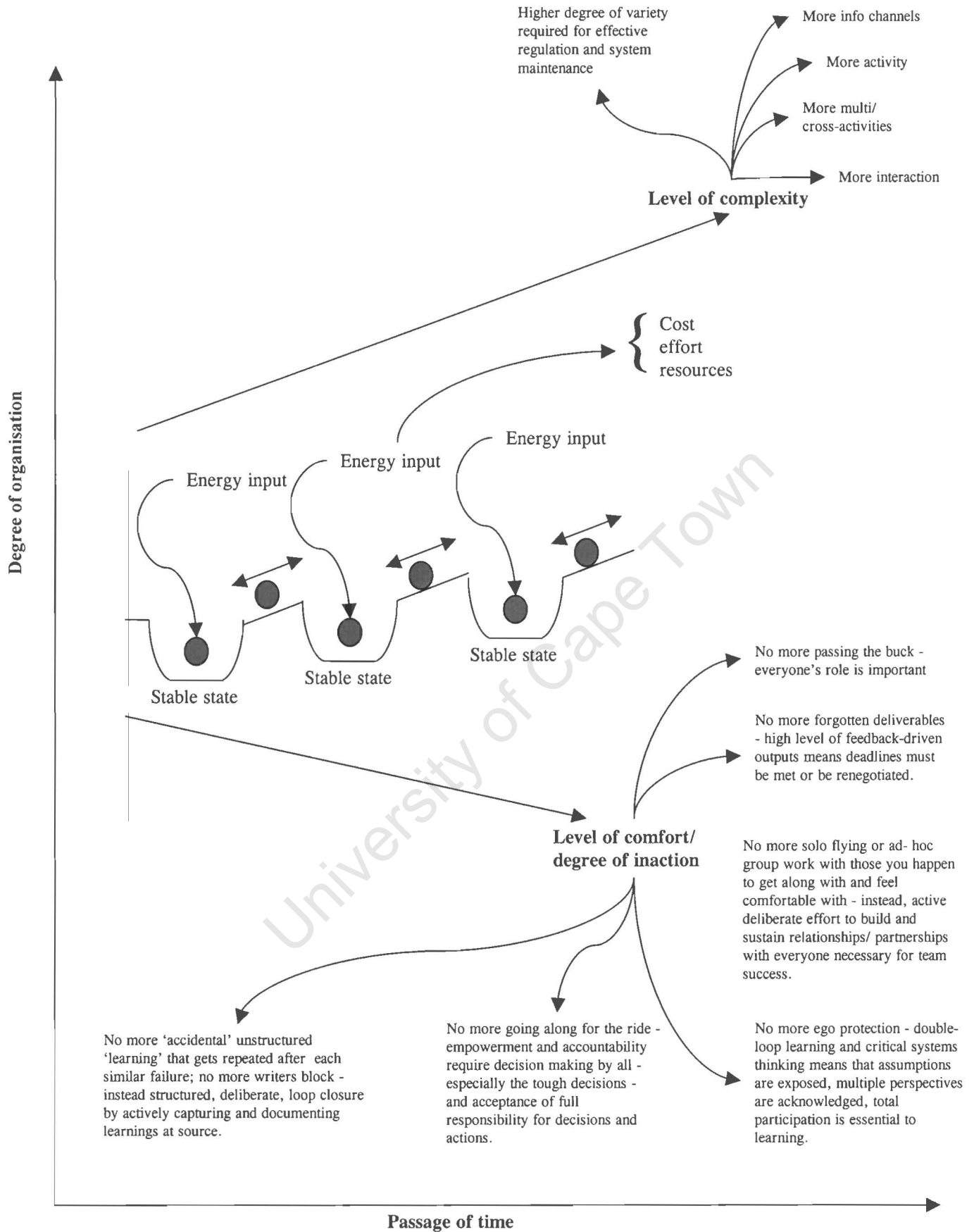
### **Co-determination**

Desire by each team member to see the team perform, succeed and develop as a result of the combined input by all. The desire to develop each team member through deliberate cross-skilling to ensure the long term viability of the team. The realization that the team is only one part of a larger organisation of teams that all have to survive in order for the team in question to survive. The desire and ability to align the team responsibilities with the requirements of the larger organisation.

I also noticed that the more interventions implemented, the more organised the team had to become in order to sustain the new systems and in order to live the process. This exposed those guys who were not pulling their weight and in several cases these were the guys who were opposing the interventions. For example, the shift supervisors welcomed the new maintenance planning focus, but some of the engineering guys did not because it displayed to all what their effort levels really were. Some thoughts on why this would happen from a systemic point of view: Cybernetically speaking, each intervention requires the system to move from one basin of stability to another at a higher energy level than before – a higher level of organisation. Thus as the system becomes more organised, the higher the degree of complexity and the lower the degree of comfort or inaction by system elements. The energy to sustain the higher levels of organisation must come from a combined effort by all system components. With highly organised complex systems it is easy to surface the non-deliverers. (see next page).

Also from cybernetics we learn that the more complex or more organised a system, the more organised the regulator has to be to cope with the increased requisite variety. Could this be one of the reasons why the level 1 teams had not been effective before – that the level-two management team lacked the requisite variety to manage a highly organised system? Too few resources to ensure system regulation through effective systemic loops of interaction, communication, feedback drivers, adequate information flow?

I needed to think about this one. I know that we are not functioning well as a level-two team, but I haven't assessed the detail yet.



## **22 July 2000 – Short interval measuring not short interval control**

The hard work wrt focussing on each problem at source as well as looking at the machines as specific engineering entities is starting to pay off. The breakdown rate is declining and continuing to do so. The successes have also spurred positive motivation within the level one engineering team to keep at it.

Despite the apparent success, I still have not managed to get the production line guys to respond to problems until they become out of control. Problems are loaded as notifications in SAP and issues are being raised at the morning SBU for attention during the shift-gap and on morning shift. However, the time delay is too big to be applied to all problems. Micro-stops, for example, are recorded but only reported the next day.

I had a chat to MC and MP about the issue and found that the SAP maintenance time and that recorded by the operators rarely coincided. So even our measurement was flawed.

I had a chat with the filler operators, the shift artisan, shift supervisor, TC and DM. They all agree that the delay is too long. There has to be a standard for triggering action. DM produced charts that were used in the Gauteng region where he was based before. They were quite useful in the sense that they emphasised short interval control. At the moment we were practising short interval measurement. The control bit was missing.

I discussed the issue with the supervisors, artisans and TC. They were all in favour of getting something simpler, more accurate and more visual on the line. We agreed on hand-plotted points for micro-and macro-stops. The control limit for each machine would be permanently drawn in on the graph. The operators would be trained on the use of the new charts. Up/downstream stoppages would also be recorded. This way we could tie up adjacent machine stoppages and hopefully get a more accurate picture of what was happening.

I drew up the forms and graphs and sent on circulation for review by all affected parties. I will be away for the next three weeks. This should give everyone enough time to review and comment/adjust by the time I get back.

## **31 August 2000 – Reflections of ... the way life used to be**

Having been away for three weeks (two on leave and one on training), has given me time to think about where we've come from, what we've done, what we've achieved and where we needed to go from here.

While I was away I was pleasantly surprised and rather impressed by the level 1 team's efforts to keep the MDT's, FFA's, safety meetings, SBU meetings, planning meetings, etc going. The guys were using the established systems to get things done. All was not rosy though, and there were several things that just came to a grinding halt – like the new short interval SPC charts at the line.

I had a chat to TC about this and he told me that he was concentrating on getting the product loss system to work. MP says he was not even aware of the level 1 SPC downtime system that we were introducing. He saw the email but was too busy with

all the time-and-attendance chores I left for him. SAP HR was not his strong point. I could definitely sympathise with that.

On the whole, I was pleased with the effort at level 1 but disappointed with the level 2 team's lack of involvement in assisting level 1 to maintain momentum. We were just not driving the standards, driving the essential feedback loops, maintaining the homeostasis. Having said that, the plant continued to perform well. The two consecutive training sessions I had held just before going on leave had not been followed up. The safety locks had not been ordered, the system had not been driven beyond where I left it. TC and MP were both apologetic but had no time. MP was also getting more and more fed up with the delay in his grade adjustment.

It suddenly dawned on me: all this time, I was so hell bent on getting things done that I was involving the rest of the team only when I needed drastic assistance. The entire approach to the change management at level 1 was being driven by myself with assistance from DM and MP in certain areas. We had not approached this as a team. I had not used the opportunity to develop the level 2 team alongside level 1. I kept reporting back at level 2 meetings and there was no great enthusiasm anyway for people to jump in and assist either. The team members, who would have been well suited to the task such as the training controller and the QA technologist/continuous improvement specialist, were busy with – well I wasn't actually sure. What was their role apart from scheduling training and doing WCTD audits? I discussed the matter with DM. We were not functioning as a team at level 2. He agreed of course and repeated how he had tried to develop the level 2 team in the past before I arrived but to no avail. The stuff had gone straight over their heads. He was also battling with the contribution from the QA bodies on the team who were non-value-adders in his opinion. Well, it was time to try again.

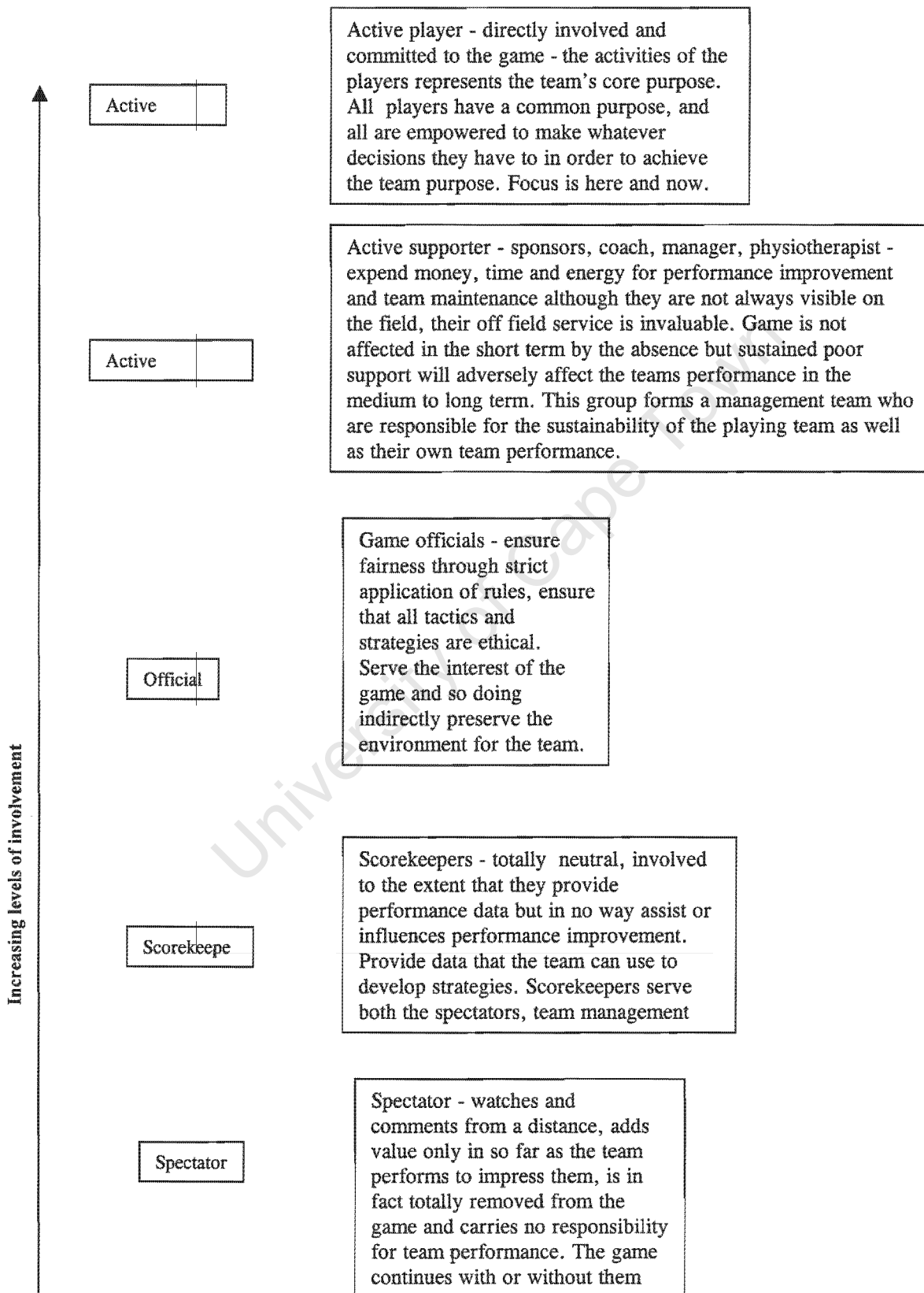
To use DM's sports-match analogy, the level of participation in what we were trying to do varied from spectator to active player. I depict my thoughts overleaf. In a rough assessment I placed most of the level two team into either 'scorekeeper' or 'spectator' mode.

