

TO IMPROVE THE FUTURE

PROFIT EXPECTATIONS OF THE

NISSAN STAMPING PLANT

**Compiled by:
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A HALF THESIS SUBMITTED TO FULFIL

THE NEEDS OF A MASTERS QUALIFICATION

IN INDUSTRIAL ENGINEERING

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CHAPTER 1

INTRODUCTION

PREFACE

The process of thought applied to establish a thesis topic has been one of non-acceptance of the situations on face value. As such the future profitability of the Nissan Stamping Plant has been considered. A mental model has been established in the authors mind that a definite problem exists within this area.

This has led to the formulation of a framework that can be used to handle the problem of low profits that will eventually lead to the closure of the operation.

Status-Quo has remained within the operations for almost 25 years, but now changes in Government Legislation pose threats. This leads to the question of how can the profits be improved.

The framework was built around a philosophy of continual search for the truth. The scientific method has been applied to understand the theories of a single or double loop response whilst proceeding through the Plan, Do, Check, and Action cycle. The basic structure of the study can be seen as follows:

Chapter 1 - Introduction

- a) Historical and present situation.
- b) Complication
- c) Question that needs to be answered.

Chapter 2 - Framework

- d) Establish a framework to enable an answer to be found to the question posed.

Chapter 3 - Abductive Reasoning

- e) Determine best list of potential reasons for question posed.
- f) Apply techniques to determine the most plausible reasons.
- g) Establish the three most plausible reasons.

Chapter 4 - Deductive Reasoning

- h) Examine the three reasons (Hypothesise) to determine if they prove to be problems in their own right.
- ii) Predict that they therefore are/are not causing the original question to be posed.

Chapter 5 - Inductive Reasoning

- j) Determine if the predictions in chapter 4 are proven to be correct.

Chapter 6 - Conclusions

- k) If the predictions are correct then suggest the best way to correct the problem indicated in the main question posed.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The company to be examined was initially formed in 1977 as Steelmobile Engineering (Pty) Ltd with the express purpose of supplying stamped automotive panels to Datsun/Nissan South Africa, and also to manufacture an order of 10 000 I.S.O containers for Safmarine. The latter activity required the establishment of a semi green field operation to be introduced next to the Stamping Plant.

Between 1977 and 1982 the company continued to operate under this name, but expanded it's customer base to include Alpha Romeo, Ford, Volkswagen, Delta, etc., and eventually supplied panels to every motor manufacturer in South Africa, with the exception of Mercedes Benz.

In 1982 a subsidiary division was purchased in Uitenhage mainly to service the Ford operation in Port Elizabeth. In 1986 Ford left Port Elizabeth to merge into the Samcor (Pretoria) operation and the Uitenhage branch closed due to logistical problems in late 1986. Also in 1986, the ownership of the plant changed from Messina Mining to Sanlam and the main operation became Nissan South Africa at this stage, Steelmobile Engineering ceased to exist and it became part of the Sanlam financed Automakers Group operating as Nissan Stamping Plant.

The I.S.O container project was completed and Plant 2 then went into manufacture of military vehicles, but with the relaxation of the border confrontations, this business could not maintain its viability. The plant now manufactures sub-assemblies for the Nissan body shop on an over-flow basis.

In 1987/8 the company began to experience massive losses and by then was only supplying Nissan and Samcor. The Samcor business was not seen to be profitable and they were committing all sheet metal to import in future. On the basis of these facts, we shed the business and retrenched 40% of our workforce in 1992. This forced a major re-think and consolidation of our organisation and along with a restructuring at the top, the company is making small profits in 1995 for the first time in approximately seven years.

Although on face value it seems irresponsible for Nissan South Africa to have continued with an operation making losses, it must be understood that they generated savings for themselves by not importing components with 110% import duties placed on them.

1.2 EXISTING SITUATION

The company presently employs 700 people and 95% of the business is with Nissan South Africa, the other 5% is export of BMW and Fiat components. The basic process that takes place is the transformation of steel sheets into automotive body components.

This is achieved via a series of operations through stamping presses which have the ability to open and close. Each component has moulds or dies manufactured to suit the required stage and these are quickly interchangeable within the stamping presses.