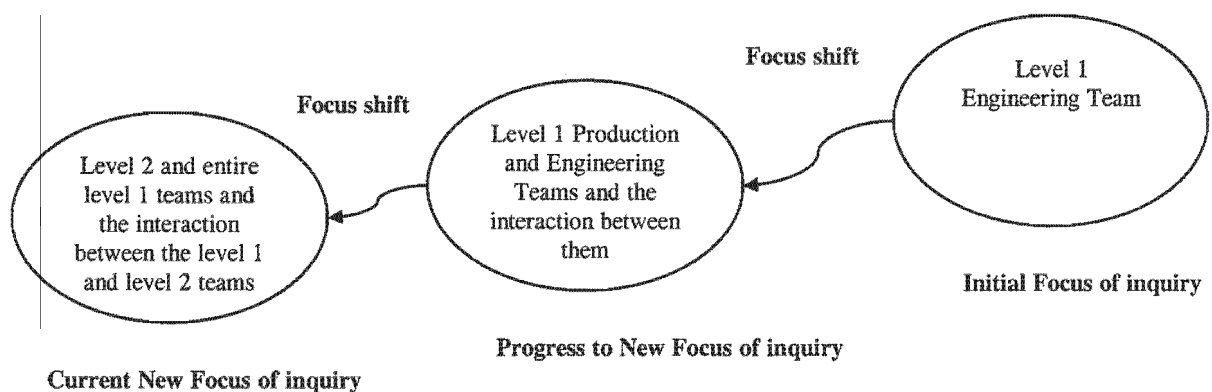
I thought about what we were trying to achieve. We were trying to develop level 1. However, the level 2 team as the regulator of the system was not being developed to take on the new role of system regulator. Until now we had been so busy with level 1 stuff that we were unable to drive the systemic loops. However, now that level 1 team is developing, what will our new roles be? We hadn't actually thought about it. Hence the teams reluctance to drive the right behaviour at level 1 – they are not quite sure of what it entails to achieve this!

I sketched my thoughts on the issue. It is almost as though we have been following a single loop learning approach instead of double loop (not in the Agyris sense, but in a systemic sense). We were attempting to transform one part of the system (the doing part) while keeping the integrally linked regulating part of the system (controlling part) unchanged.

I tried to reflect on why I had done this. The reason is of course that I had defined the level 1 engineering team as my system in focus and everything around it as the environment. As the research unfolded, the entire level 1 (interaction between engineering and production) became important enough to be included into the system in focus. And now, the next step would be to include the interaction

between level 1 and level 2 onto the system in focus. Thus during action research as expected the focus of inquiry evolves continuously as the learning cycles progress.

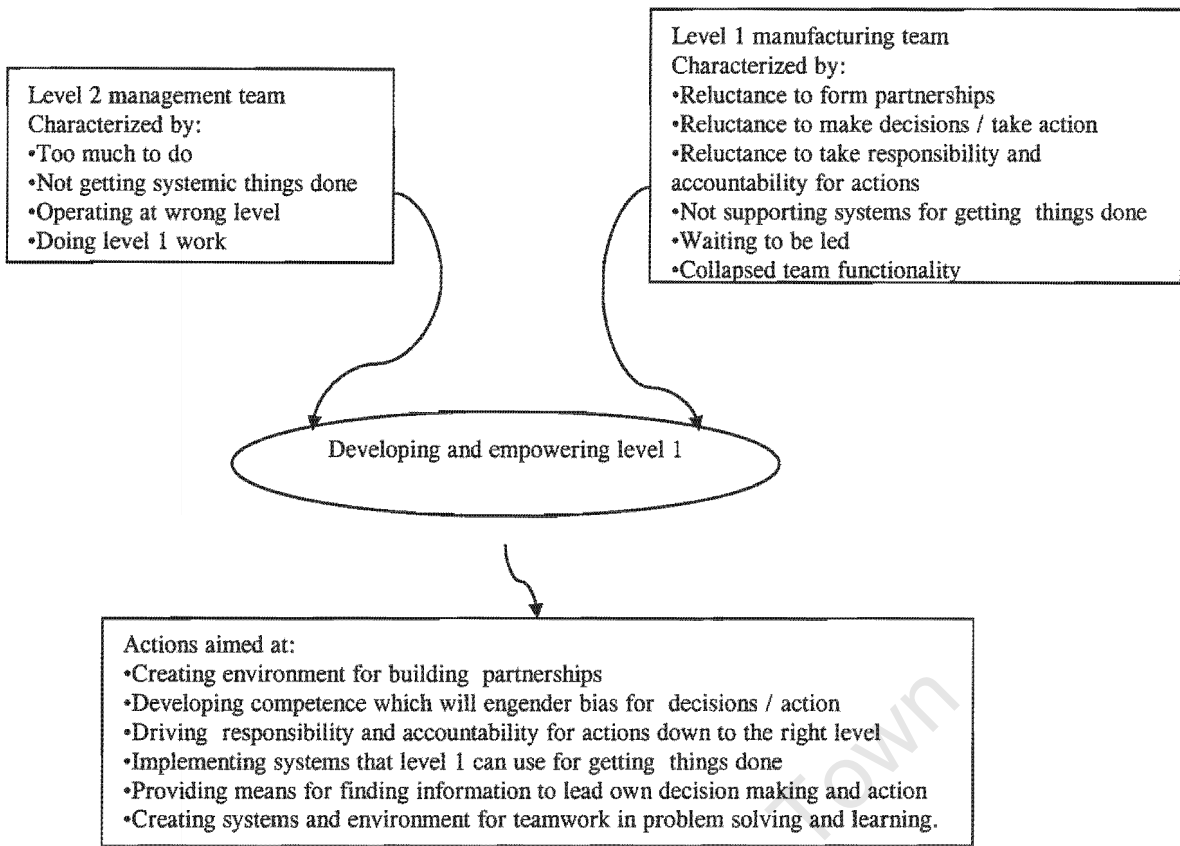




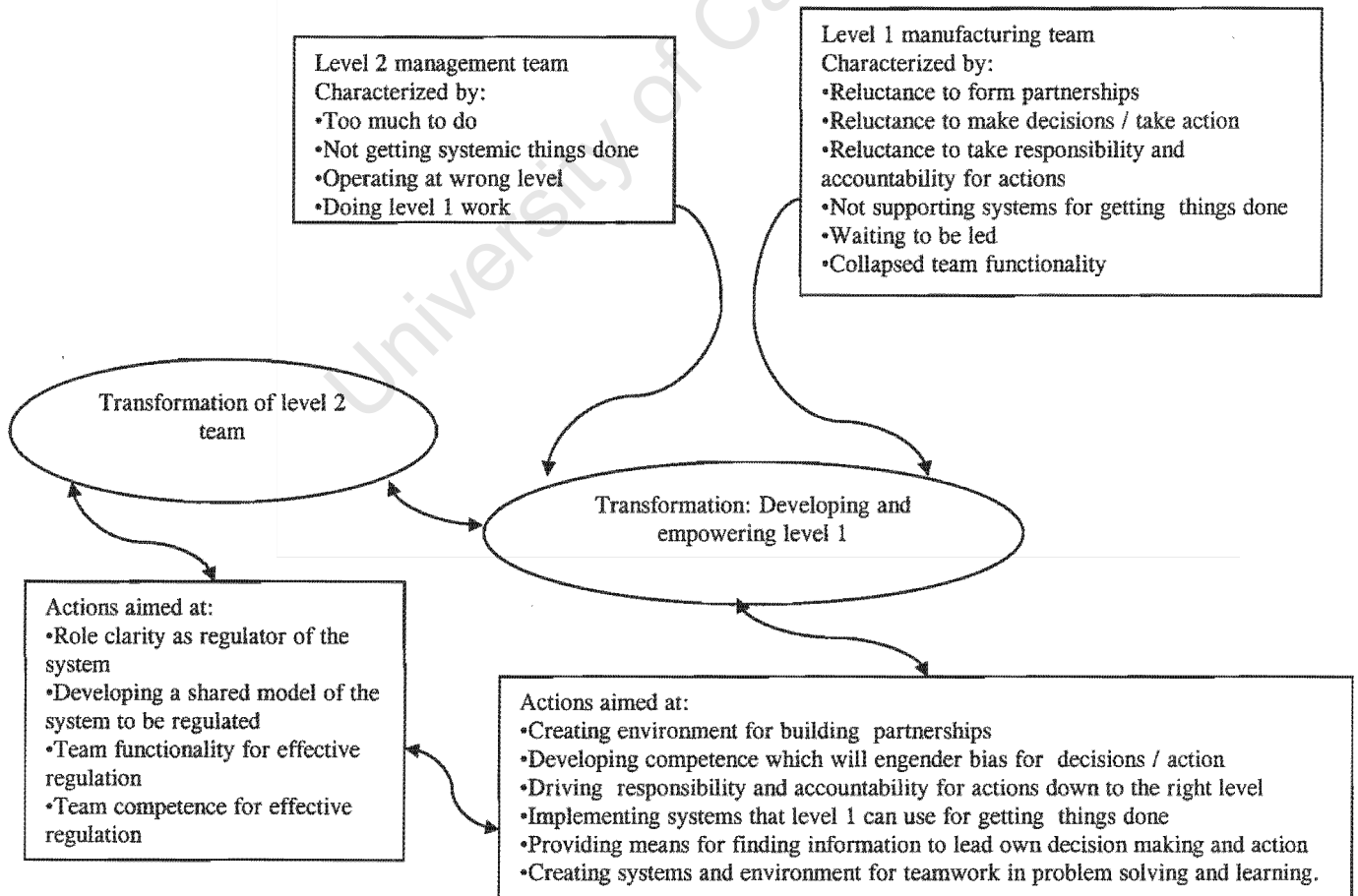
The 'single-loop' vs. 'double-loop' approach is shown overleaf.

What exactly is it about level 2 as a management team that makes us dysfunctional? I know that we had received two bad reviews from level three in the last two team reviews. Apart from the fact that I believe that the review itself was a textbook management failure that left us demoralised for weeks, I nevertheless think that the warning signs were there as early as last year. If I really think about it then I honestly cannot say that I know what any of my team-mates' duties are, never mind their roles as team members. I certainly cannot say whether my daily activities are in line with the team's expectations. In a cybernetic sense, if we were to take our team as a management system, then we have not defined our purpose, the inputs and regularly occurring acts (transformation) required to achieve the purpose or the essential feedback loops necessary to drive the transformation. So we have no means to manage our own performance and therefore as a management team have not yet grown to understand what it is that we need to do collectively to achieve total level one system regulation.

With these ideas in mind I chatted to DM, TC and MP about system regulation. There appears to be a reluctance to actually go out and manage. The terminology of managing and regulating seems to be a problem. The feeling is that level 2 should not regulate or manage level 1. Level 1 should be self-regulatory and be self-managed. DM's feelings are that if level 1 actually do what they are meant to do then level 2 can concentrate on what they need to do. While this is all fine, where have we actually defined the regularly occurring acts that constitute "what they are meant to do" and "what we are meant to do"? The bottom line is that systems by definition are self-regulatory and unless the self-regulation is modelled around desired outcomes, we as level 2 management will have to get involved to build the systems required to achieve overall system purpose. There appears to be confusion between cybernetic principles of regulation and the Taylorist model of controlling a "first class man" according to a strict task-time schedule. We will have to work through this as a team.



I was doing the above, when we actually needed to do the following:



I also looked critically at what we in packaging engineering had actually learnt as a team. We had managed to stop certain repeat failures, we had managed to effect much needed plant repairs and we had managed to solve problems that had plagued us for a long while. We are far more aware now about where the key performance problems were and all in all our level of plant attention is much higher than before. But have we actually learnt anything and how do we know?

Going back to the learning cycles of Handy, Kolb, etc it is clear that all our learning has been individual and tacit. Apart from this research report, none of our learnings have actually been documented explicitly. The actual records are available in the form of work orders, project files, meeting minutes, new systemic structures actually in place e.g. machine focus groups, etc but no coherent documentation recording our learnings exists. This brings us back to the essence of Best Practise as a corner stone of WCM. Loop closure by documenting best practise is considered essential for organisational learning. I put the question to DM. Of course, he disagreed that we had really achieved anything because the BP manuals had still not been updated with our learnings along the way. For him, that is the most important step in any change process. He believes that the BP manuals should be the organisational bible against which all activities are done and as continuous improvements are made, so are the BP manuals updated.

I started to analyse why I had not felt the need nor made the time to actively update the BP manuals. I remember doing several BP updates in preparation for the ISO 14001 implementation. Admittedly, I haven't looked at them once since the ISO accreditation. I once again spoke to the team about the use of the BP manuals. I remember doing this when we just started implementing FFAs at level one and even then there was a huge reluctance to work from and update these manuals. My own personal experience is that the engineering manuals are virtually non-existent. There are cover pages and divider cards for each section but no contents – as though someone had to get them done but the quality was not important at the time. The tedium in getting the production manuals changed for ISO preparation certainly has put me off the task of revisiting all the engineering manuals.

I engaged the team about the BP manuals. Firstly, not one team member saw the benefit or reason for their existence. Several of the guys had not been involved in the development of BP and therefore did not identify with them. Being old hands (neither of the two new guys are still with us) they believe that anything there is to know is "up-stairs". Through the discussion I learnt that it is not so much a case of wanting to work without having to reference a manual, since most guys have made their own little dossiers over the years containing technical notes about their learnings on the plant. The big issue was that in the past someone else used to record all these new learnings. When an artisan would open a gearbox, for example, that had no plant history documented, some other person such as the planner or filing clerk or someone would come down to the workshop and make a record of all the spares involved so that the bill of materials section of the BP manual could be updated for that plant component. Since these 'scribes' had left, no more records were being made. I realised that we were back to our system proponent problem.

I think the essence of what is being said by the guys is that there is currently no defined system for capturing BP. We do not have a change management system – the plant modification control system we are currently using is a manual system until

the actual electronic version is back on-line. There is no real problem with the paper system although it has already been decided at national level to abandon it in favour of a SAP documentation control system that will incorporate the change systems. The essence of the problem is that there is no regulated, defined system for documenting changes. No one sees making changes to BP manuals as their job – certainly not at level 1. At level 2 we have been talking ad nauseam about updating BP manuals but the reality is that without management of the process the output is never going to materialise.

Why the resistance? I have the guys' views – they don't use the manuals because they feel they do not need to. I personally believe that the real benefit comes from updating the maintenance programme – changing the maintenance schedules and work instructions. But we have a separate system for those so why duplicate the change again in the BP manuals? The question has to be asked, are our much sought after BP manuals really a true reflection of what we aim to achieve with WCM? Have we chosen the right system to reflect our Best Practise strategy? If these manuals are not useful at the level for which they are intended then have we populated them with what is meaningful to achieve our outputs?

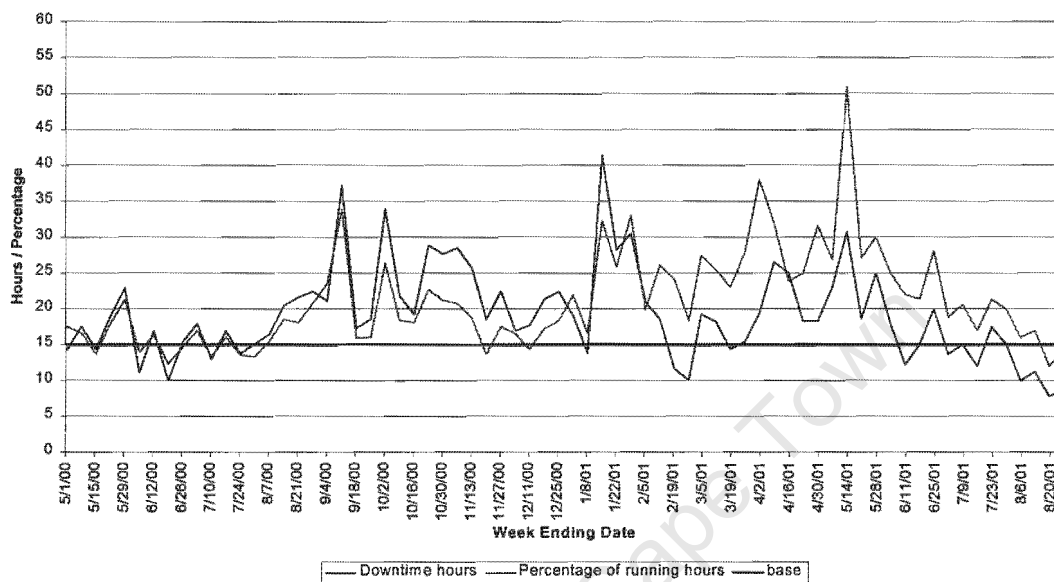
I asked the guys how else they would ensure organisational learning was captured. This sparked a whole new debate around organisational learning. The guys believed that they had not really learnt anything because they are never sent on courses like their colleagues in other departments. The lack of competence development and lack of job-enlargement came up again as it did months ago. Perhaps the problem is that management and staff are not even able to agree on what constitutes organisational learning. There is no common vision about the extent to which problem solving, loop closure, documented best practise and competency acquisition each contribute to organisational learning.

I think that until we have an effective change management system in place we will not achieve loop closure in the sense of updated BP manuals. We may have to look at why we so desperately want to use this form of loop closure. What other mechanisms do we have for measuring and managing continuous improvement? If BP updates are all we have and we haven't updated most of our BP manuals since 1995 then we should seriously question the validity of our claims that we are a WCM organisation! As harsh as this sounds, if we are that serious about continuous improvement then we should have a system in place to manage continuous improvement. If continuous improvement is managed by stretching our goals every year to meet new and more challenging targets (and we actually do this well), and this mechanism works for us, then why the insistence on BP documentation? Do we really believe that it is imperative to record the reasons for our successes and the root causes for our problems? If so, then we should actively implement a management system that will ensure that our BP manuals reflect our current best practises.

Looking at our plant performance over the last three months certainly gives me the impression that we are on the right track. We haven't yet settled ourselves into the new systems in a way that embodies total self-regulation but there is sufficient drive and belief in what we are doing to at least focus on the right things. Our response to problems has improved and our ability to prevent repeat failures has also improved. The result is that the plant is starting to receive the right level of attention. And perhaps this has been the key all along – focussing on the right things in the right

areas, reporting source problems, reacting timeously to them and ensuring that these regularly occurring acts do happen and that they do deliver the right outputs. Having said that, we have a long way to go and in particular we will have to pay special attention to people development and loop closure if we are to sustain our current success.

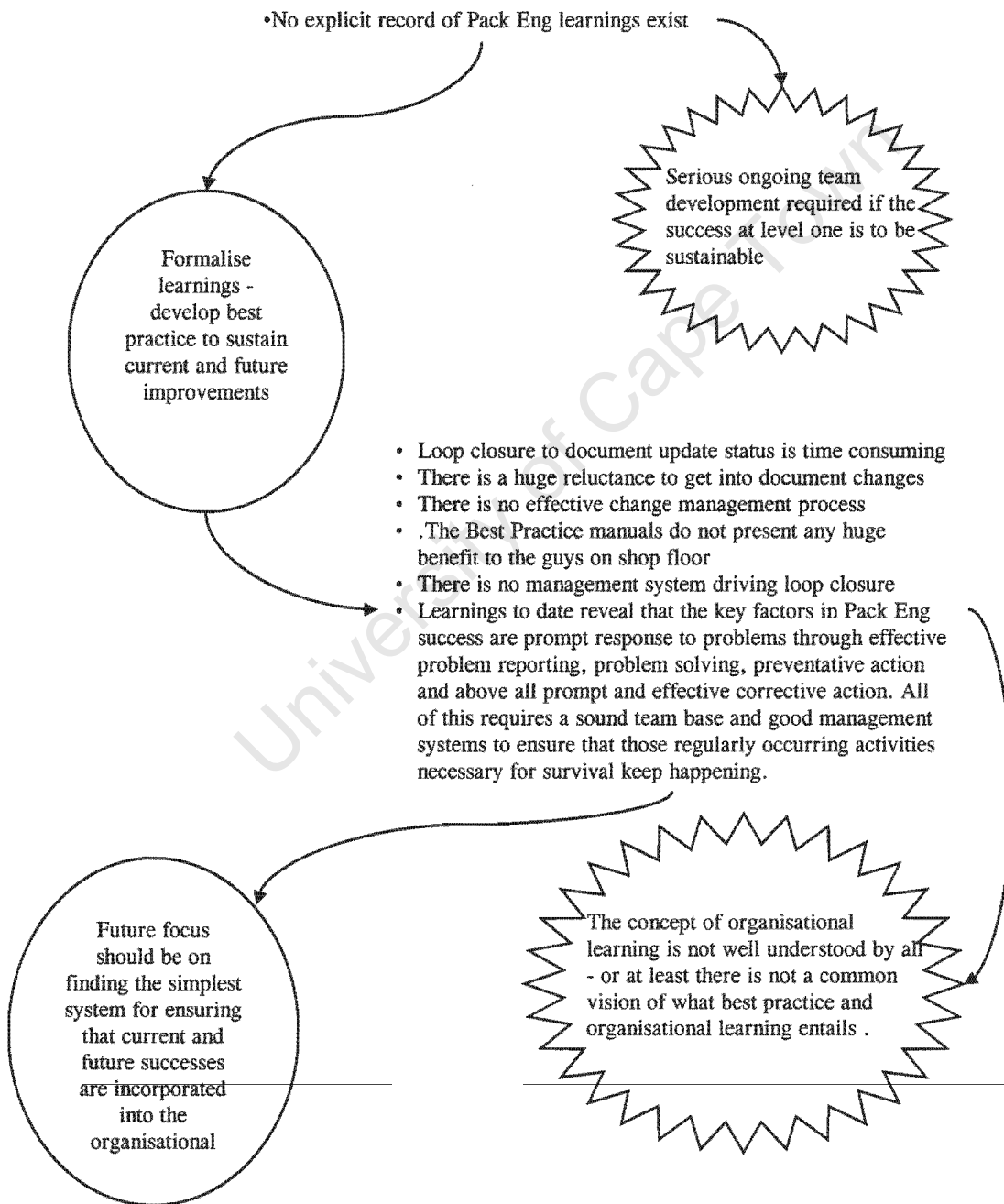
### Total Downtime



What will the future hold for this group? This concerns me a great deal. In particular, I will no longer be this closely linked to the day-to-day activities of the team. I have moved on to a new position that spans two departments and will require a different level of operation if I am to maintain engineering standards. Getting bogged down in daily problems while still trying to manage at the correct level is not going to work given the extra workload of two very different production departments. I have handed over the day to day system maintenance to MP who as an engineering controller is more than capable of handling this function. I will continue to look at the medium to long term issues. The continued success of our efforts to date will depend largely on how well MP takes up the challenge. The role that I played through my presence in daily meetings, weekly planning sessions, and daily FFA's, weekly machine MDT's, monthly safety meetings, etc was, in a systemic sense, a powerful feedback mechanism. It was aimed at ensuring that those regularly occurring acts essential for system maintenance always occurred so that the essential system outputs were always in control, and where this was not the case, suitable problem analysis was done and corrective actions were taken. We had already learnt through this research process that the whole notion of a team being able to sustain the loss of an individual relies on the systemic role of that individual being fulfilled by the rest of the team or someone else. It is therefore essential that MP slot into that role immediately. However, I do not foresee this happening soon as MP and DM have yet to resolve MP's grading issue and this has driven MP into a low motivational 'go-slow' approach that is not being managed well by DM. I have confronted both of them on the issue but MP will not even negotiate his position while DM is waiting for the HR fraternity to make up their minds as to which way to go.

Although outside of the scope of this research, I will continue to monitor the situation in terms of plant performance and system functionality to ensure that we do not pull too far back. In fact, as mentioned earlier, if the level two-team members start functioning as an effective management team then we will be well placed to sustain the current successes.

The additional learnings from this last reflection have been added to the overall learning loops below.



## **APPENDIX 2: ACTION RESEARCH REPORT**

### **A CYBERNETIC APPROACH TO WORLD CLASS MANUFACTURING**

**BY LAUREEN VAN ASWEGEN**

**AUGUST 1999 – AUGUST 2000**

University of Cape Town

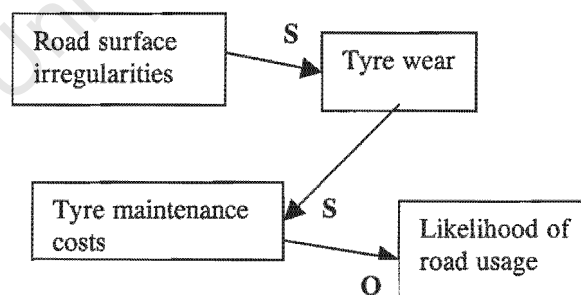
## INTRODUCTION

This action research report presents the learnings surfaced from the actual events over the past year as embodied in the ethnographic research journal (appendix 1).

The findings are presented and discussed as themes and patterns that emerged from the research data. These patterns are presented in 'recursive layers' from consolidated thoughts down to the detailed interactive loops that make-up these consolidated themes.

Throughout the action research process, I found it extremely useful to draw together thought schemas from the narrative (journal entries) and raw data. These thought schemas are in the form of pictures that range from simple explanatory theories to predictive situational models. For each action research cycle, the initial situation diagnosis is presented as a 'story loop diagram' (SLD). This is essentially a representation of the connection between events that appear to be telling a story about how the system is behaving at the time. This SLD is essentially my first pass at a theory about the system's behaviour. The loops represent relationships between system concepts that are not necessarily causal in nature but could be. The SLD suggests leverage points for intervention. Following the action research process, the planned intervention is implemented and evaluation follows. The evaluation of the action taken allows one to significantly update the SLD into a firmer theory about the nature of the relationship loops. Thus a causal loop diagram (CLD) emerges that forms the basis of a theory of system behaviour which can be explored during a subsequent action research cycle.