Within the press shop there are 32 stamping presses with a pressing capacity ranging from 250 tons to 2500 tons which are processing 100 tons of sheet steel per day on a 2 shift basis. The profitability of the Stamping Plant has been unsatisfactory to the Directors and Shareholders of Automakers for many years. The expectation has been a return on sales of 5 to 6% and a return on assets employed of 20% i.e. an asset turn of 4. The achieved figures have been as follows:

	<u>RETURN ON SALES</u>	<u>RETURN ON ASSETS</u>
92/3	- 8%	- 12%
93/4	- 2%	- 8%
94/5	+ 2%	- 2%
95/6	+ 3%	+ 10%

Although improvements are evident this is still not acceptable.

1.3 CONCERN

In the past the Automotive and Component Industry has been protected by import tariffs of 110%. This is presently sitting at 70% for components and will reduce eventually to 40% as per the General Agreement on Trade and Tariffs, which is a trade agreement signed by most Countries in the World.

South Africa has been officially deemed a Developed Country as apposed to a Developing Country which means it must compete in its own right with the major powers in the world. Basically this means that any major form of protectionism has been removed and local components need to be more competitive than before. This is further aggravated by the low volumes causing high absorption rates in regards to tooling costs.

As such selling prices need to be reduced to maintain not only the competitive edge against imports, but to match the activities of other producers. They will be forced into the same scenario and will surely improve their situation out of necessity. If selling prices are reduced without corresponding decreases in cost the profitability of the operation will decline to unacceptable levels.

1.4 QUESTION

The need to sustain and improve profitability is driven by the desire to survive. If this is not done successfully the potential future of the operation can be seen to be in jeopardy. It is necessary at this stage to form a framework to examine the possibility of preventing the potential closure of the operation. The framework in use must have the ability to provide an answer to the problems. The answer will take the form of recommendations for the future that have the best chance of success available at this stage. This will facilitate the potential to answer the question how do we sustain and improve profits?

CHAPTER 2

FRAMEWORK

2.1 INTRODUCTION

Having established that the profits of the operation are in danger a remedy or solution needs to be sought. If this is not successfully obtained the Company will eventually close in the face of increased competition. It is vital to approach the solution to the problems within a framework that will be the vehicle to lead to proposed solutions.

The Framework must have the ability in a controlled manner to suggest potential reasons for the low profits, test them in their own right and determine whether the problem can be solved in that manner.

Firstly the philosophy underlying will be discussed and then the methodology to be applied. Finally the techniques to be utilised during the study will be examined to enable a clear framework of approach to be established.

2.2 PHILOSOPHY

To develop the philosophical overview of the thesis, reference will be made to Charles Sanders Peirce (1839-1914)^①. Whilst Peirce did not publish a clear and concise summary of papers regarding his work he is regarded as a leader in the field of philosophy. This has led to papers being produced on a regular basis regarding his work and the interpretation of his meanings.

One of the more comprehensive explanations of Peirces works can be seen in Charles Peirces theory of scientific method by Francis E Reilly (1970)^①. Peirce developed a comprehensive philosophical basis for scientific enquiry. He states that any enquiry starts with a doubt and ends with a belief - this can also be deemed to be a Question and Answer.

A pragmatic approach would be to pursue the love of knowledge and satisfy belief through experience. Whilst searching for this belief or answer a pragmatist would be prepared to pursue actual experimentation. During the experimentation all avenues would be prepared to be examined and cast aside if needed in the search for rational meaning. This is a means of grasping the real truth. Alan Mumford also discusses pragmatism in his paper Learning Style and Learning Skills.^② Here he identifies 4 distinct types of learning skills.

- | | | |
|----|------------|--|
| a) | Activists | They enjoy the here and now experience. |
| b) | Reflectors | They like to stand back and ponder on experiences. |
| c) | Theorists | They like to make things tidy and neat and fit into pre-conceived rules. |
| d) | Pragmatist | They positively search out new ideas and see problems as a challenge. |

The similarity between the two concepts can be seen. A pragmatist will continually search for answers to a doubt by searching for problems to be solved.