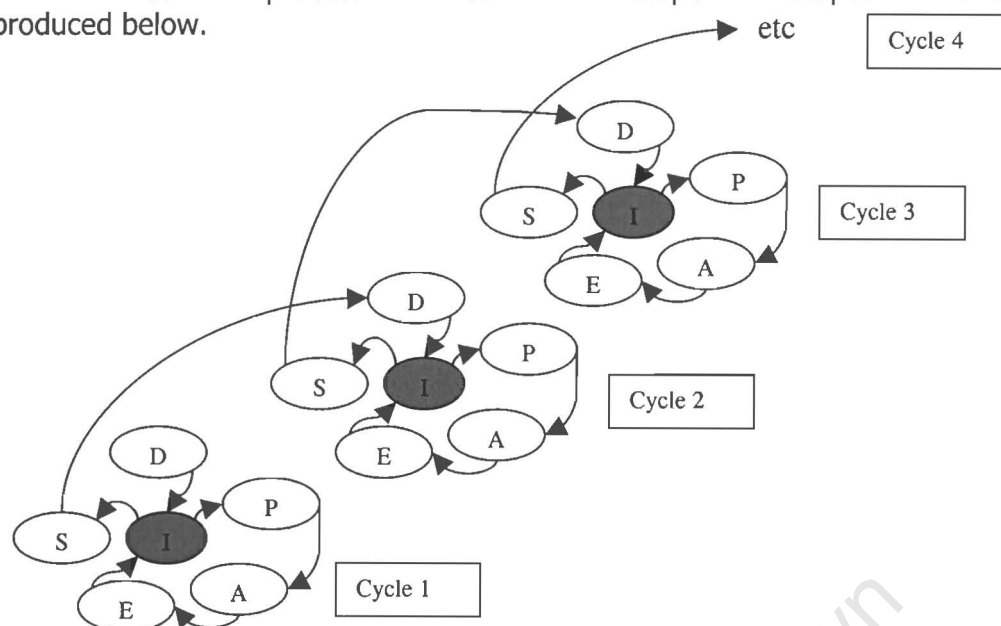
The methods for drawing causal loop diagrams are described in Goodman (1997)<sup>43</sup>. The activities or behaviours being linked have to be written in such a way that they can be described quantitatively. These statements therefore have to be as neutral as possible without losing the essence of the activity. For example, if one wishes to describe a possible causal relationship between a badly surfaced road, tyre damage and tyre maintenance costs, then the following conventions should be followed:



The "S" signifies that the causal link between two activities is believed to be in the same direction. The "O" signifies a causal link in the opposite direction. This CLD example would be read as follows: the *more* the road surface irregularities, the *more* the tyre wear, the *more* the maintenance costs, the *less* likely you are to use the same road.

<sup>43</sup> Goodman, M., 1997. Designing a Systems Thinking Intervention. Pegasus Communications. Cambridge MA.

The action research process followed was developed in chapter three and is reproduced below.



**Figure 1. Action Research Process Followed**

As discussed earlier, each Diagnosis and Inquiry loop results in an SLD that suggests a Plan for Action. Through Evaluation and Inquiry of what transpired during the Action step, Specific learnings are captured in the form of CLDs. The CLDs are tested by reflection against the "improved" situation by moving through the Diagnosis to Specific learnings in a new loop. New CLDs are developed. This process continues as the research process develops.

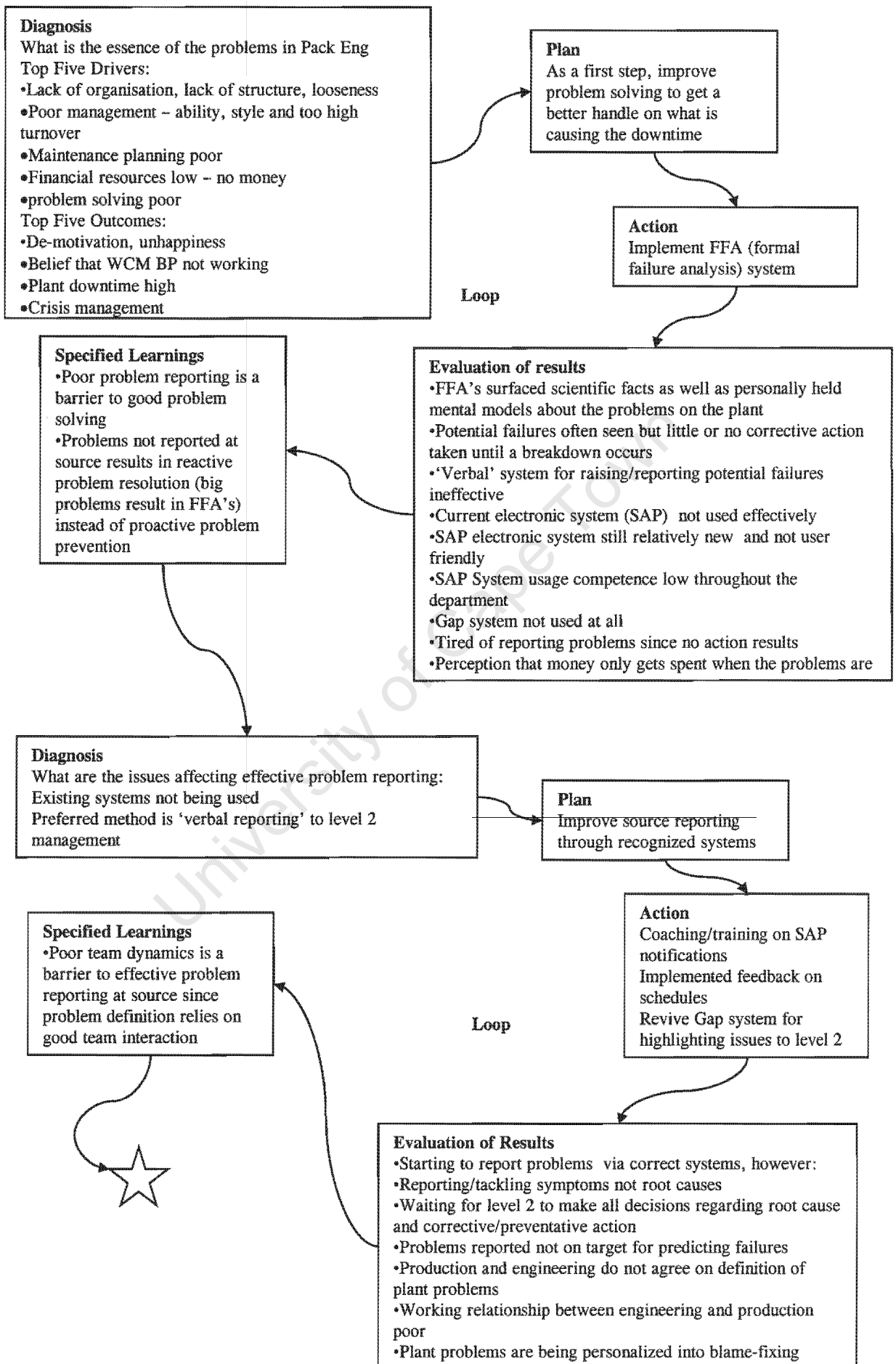
Through ardent implementation of the methodology presented here, I took the group through sixteen learning cycles, which upon further reflection, could be structured into four higher level learning cycles each with a thematic learning outcome.

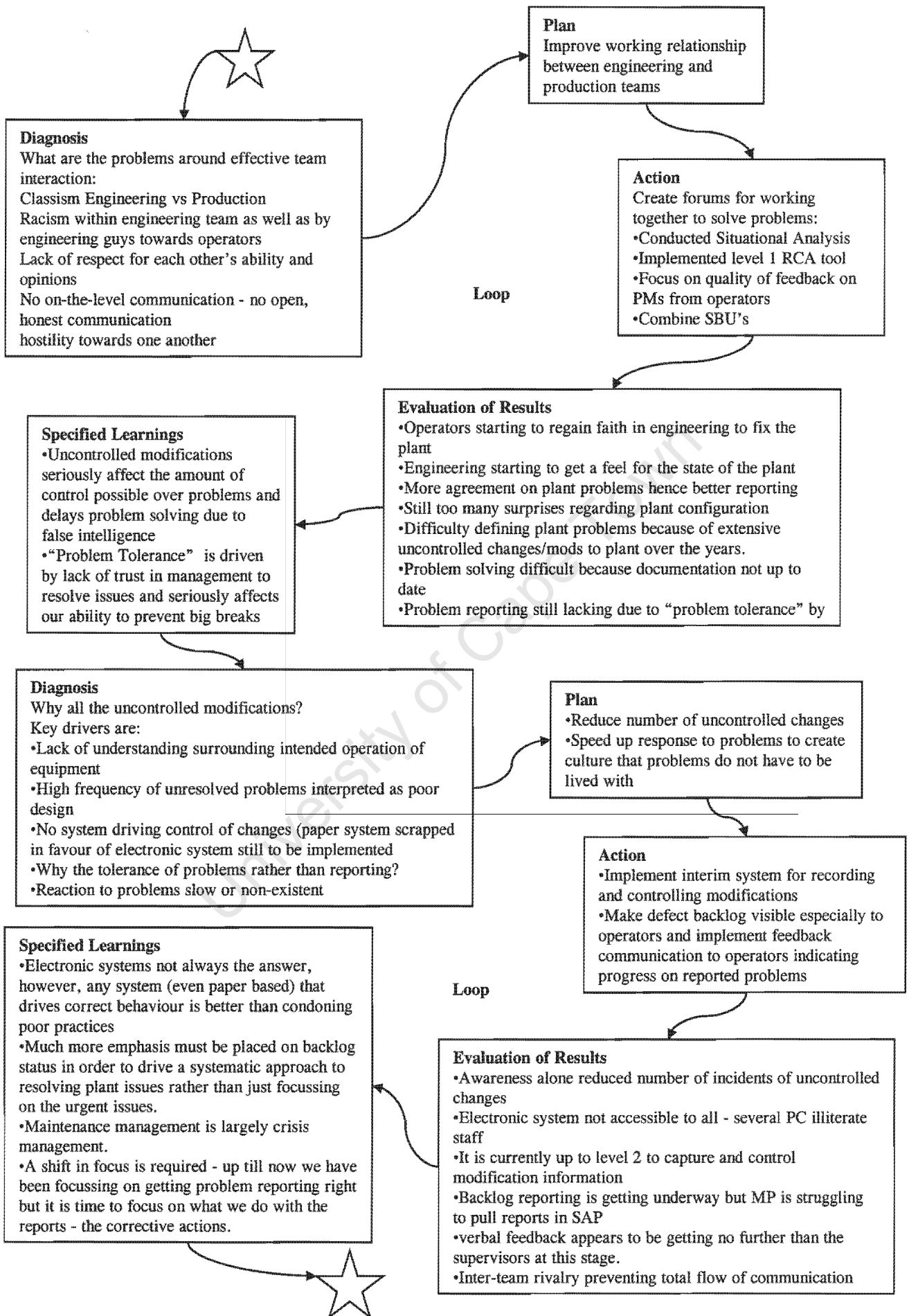
A summary of the overall learning cycle is shown overleaf in terms of the four main loops. The first action research cycle spans the period from August 1999 to November 1999 and presents the learnings in moving from a situation of chaos to building internal intelligence on our problems. The second cycle from November 1999 to February 2000 tracks our learnings from inaction to meaningful action. The third cycle from Feb 2000 to May 2000 summarises our learning at a systemic level having been subjected to team disintegration and rebuilding. The fourth cycle from June 2000 to August 2000 presents a reflection of our progress and an evaluation of the new challenges facing the team as it moves into the future. This last cycle is incomplete as it points to future action, which has to be evaluated at a later stage as part of the ongoing learning and continuous improvement in the department.

The discussion that follows each cycle is a summary of the learnings throughout the action research process. The finer details of how I progressed from observation to learning including all my thought processes to this effect are contained in the ethnographic research journal.

The details of each loop are shown in the pages that follow.

**Loop 1 -From broad sea of problems to first major learning (Aug 99 - Nov**





## **1. First Learning cycle – Uncovering the problems**

In a highly complex, high-speed operating system such as this, internal intelligence is essential. There has to be mechanisms and systems in place to reliably assess impending problems so that these can be resolved speedily. Tackling the wrong things or still worse waiting for small problems to result in a crisis before taking action are signs that firstly, there is an inability to notice problems and secondly, there is an inability to amplify problem reports to the level where it will receive attention.

### **1.1. Problem solving routines are essential for understanding problem causes**

Formal failure analysis (FFA) sessions are not only useful for revealing the root causes for problem occurrences, but are also useful ways for management to surface personally held mental models about why things are the way they are.

Making these assumptions explicit can reveal how everyday decisions and management action drives the wrong behaviours. In this case we found that insistence on electronic means for problem reporting in a workforce with very low computer literacy and little access to PC's has made problem reporting at source difficult. Coupled with this is the fact that verbal reports are not effectively translated into some management system and appear to be largely ignored until a crisis ensues. Those reports that are heard by management due to insistence by some of the workforce enjoy delayed response seemingly due to financial constraints. With the amount of crisis management that was happening at the time – management becomes good at handling crises. Apart from the inconvenience of reporting problems, the above also drives the message that 'we may as well not report anything until it is too late – in that way the problem gets immediate attention and money to resolve'.

### **1.2. Problem definition requires effective team work**

I found that even with a fairly simple well recognised system for problem reporting and highlighting for action, the problems reported were not on target for predicting or preventing several of the failures. The reports were largely symptomatic and these were not effectively translated into root cause. The problem stemmed from poor working relationships between production and engineering teams and within the engineering team itself. The working relationships were so bad that team members were unable to have a meaningful discussion about the plant issues without becoming aggressive and argumentative, and hence could not agree on either problem definition or root causes. The result of this was that ownership for further analysis on low quality reports was relinquished to level 2 management – increasing the workload at the wrong level.