Pierce further states that during the enquiry process a disciplined methodology must be applied and he describes 4 methods of achieving this.

a) **The method of Tenacity**

This relies on mainly verbal information gathered from other sources through daily experiences. This information can be used to obtain fixation of a belief. The information would be used to determine a solution to a problem and has not been tested.

b) **Method of Authority**

Here the rules and requirements of an existing system or organisation are accepted. Therefore if that is forced upon an individual it will be used as a solution or answer. Again testability of the solution has not occurred and may not necessarily provide the current answers.

c) **Method of Apriority**

This method relies on the acceptance of a series of Axioms gathered from other sources or experts. These then tend to be sifted and applied to the problem. Here the actions themselves are not tested therefore the method and solution would prove to be unreliable.

d) **The Method of Science**

Here Peirce describes the 4th way of setting opinions. This method is based on the application of rigour. Rigour being described as the Precise formulation of method, something clear and definite, testable and repeatable. A pragmatic philosophy has driven the desire to generate this study and will be applied throughout. As a means of enquiry the method of science will be applied in a methodical and rigorous manner. The process is illustrated in figure 1.

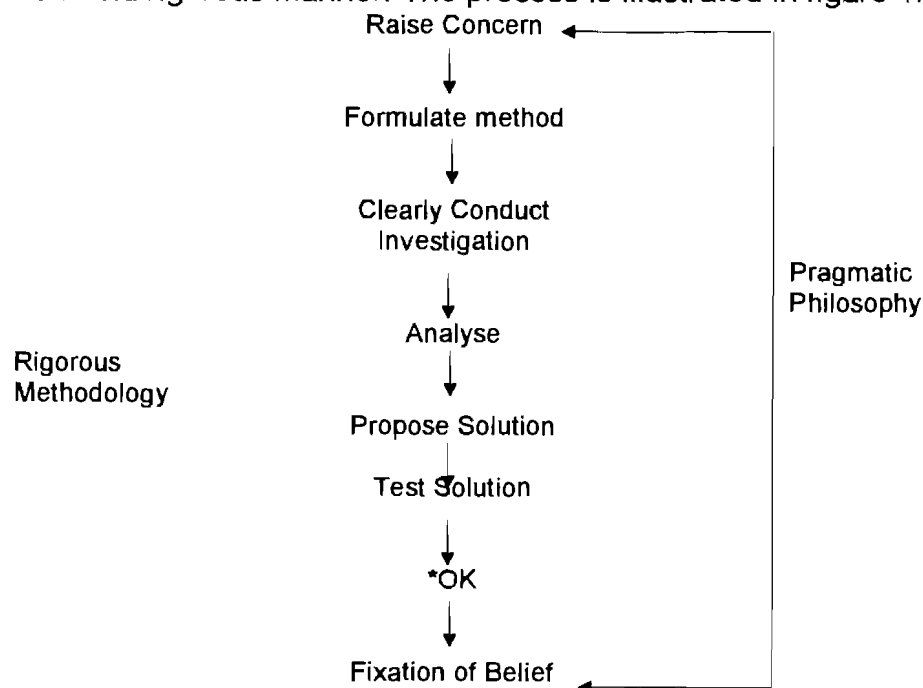


Figure 1

* The options of the answer being not O.K. will be examined in the final framework model,

2.3 METHODOLOGY

As stated in 2.2 the pragmatic philosophy of fixing a belief and satisfying that belief is to be employed. The method of science will be used, but within that maxim a method of procedure needs to be determined.

We need to determine what we think is causing the problem. Then determine and predict in its own right if it is or not and finally test or determine if it is causing the problem. These are requirements to suit the scientific method and must be followed in a rigorous manner.

Peirce contains in his proposals that the 3 stages of reasoning are determined as Abductive, Deductive and Inductive reasoning and can be described as follows:

2.3.1. Abductive Reasoning

The reasoning process of Abduction has no strict rules of procedure though it contains certain requirements for its successful conclusion. The basic theory of Abduction leads to an explanatory hypothesis or case taking cognisance of the result and rule presented in the situation.

It is the first step or explanatory phase of a scientific investigation. Peirce states that Abduction is a term used to designate the mental activity that is formed^①.

It is critical when formulating an Hypothesis that it has testability and therefore a potential of success.

Prior To Formulation Of Explanatory Hypothesis

To formulate an explanatory hypothesis through an abductive process a pragmatic approach is natural because the need for knowledge is a pre-requisite and Peirce states that all knowledge whatever comes from observation^①. This constitutes not only knowledge of the present activities, but also knowledge of past experiences.

Observation can be deemed to be a perception with thought, and analysis and is an act of voluntary attentive experience usually with some, often with great effort. It is critical to join experience with reasoning and also to fully understand how ones own perception or world view is influencing the observation.

Formulating An Explanatory Hypothesis

Peirce terms abduction as the mental activity by which an hypothesis is formed and says that abduction furnishes the reasoner with the problematic theory which induction verifies. Further to this an hypothesis can be proposed as a possible event likely explain an experience. Two basic rules suggested by abduction regarding hypothesis are:

- 1) An explanatory hypothesis renders the observant facts necessary or highly possible and;

- 2) An explanatory hypothesis deals with facts which are different from the facts to be explained and are frequently not capable of being directly observed, but could be observed in a more analysed set of occurrences.

For the pragmatist it is vital to realise that the means of hypothetical influence and its conclusion cannot both be observed together therefore making it critical for the reasoner to stay clear of pre-conceived end-results.

Requirements For Choosing An Hypothesis

The most important requirement which an hypothesis must have is testability as previously stated. It must be possible to evaluate the proposed theories and eliminate the unsuitable hypothesis whilst in the abductive phase without needing to test them. At this phase the economies of money, time and energy i.e. the resource availability must be taken into consideration.

Whilst testing several hypothesis the choice of order of merit can be pertinent to the situation, a generic test may eliminate more than 1 theory and is a preferable starting point. It will always be a personal choice again based on experience and personal values. A good hypothesis for testing is one that can be disproved with ease. Also at this stage the effects of an hypothesis need to be considered in the larger system as it would react to other elements as shown. All things being equal an experienced observer will surely hit upon a correct hypothesis sooner than the inexperienced observer.

The logic of abduction can be described as pragmatism as it supplies the right for the admissibility of a hypothesis. In figure 2 we can see that the transformation process to turn the problem into a solution is complex. Within the transformation process are many critical process and the one with the most direct influence on the output must be selected.

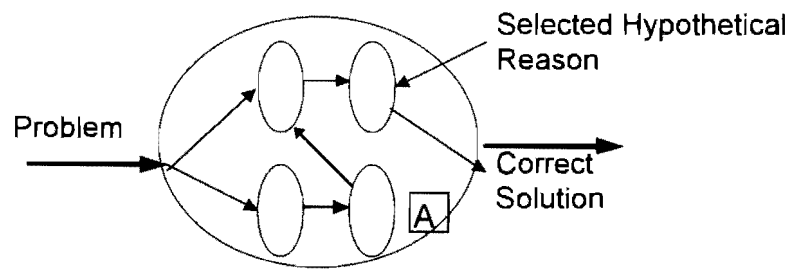


Figure 2

Once a hypothesis has been selected the deductive reasoning can be examined. The potential hypothetical reason 'A' is not as suitable as it demonstrates a less direct influence on the required outcome of a correct solution.

2.3.2 Deductive Reasoning

The deductive phase of a process deals with speculation by predicting the results from the hypothesis. During this testing phase 3 rules need to be considered.

- 1) The hypothesis should be distinctly put as a question before making observation which are to test its truth. In other words we must try and see what the consequence of predictions from the hypothesis will be.
- 2) We must not take a particular kind of prediction for which the hypothesis is known to be good.
- 3) The failures as well as the successes must be honestly noted. The whole proceeding must be fair and honest.

Also the inquirer must be so detached from his hypothesis to make repeated attempts to refute it. The testing phase starts by examining the hypothesis and then gathering the experiential consequence that would follow from its truth.

That is in the example shown "possibly I touched the heater and it did/did not feel warm." This step Peirce terms the process of deduction.

Deduction then is an unfolding of experiential consequence from an explanatory hypothesis or prediction of reality. Its main function being to justify the hypothesis by drawing experienced consequences from it.

The deductive process in a scientific inquiry must terminate with genuine predictions of the if-would variety. The deductive phase of an enquiry investigation terminates with observable predictions which have been drawn-up from the explanatory hypothesis. It must now be seen if the predictions come true which is the following phase.