Poor quality reporting via the correct management systems are as bad as random unstructured verbal reports because the time required to attend to them or the time taken doing the wrong things negates the value of problem reporting at source.

### **1.3. A healthy working climate allows for meaningful information sharing**

It is not always possible to remedy deep-seated relationship problems overnight. However, by implementing root cause analysis tools that forced teams to work together to find problems and their origins, I was able to slowly improve working relationships over a period of time.

The more team members have to interact with one another, the easier it becomes to share meaningful information.

Sometimes, when emotion and irrationalism is taken out of the equation, we find legitimate factors that gave rise to the initial confusion and conflict. In this case we found that several uncontrolled and hence undocumented changes had been made to the plant over the last ten years. Lack of knowledge about these changes often resulted in conflicting information about plant problems and hence some of the confusion.

The new-found communication with the production staff revealed a problem-tolerance. When there is a history of little action and low response to problem reports, then frustration is often followed by a tendency to live with the problem.

### **1.4. Problem Intelligence is but the first step**

We were getting better at defining our problems at source. However, our response to these problems was as poor as ever. We were only focussing on the urgent issues.

The inability to systematically implement corrective action in a structured fashion despite the best reporting processes points to a failure in the maintenance management system. This not only results in the problem tolerance and crisis cycle, but also fuels the uncontrolled modifications. People at shop floor are forced to 'make-a-plan' while waiting for management to take some decision towards corrective action.

This completes the first cycle of learning from being faced with a sea of problems to actually finding the best ways of defining and highlighting these problems for easier, speedier and targeted corrective action.

The next cycle shows learnings around the barriers to taking this meaningful action and how these can be overcome.

**Loop 2 -Establishing the core issues (Nov 99 - Jan**

**Diagnosis**

Why are we taking so long to respond to problems and why do we only seem to respond in emergencies?  
 •Looking back, all the interventions to date were done in an attempt to isolate the problem - not fix it.  
 •There was focus on finding our problems through root cause analysis, reporting of problems at source, working together to find our problems. But, there was a lack of purposeful, meaningful action.  
 •The actions that were recorded were not getting done. Our maintenance effort was haphazard - crisis management - a lack of structured maintenance management processes (random events that happen to coincide like Brownian motion).

**Loop**

**Evaluation of results**

•Focus on CMs (fixing) only, no time for PMs  
 •Resource planning poor  
 •Planner competence an issue  
 •PMs not always effective in identifying potential failures/predicting failures  
 •Best Practice not reviewed - organisational learning form maintenance PMs ineffective  
 •SAP maintenance system cumbersome and not well entrenched.

**Plan**

•Improve maintenance planning and execution processes

**Action**

•Maintenance planning process interrogated and formalised from defect report through to completed action.

**Specified Learnings**

•Maintenance planner's competence is a key factor in ensuring effective maintenance planning.  
 •The use of electronic systems without proper training and entrenchment negates business benefits.

**Action**

•Maintenance Specialist Course  
 •BIS support brought in to entrench systems usage  
 • Refresher on TPM  
 •Training on MS project and how to download plans from SAP to MS project  
 •Continuous hands-on coaching and support for several weeks  
 •Focus on PM quality ito frequency, standards, etc.

**Plan**

•Rigorous training for maintenance planner

**Diagnosis**

•Problems with getting to grips with SAP is a divisional gripe at this stage but the tool is here to stay.  
 •Planner's problems not only confined to difficulty with SAP but also struggles with producing plan in any software and is not intimately offay with TPM - espoused theory is TPM, while theory in use is breakdown maintenance.

**Loop**

**Evaluation of results**

•Planning more structured and delivering better results, however:  
 •Planner overloaded with level 1 issues  
 •Level 1 team not committed to plans since they are not party to resource allocation  
 •Resources in engineering a limiting factor  
 •Costs control at level 1 non-existent  
 •Spares management limiting engineering performance  
 •Level 1 decision making happening at level 2

**Specified Learnings**

•Even a competent planner cannot and should not do planning in isolation of the team  
 •Level 1 lack of ownership and bias for action is hindering effective maintenance practices  
 •Financial management and spares management requires a team effort - currently handled solely by planner with poor results.  
 •Resource management is key in any human activity planning process



**Plan**  
 Improve level 1 involvement  
 in all aspects of maintenance  
 management.

**Action**  
 •Implement planning meetings  
 where the level 1 team can  
 influence planned tasks and  
 resource allocation  
 •Implement ownership for  
 maintenance cost within budget  
 •Implement direct interaction on  
 weekly basis between shop floor  
 and main supplier

Loop

**Diagnosis**  
 What are the issues preventing maintenance planning  
 entrenchment throughout the level 1 team?  
 •Resource management affected by missing bodies  
 (vacancies not filled) - puts strain on rest of team  
 •Planner has preference for certain artisans - workload  
 not spread evenly - this makes the 'non-favorites bitter  
 and withdrawn  
 •Skills base is uneven - not all artisans can be used on  
 all areas of plant and with favoritism the skills base is  
 not being broadened.  
 •Artisans do not interact with suppliers at all - MP has  
 to do all spares inquiries  
 •Artisans do not have access to budget, and have no  
 idea of how much spares cost that they draw out of  
 stores - attitude that it is company money so it doesn't

**Evaluation of Results**  
 •Spares control at level 1 working much better - QC on spares  
 at source has cemented supplier relationship with team  
 •Cost ownership starting to take off but poor understanding of  
 accounting practices around spares purchasing and stores  
 withdrawals makes finance tracking difficult  
 •Quality of maintenance execution is becoming an issue -  
 despite better planning and execution  
 •Interactive maintenance planning involving level 1 directly in  
 planning decisions has improved level of maintenance

**Specified Learnings**  
 •Financial control is not possible  
 without expense tracking  
 •Poor quality of maintenance  
 execution is results in rework -  
 this negates good up-front  
 planning

**Plan**  
 Improve accounting practices  
 regarding spares procurement  
 and stores issues.  
 Improve supervision and QA  
 on maintenance day.

**Action**  
 •Agree and implement process for correct  
 capturing of costs to the right cost centers and  
 GL accounts. Involve Pack Eng. team and  
 stores.  
 •Make cost reports more visible to shop floor -  
 visual displays in SBU room.  
 •Involve level 2 team in maintenance day QA to  
 assist supervisors in terms of driving  
 performance to standards.  
 •MP's role changed from chasing last minute  
 spares to 'project manager' on the line to  
 ensure tasks executed on time and to standard.

Loop

**Diagnosis**  
 What are the issues preventing maintenance cost  
 /expense tracking and why the poor quality  
 maintenance?  
 •Accounting practices surrounding stores issues not  
 good - costs not allocated to specific machines but  
 mainly to general spend  
 •MP creates work orders for the purpose of purchasing  
 bulk spares instead of creating purchase documents  
 against the existing work orders - creates journal  
 inaccuracies  
 •Supervisors and MP seem to be using maintenance day  
 to catch up on admin work such as SAP time  
 management leaving shop floor without supervision or  
 QA on maintenance execution.  
 •Competence issues are not addressed especially with  
 temp operators  
 •Time pressure to get jobs done due to peak production  
 volume requirements

**Evaluation of Results**  
 •Now that costs are more visible and easier to track, the  
 drivers for cost problems are becoming evident -  
 repair/replace practices not consistent or well organised and  
 still too many emergency buys.  
 •Level 2 interest in maintenance day and shop floor  
 supervision is poor - no real commitment from the level 2  
 team.  
 •However, the emphasis on better maintenance day task  
 planning is paying off and actually provides a good platform  
 for supervision and QA on maintenance day. The same level

**Specified Learnings**  
 •There are no systems for  
 repair/replace decisions and routines  
 around repairs to offline equipment are  
 disorganized and poorly managed.  
 •The poor management t repair items  
 adds to maintenance costs because new  
 items have to be purchased.  
 •Poor spares planning results in  
 emergency buys at a higher cost.  
 •Level 2 team is starting to show signs  
 of dysfunctionality





**Plan**  
Improve repair planning processes.

**Diagnosis**  
What are the factors affecting 'midweek' planning?  
 •Planning of tasks on maintenance day has improved drastically, however:  
 •Planning of other weekday tasks such as follow-up on breakdowns, repairs to equipment that came off the plant, planning of spares and /or expertise to enable outstanding repairs to be done, etc. is poorly done.  
 •Poor planning of repair tasks means that items that should be returned to stores gets kept on a back shelf in the workshop which is costly.  
 •Replace/repair decision making not consistent - it is easier to replace and discard but more costly.  
 •Financial pressure is seen as a barrier to spares procurement until it is a crisis.

**Action**  
 •Method of replace/repair decision making challenged.  
 •Standards for discarding not always clear in maintenance procedures - reliance on gut-feel.  
 •Formulated generic standards for decision making as a start with plans to formally interrogate procedures for standards  
 •Implement system for managing and planning repair items and returning to stores upon completion.

Loop 2.5

**Evaluation of Results**  
 •Repairs management system starting to show benefits.  
 •Interesting to find that the systems introduced here had been done before but had fallen away.  
 •Several of the systems introduced over the past few cycles have been a revisit to seemingly excellent systems of the past.

**Specified Learnings**  
 •It appears that in all the cases so far, the good systems of the past collapsed when the system proponents left. Turnover of key staff is fairly high.



University of Cape Town

## **2. Removing the barriers to meaningful action**

Having an effective reporting system is meaningless if no action is taken in response to these problems. There are several reasons why effective structured action is not taken. Crisis maintenance management was found to hinge around lack of understanding regarding maintenance management processes, poor resource allocation, poor spares management, questionable maintenance quality, poor financial planning, unstructured replace/repair decision making, and poor workshop repair planning. In addition, lack of level 1 bias for action results in overloading the planner with hour-to-hour tasks and decisions.

### **2.1. Competence in maintenance planning is key**

The maintenance planner is the key to effective maintenance management. Competence issues around electronic maintenance system usage, lack of understanding of TPM and worldclass maintenance best practises reduces the maintenance effort to a "back of cigarette box" approach to action. Understanding of the maintenance bases, how the maintenance process works and how to extract maintenance management reports (e.g. backlog reports) from the electronic MMS are all key competencies that has to reside within the planning function if maintenance management is to be effective.

### **2.2. Effective planning is team-based**

A large part of maintenance planning has to do with resource allocation. Commitment to the plan is best achieved by involving the team members in decisions around how resources will be allocated to the various jobs. This process also tends to smooth resource availability as it reduces the tendency of overloading certain people or reserving special jobs for special persons only.

### **2.3. Level 1 involvement in financial control and spares quality is key**

It is extremely difficult to do effective spares planning when the planner is solely responsible for having to research and source every single spares item and resolve all spares related issues post delivery. Also, when the burden for controlling costs is strictly at level 2, then financial control is extremely difficult. We found that setting the platform for spares management and financial control within level 1 improved the situation in both these areas. The key is getting sufficient information to the team to enable decision making lowerdown in the organisation.

### **2.4. Accounting Practise and Maintenance Quality**

Financial control at source is only possible when everyone follows the correct accounting practises regarding cost allocations to the various cost centres and general ledger accounts. Clarification and training on the correct systems to use highlighted potential problem areas. The fact that this information had to be accurate at level 1 in order for them to make the right decisions about how much money could be spent engendered commitment to get the process right first time.

Despite the improvements in maintenance day planning, the lack of supervision, control or QA during execution allows lack of attention to detail to go by unnoticed. As supervision and QA dwindle over time, the amount of shortcuts increase and competence issues or shoddy workmanship does not get corrected.

Maintenance day quality assurance should be the level 2 team responsibility. However, at this stage there were signs of level 2 dysfunctionality and the commitment of the level 2 team to maintenance day processes was low.

## **2.5. Repair/Replace decision making and repair planning**

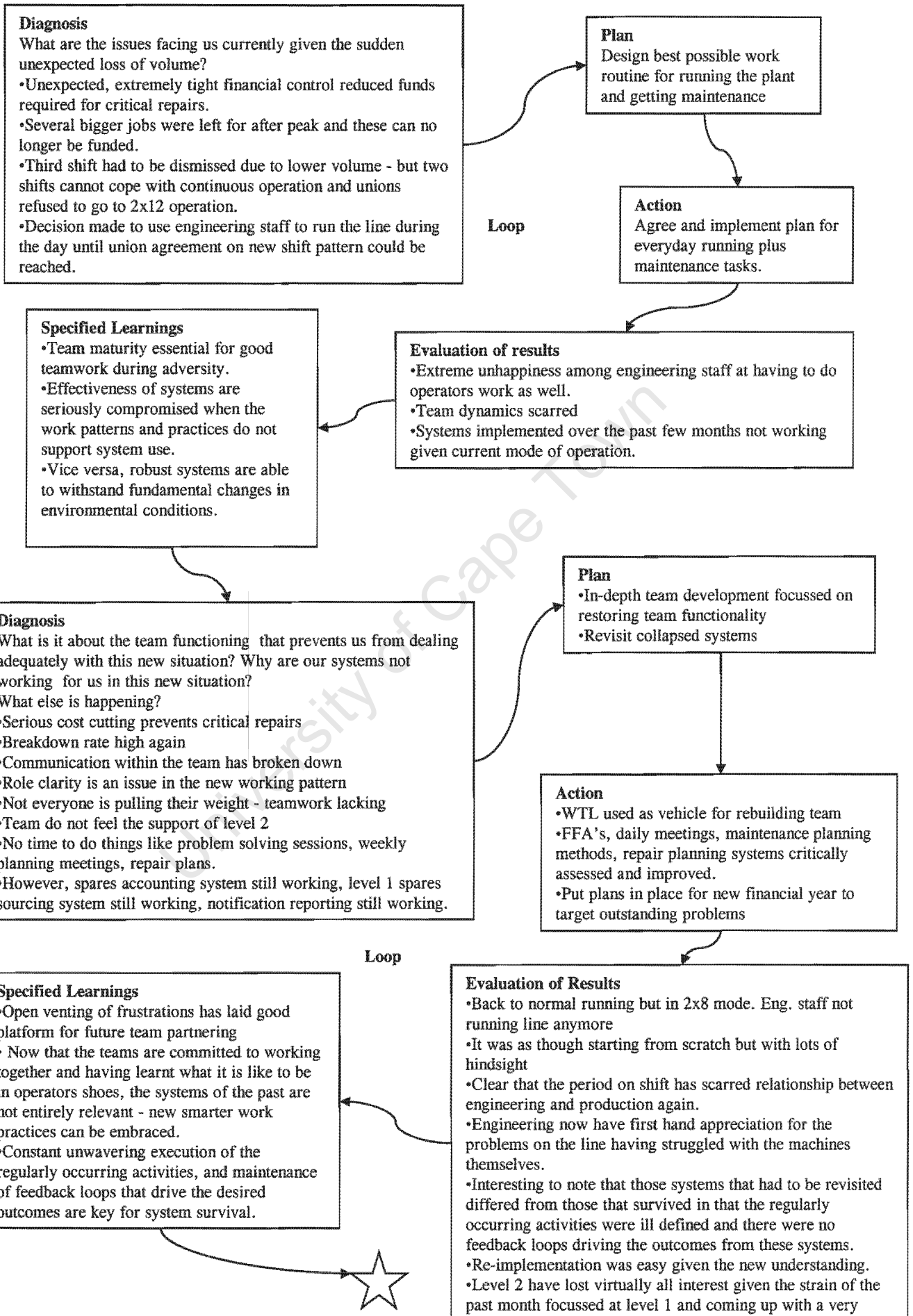
Closely linked to spares planning is the task of ensuring that defective rotatable items removed from plant are to be repaired promptly and returned to stores as spares. This branch of the maintenance planning cycle is easily neglected when all the focus is on maintenance day planning and the midweek planning is poor. Workshop repair planning is also compromised by ineffective visual management of the repair items, e.g. when these items are tossed into dark storage corners .

The absence of an effective repair programme drives the repair/replace decision towards the wrong end of the ratio. It became easy to discard an item and replace with a complete new part rather than to restore an item. The low volume of repair work through the workshop also meant that the machine-shop skills in the team had not been sufficiently developed.

An essential overall learning that emerged during implementation of systems to correct all the above, was that most of these systems existed in the past and collapsed when the key system proponents left the department.

The next cycle traces a period of huge team turmoil when the engineering team were uprooted from their normal working pattern and placed on the line as operators as an interim step between the abrupt loss of our third production shift and reaching an agreement with the unions on the new working patterns.

**Loop 3 -Fundamental changes to system Environment, discovering higher-level system problems and entrenching good behaviours (Feb 2001 - May 2001)**





**Diagnosis**  
 Are we winning with the revived team drive and systems?  
 •Team development program off the ground  
 •Degree of accountability at level 1 increasing  
 •Relationship between engineering and production improving  
 •Strong motivated individuals start pulling team together  
 •Level 1 see little value in traditional morning meeting between supervisors and level 2 team partially because of level 2 disinterest and partially because the rest of level 1 are left out of communication structures.  
 •Guys have come to appreciate the importance of communication and feedback when working on the line.  
 •Level 1 problem solving working well again. Maintenance planning routines still too reactive.

**Plan**  
 Establish best possible structure and systems for engineering and production level 1 teams to communicate and solve problems.

**Action**  
 Started combined Production & Engineering SBU. One combined daily performance review meeting for the newly formed manufacturing team involving both engineering and production at level 1 with morning meetings run by supervisor who reviews past 24hours performance and highlights problems for action. Team members then allocate

Loop

**Specified Learnings**  
 •Focus is too broad to hone in on problem resolution.  
 •No effective systemic feedback loop driving closure of outstanding actions.

**Evaluation of results**  
 •New meeting system well supported at level 1 because it was designed by the team themselves.  
 •Rate of action completion and problem resolution too slow.  
 •Too many problems too deal with in one meeting.  
 •Meetings are long and drawn out.  
 •Plant performance still subdued.

**Diagnosis**  
 How do we concentrate our efforts where most needed?  
 •Too much problem solving in morning meetings which drags meeting out to point where meeting has to end without all the issues for the day being discussed or conclusions being drawn.  
 •Immediate and long term problems given equal weighting.  
 •No follow-up system to ensure actions agreed to are being completed.

**Plan**  
 •Ensure information gathered at source is easily summarized to show problem areas and related potential causes.  
 •Find way of separating urgent day to day problems from long term ones.  
 •Implement visual gap management system to drive closure of actions.

Loop

**Evaluation of results**  
 •New method of crystallizing daily problems and driving actions to completion is starting to pay off in that the number of repeat problems are decreasing.  
 •Long outstanding repairs are being effected.  
 •General plant state improving, downtime decreasing.  
 •Team interactions improving.  
 •With level 1 starting to function as an empowered team, level 2 has lost all sense of what it should be doing now that it is no longer functioning at the wrong level. The team is not functioning well at all. Individuals are immersed in there own personalized missions as they deem fit.

**Action**  
 •Implement machine specific downtime summary graphs to focus problem areas  
 •Implement machine focus groups (MDT's) to handle longer term issues.  
 •Start recording actions, names and due dates on permanent flip chart and record daily feedback against open actions.

**Specified Learnings**  
 •Systems function well when the regularly occurring acts and systemic feedback loops driving desired outcomes are in place.  
 •When management has collapsed a level, then concerted effort is required to restore such a management team.



### **3. Through turmoil to Systems fundamentals**

Having spent nearly six months analysing our problems and having implemented systems to ensure that the problem resolution was sustainable, we were struck by a sudden turn in the market and loss of production. The financial pressure brought to bear and the massive loss in production was such that a decision was made at plant level to reduce the packaging production staff compliment by one shift. With the unions unhappy to change the shift pattern of the remaining two shifts, a decision was made that the packaging engineering team would fill in for the third shift as an interim measure. Important learnings emerged out of this disruption in the team's working pattern.

#### **3.1. How responsive is our system to sudden step changes?**

The key was to re-organise ourselves in such a way as to achieve the best possible work routine for running the plant while still getting the maintenance done effectively.

It became clear early on that team maturity is essential for good teamwork during adversity. There was an overwhelming external locus of control among team members – "they did this to us" - that threatened inter-team relationships and arrested good decision making within the team.

Effectiveness of systems are seriously compromised when the work patterns and practices do not support system use. All our problems solving systems, repair shop systems, spares management systems, maintenance day planning systems, etc. came to a halt because there simply was no time to perform several of the key activities associated these systems while running the line. System flexibility to be able to adapt the key process steps to suit the new conditions is required.

The ability of the system to call on extra reserves in times of need is essential. In this case the level 2 team should have been able to step in to assist but this did not happen.

It was clear that due to the above factors our system was not robust enough to withstand fundamental changes in environmental conditions.

#### **3.2. New beginnings**

The interim working patterns having come to an end after agreement with the unions on 2x8 shift configuration, it was time for in-depth team development focussed on restoring team functionality and also focus on revisiting our collapsed systems.

During this phase we learnt that partnering within teams and among team members is required to build effective relationships that bind teams. It was also clear that empowered teams exist only if the individual members of the team are empowered individuals.

Working as operators enabled all of us to see our plant with new eyes. Having this added insight – having looked at the system through a new lens – enabled

us to build even better systemic structures than we had before. These new systems are more relevant to our changed environment.

Having had the opportunity to witness and analyse the reasons for systemic collapse it has become clear that

- No system can survive without those regularly occurring activities (ROA's) that drive the desired system outputs.
- The ROA's will fade over time if there are no systemic feedback loops that drive the occurrence of the ROA's.

It also became clear that role clarity was the single biggest reason why ROA's do not happen when they should and without role clarity no feedback system (e.g. performance management) can be made to work.

Having a fresh approach at organizing surfaced another learning – that the ability to sustain multiple systems requires a high level of organisation.

### **3.3. Teams flourish**

The revitalized teams come together to form one packaging SBU team in a bid to further reduce engineering/production rift. The key learning in this loop being that the surge in problem reports and avid communication has lacked focus and we are currently taking as much time to react to immediate issues as longer term issues. The problems themselves need to be categorized in order to ensure the right focus in the right area.

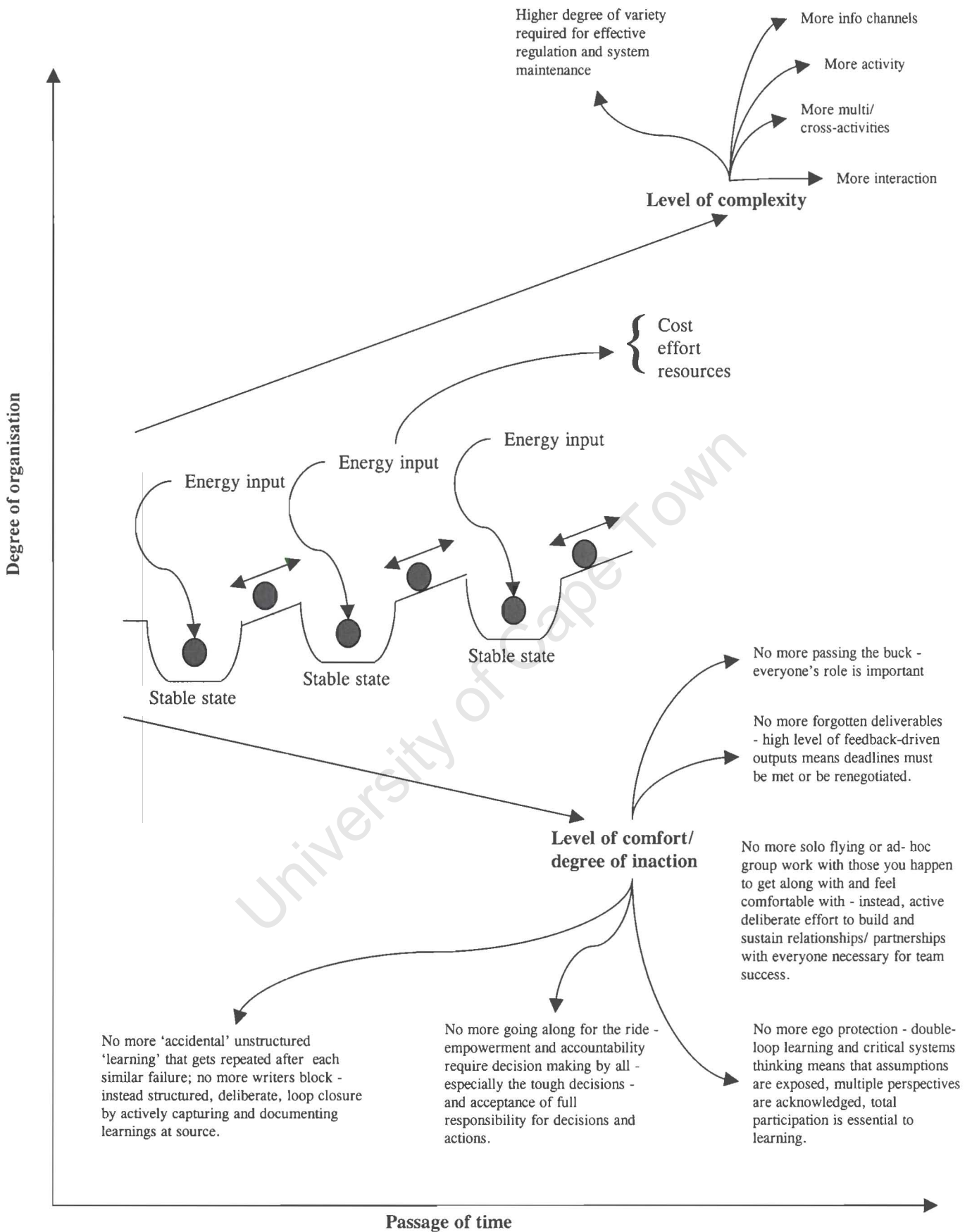
The rate of corrective action closure is too low. The key learning here being that there is no systemic feedback loop driving corrective action closure.

### **3.4. Level two management has collapsed**

Even a simple system such as a permanent visual display of outstanding actions, responsible persons and due dates has been sufficient in most areas to drive the desired action. As a front-line system this works fine, however, with the collapse of level 2, there is no follow-up feedback loop in the form of performance management.