The theory of deductive reasoning can be seen in the following example:

Main problem	A broken heater can cause a cold room
Situation	The heater is/is not broken
Prediction	The room is likely to be cold due to a broken heater

Once the hypothesis has been tested and its potential effect on the problem determined inductive reasoning can be applied.

2.3.3 Inductive Reasoning

After establishing that the predictions are likely to be causing the problem they can be tested in the inductive phase. Therefore, the success of that prediction is evaluated within this process.

The theory of inductive reasoning can be seen as follows:

Situation	The heater is broken
Main problem	The room is cold.
Prediction to be proven	The heater could be causing a cold room.

Once the prediction is proved to be having an effect recommendations can be listed for a change to occur in that area.

Therefore we see at this stage that Peirces theory of reasoning will be used as in figure 3:

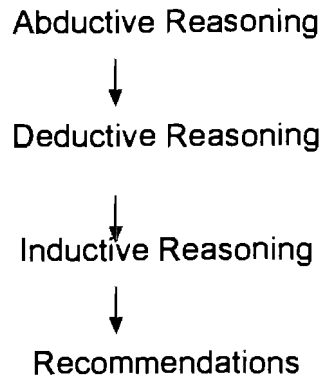
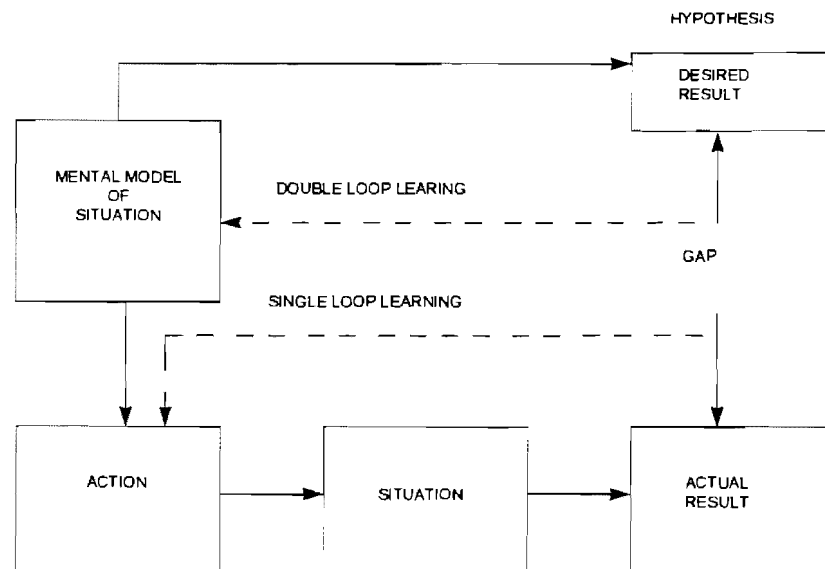


Figure 3

Whilst building the framework using the route of Abductive, Deductive and Inductive reasoning within the philosophical framework the assumption of success only has been examined.

What happens if this is not the case? If during the reasoning an entity is disproved this surely generates a re-visit at the some place in the framework itself. Chris Argyris describes this process as follows showing the difference between double and single loop learning techniques.



Once a Mental Model of a situation is set an action is started from concerns and questions raised. The process of reasoning is applied using whichever method is preferable to the role player which leads to an actual results or answer.

If a difference is apparent between the original desired result and actual result two courses of response are possible.

First is the more traditional style of single loop learning to close the feedback loop. This involves revisiting the action taken and adjusting to close the hypothesis gap. This is virtually forcing the situation to change to suit the Mental Model in use.

Secondly the learning loop can be closed using the double loop learning process. This involves re-visiting the Mental Model in use and re-adjusting the expected desired result with view to the learning process which has given the actual result. This adjustment process may involve the removal of that aspect entirely if the perspectives within potential Mental Models cannot cater for the gap removal.

To clarify in terms of the framework:

If during the inductive or deductive phase the hypothesis selected is deemed unacceptable a re-selection would need to take place. This is single loop response which re-examines the initial actions and reflects. If the effects i.e. inductive phase the effect is disproved then we need to re-visit the mental model in place whilst passing the major and minor premises. This is what Argyris refers to a double loop response. Revans in the managerial alphabet (See appendix 1) through his system BETA model^⑤ displays the same thoughts as can be seen in figure 4.