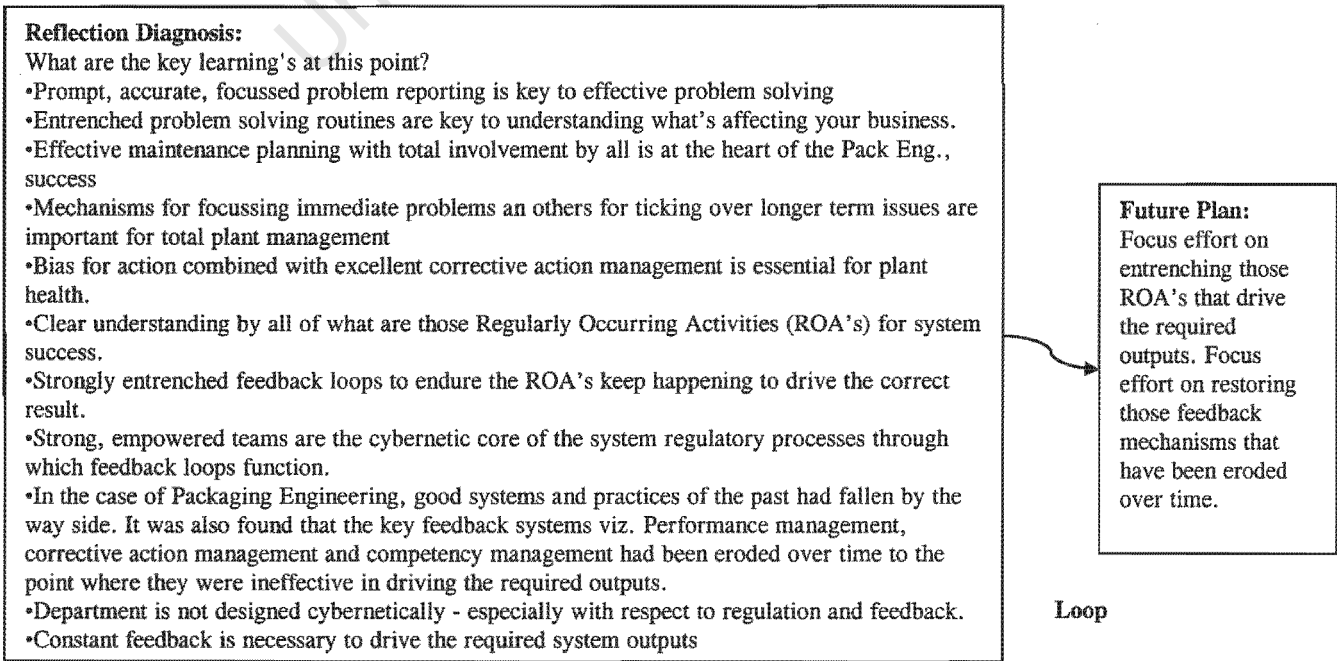
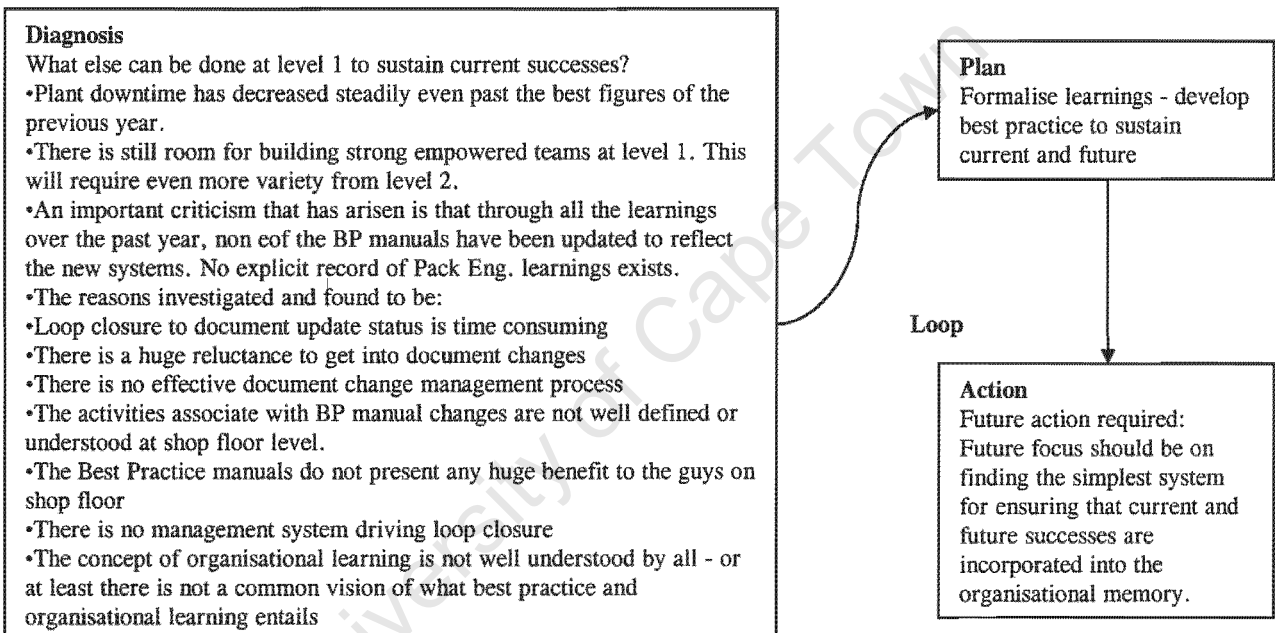
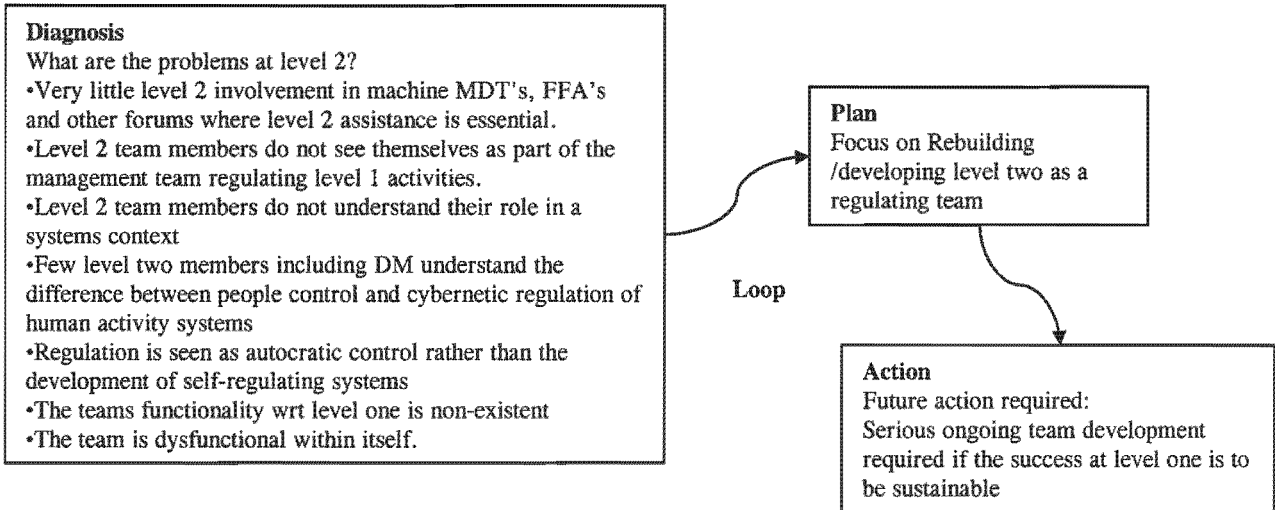
With level 1 regaining control of what it is they are supposed to do, level 2 have lost all sense of what it is that they should do now that they are free to operate at the right level. The key learning here is that once a management system has collapsed down a level, concerted effort is required to re-establish such a system.

The higher organisation required at level 1 due to the multiple systems cannot be maintained without an effective regulation system. Level 2 management currently lack the required variety to manage such a system.



**Diagram depicting the changing levels of organisation and variety required as new systems are introduced.**

**Loop 4 -Focussing on Management problems and future direction (Jun 2000 - Aug**



## **4. Future Focus**

### **4.1. Cybernetic Regulation**

Diagnosis of the problems at level 2 reveal that the team does not understand its role as cybernetic regulator of the Packaging system as a whole. Future action should be on rebuilding the team into a functional unit firstly, and then to develop the team into an effective management team.

### **4.2. Organisational Learning**

The success measured in hard numbers (plant efficiency, downtime, etc.) over the past year tells a story of exceptional improvements. However, the learnings derived during this success process have not been captured in the organisation's best practise documentation. From the analysis we learn that there is no system in place for capturing learnings and the department has no feedback loop driving the capturing of new best practises. Understanding of organisational learning as related to continuous improvement and best practise is extremely low. In fact, understanding of what WCM really is, is extremely low. Cybrnetically, from the selg-organising systems law we learn that for a sytem to preserve its integrity and survive its rate of learning must at least match the rate of change of its environment. Future action should focus on re-implementing a process for capturing best practise with the necessary feedback loop in place to drive the systemic outputs.

### **4.3. Overall Learnings**

This final loop served as reflection over the entire action research process, drawing together the key learnings. Out of all the learnings summarised above the following has emerged as the overall high-level learnings and key to the problems in LSAM's North plant packaging engineering department:

No matter how elaborate or simple the WCM systems that were implemented originally, these have not succeeded because of the absence of the following:

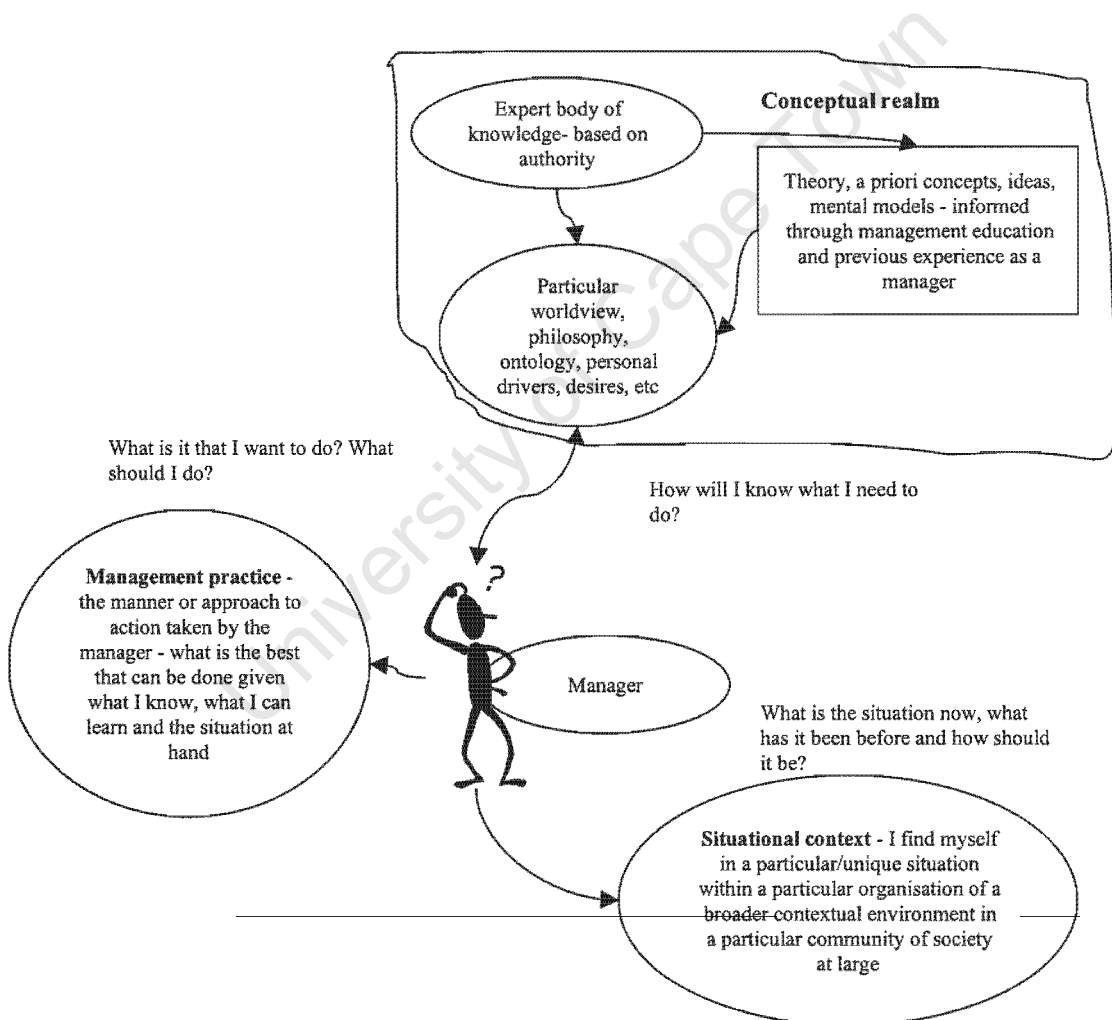
- 4.3.1. Mature, empowered teams who see themselves as partners in the process – not just a group of people working in the same area.
- 4.3.2. Clearly defined ROA's for achieving desired outputs.
- 4.3.3. Feedback loops for driving the occurrence of the ROA's.
- 4.3.4. Effective regulatory systems through which the feedback loops function.
- 4.3.5. A living best practise system for capturing organisation learning that is understood by all and relevant to the system. Without learning the system collapses under environmental change.

## Managerial Learnings

Apart from the learnings gained about the system, I gained some valuable personal insights that have improved my own management practise.

## Structured, Critical Thinking

When I started the research, I had no idea where to start looking. I found that I had to examine my motivation for the research before I was able to focus on the actual problem situation. I also had to make all my thoughts explicit – including my thoughts about the situation or problem, the information that I needed, the steps I wanted to take and the conclusions that I found myself making throughout the process. We think all the time about several things but it is only when I structured and challenged my thinking critically that I was able to move on from any particular point in the research process in a focussed manner.



Only once I had actually asked the questions and specifically focussed on what it was that I wished to achieve, did I start seeing the situation in a new light that extended beyond the overwhelming complexity of the first glance.

In retrospect this is like the first step in Handy's wheel of learning. Handy advocates learning lubricants one of which is a "*proper selfishness*" – the notion that what is to

be learnt or the question that needs an answer should have personal future implications or the wheel will be difficult to turn.

## **The Role of the Manager during Change Processes**

I also developed some thoughts around the role of the manager during the change process based on my personal experience. These are summarised below. The two main battles I had was balancing Speed vs. Efficacy in action, and Acting vs. Enabling.

### **Speed vs. efficacy**

Speed can be achieved by doing it yourself - or getting in a trained consultant or assigning a champion, etc.

It will be effective in as far as the evidence (manuals, training records, graphs on the wall, etc) goes but it will be the wrong thing to do because although you have met a deadline (efficiency) - you would have achieved nothing in the long term - the learning has not been transferred, hence the ownership has not been transferred hence the accountability center has not shifted.

To be efficacious you have to sacrifice speed in the short term in order to gain momentum that will sustain into the future so that you do not have to spend time and effort when others are re-launching, revisiting, re-inventing.



Finding the right balance

### **Acting vs. enabling**

The team lethargy gets to you, so you kill yourself trying to do it all - get only a few things done anyway - and only partially at that - while the team learns nothing and so cannot do anything and you are left to do it all for longer than you thought.

Or you restrain yourself from doing it all and allow for warm and fuzzy things like emergence and vane hope in things never seen while your superiors see no actual results and you score a zero on your performance appraisal?

Emergence comes out of the noise of lots of action. As a manager your key role is to drive the use of the systemic feedback loops that have been set up, to allow for deviation through a process of surfacing assumptions about why a change in course is necessary, to question and allow for questioning, to create the environment for sustainable team development.

Personal action in the issues at hand should be limited to team input as a member not as a driver.

Team development is key. Development engenders ownership, accountability, partnering, respect, empowerment, competency, ability, self-actualization, self-responsibility.

Acting allows things to get done. Ensuring that things will always get done is enabling.

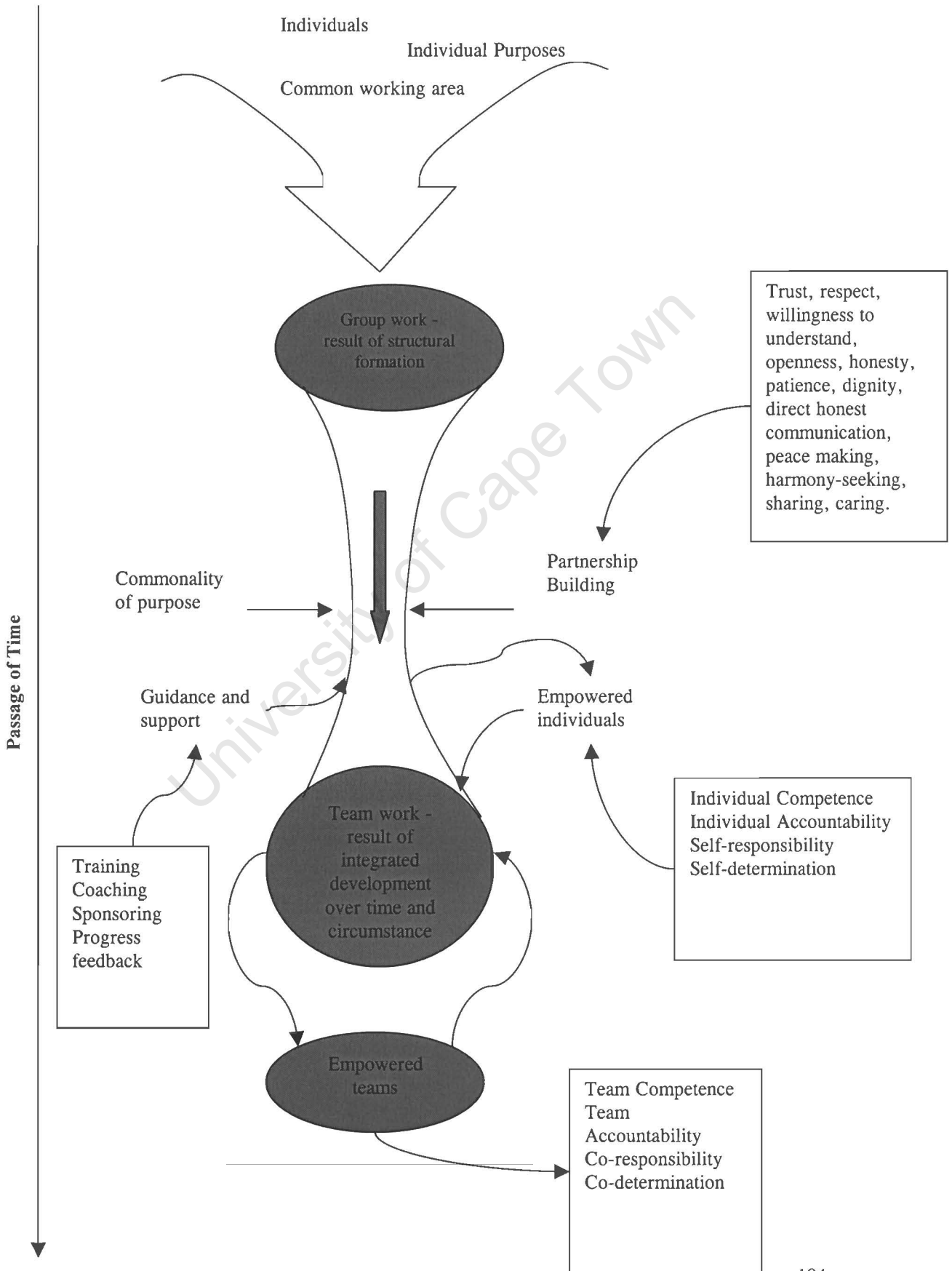
The old adage about teaching a guy to fish rather than giving him a fish.

The reality is a balance - initially he won't be any good at all and may even become disheartened at his initial failure and give up completely. So you will have to supply him initially while he is learning to fish until he is able to do it successfully by himself.

However, the manager has to make some tough decisions sometimes and systemic feedback loops will drive death, compliance or innovation.

## Effective Teams

Having worked extremely closely with various teams given that WCM organisations are team based. This has afforded me the opportunity to learn what drives team success. I have summarised it in the pages that follow:



## Empowerment in individuals



### Competence

Knowledge and skills to perform required tasks to the required standard and the ability to transform those skills in situ when faced with new challenges and the ability to problem solve around one's immediate area of competence and beyond.

### Accountability

The ability to take ownership of an issue as though you have a vested interest in it. Coupled with the ability to see-it-through to the end - whatever the outcome and the ability to accept the consequences of one's actions without looking for someone else to shoulder the load when things don't go well but rather to learn from the situation and put in place whatever is necessary to prevent a re-occurrence of a failure.

### Self-responsibility

The desire to be in control of and take charge of all that happens in one's life and the desire to react positively to those things that do not go according to plan by taking real steps to learn out of the situation. The essential attitude must be that personal choice has resulted in the outcome and not 'some force' has done it to me. Internal locus of control vs external dependency.

### Self-determination

Proper selfishness. The desire and will to succeed. The desire for constant personal development and growth and the disciplined determination to excel in every aspect of one's life

## Empowered teams



### **Team Competence**

The knowledge and skills to accomplish team goals in a way that transcends any collective effort but is rather a cohesive effort. Where cross-functionality is the norm and no one person is confined to one area of skill application. The ability to re-organize in order to face new challenges. The ability to generate evolving competence through combined problem solving.

### **Team Accountability**

The ability to take ownership of issues, processes, outcomes, problems and solutions in a way that allows continued learning, growth and development. The ability to keep track of an issue until closure has been reached and a sustainable outcome has ensued. The ability to formulate and implement action plans and achieve success through interdependency of team members. This stems from individual accountability in support for the team goals by each team member.

### **Co-Responsibility**

The desire to be in control of and take charge of all that happens and the desire to react positively to those things that do not go according to plan by taking real steps to learn out of the situation. The ability to address team member weaknesses and strengths in an open and honest manner that does not protect individual egos but rather protects the team's integrity. This stems from mutual trust, understanding and genuine partnering that arises out of the attitude that the team cannot succeed without each individual's input and that the team has a responsibility toward each individual in turn.

### **Co-determination**

Desire by each team member to see the team perform, succeed and develop as a result of the combined input by all. The desire to develop each team member through deliberate cross-skilling to ensure the long term viability of the team. The realization that the team is only one part of a larger organisation of teams that all have to survive in order for the team in question to survive. The desire and ability to align the team responsibilities with the requirements of the larger organisation.

## Management Cybernetics

On a more cybernetic and systems thinking level I have realised that being able to use systems thinking tools does not necessarily mean that you think systemically nor that you are systemic in an ontological sense. To think systemically requires that one visualise existence in a very different way. One has to see the 'connectedness' of seemingly unconnected phenomena or recognise the lack thereof.

When managers are able to think systemically, then cybernetics of natural social systems becomes a valuable management tool.

Cybernetics teaches us that frequency change, amplification and filtering are functions that managers have to become offay with if they are to be good managers of systems. We should stop asking the question: "Why do all our good attempts to organise only work for a while before returning to disorganisation over time with no required intervention?" This question is futile. The laws of cybernetics teach us that:

1. Any system is tending towards a state of higher entropy (lesser order or organisation)
2. A system's output is driven by feedback

These two laws alone tell us that for as long as we wish to maintain a system's integrity to keep producing the intended outcome, we need to continually and forever maintain feedback loops that drive the desired outcome and that the channel capacity of the feedback loop must never drop below the minimum required to counter entropy gain.

The number of people or the amount of technology an organisation employs to fulfil these functions is irrelevant in cybernetic terms (although there is an economic impact).

### **Reflections on WCM drivers/barriers and the problems around defining best practise**

In reflecting on WCM, the key drivers surfaced during the action research process are as follows:

- Activity Systems for doing things – understanding what has to be done to achieve outcomes – clarity of regularly occurring acts (ROA's).
- People interrelationships – partnerships – open, honest, healthy relationships that lead to effective teamwork
- Strength of the people – competence, self-empowered, self-determined people who are able to contribute effectively
- Management - clarity of purpose, system understanding – what is to be regulated, how and by which regulatory entities.

The key barrier to WCM is perhaps the low level of understanding of what it entails. WCM is too loosely defined to be well understood. There is a misconception that flexibility in roles in fact means that there are no job specifics but rather team tasks that are executed however the team sees fit. This generalist approach to WCM renders it useless to achieving specific outcomes if these are not well defined. When everything becomes everyone's job, then in fact the lack of accountability reduces everyone's job to nothing.

Resource availability is limiting to effective WCM. When the heat is on and the luxury of time is absent then getting the job done in the fastest way circumvents WCM processes. Why? Surely best practise should be the simplest, fastest way of doing something effectively? In a culture/environment of non-regimented procedural laxness, people will find the least painful way of achieving a desired outcome – perhaps here-in lies the secret to WCM – if the least painful method is not best practise then how have we defined best practise? Does this definition have meaning in a WCM context?

### **Job rotation, multi-skilling and multi-tasking**

The key factor affecting the move from assembly line widget maker to empowered manufacturing team member is the surprising lack of structured multi-skilling. This applies to formal training programs designed to improve the competency of level one engineering staff. Instead, the experience gained through multi-tasking as the need arose over the years has resulted in tacit upskilling.

Job rotation in the WCM sense has not been successfully applied either. The Taylorist model of certain jobs for certain classes of worker is still evident. This is the focus of BPII. It is strongly recommended that rather than wait for phase II, LSAM should formalise job rotation and multi-skilling as soon as possible. This will assist in the transition when BPII implementation arrives.

Another factor, which primarily affects team member motivation and willingness to get involved, is the relatively slow progress in the competency based remuneration system. At LSAM, job advances and remuneration especially at level one is still based on formal qualification and job-grading structures. Meanwhile, the gradual upskilling of previously unskilled labour continues to produce workers whose tacit skills obtained through years of experience, are indispensable to the multitasked work they perform, yet are formally unrecognised. The introduction of SAQA's NQF may change this but there is little evidence at regional level of preparatory work for curriculum 2005 at LSAM. This needs to be given focus.