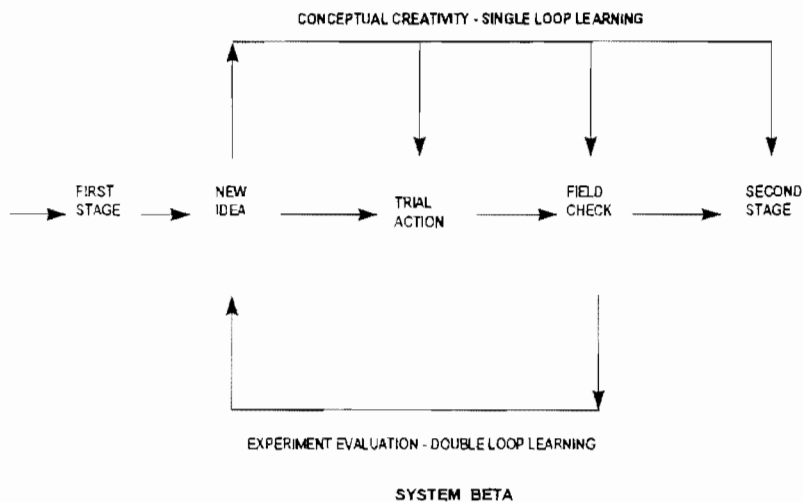


Figure 4

He demonstrates through the model a continual single loop response with a double loop response potential. If we combine the areas examined at this stage through the pragmatic philosophy and methodologies discussed we see the framework as in figure 5:

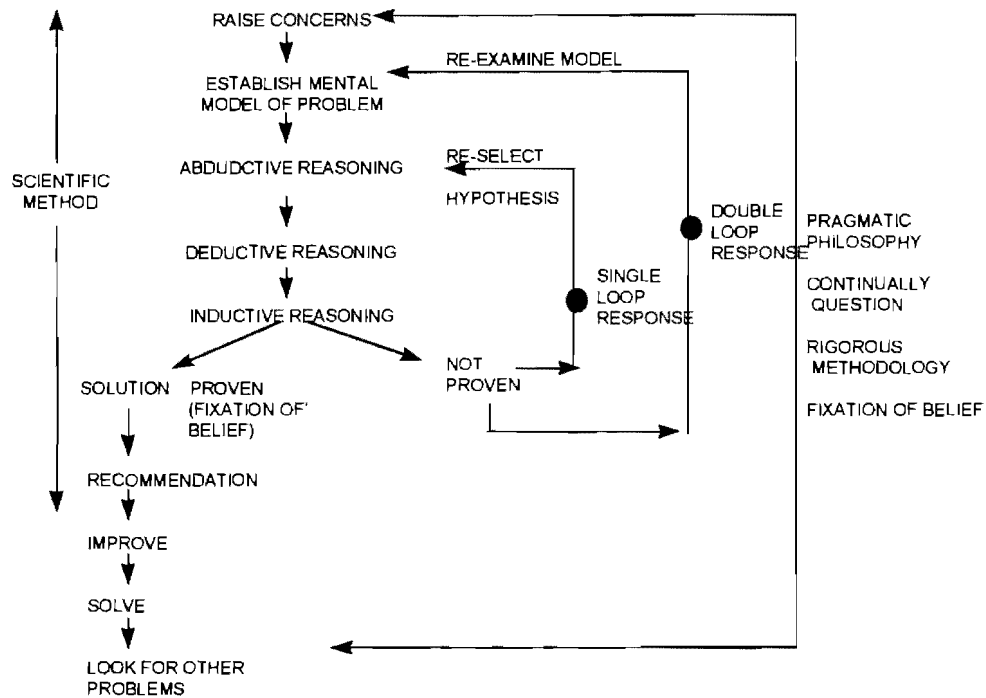


Figure 5

We have now fixed a belief in a problem selected a scientific approach and proceeded with the reasoning. If during the process something is disproven a revisit to the hypothetical reasons would be a single-loop response. If we cannot determine a fixation of belief regard the solution a re-visit to the mental model would be required via a double-loop response to examine if it is correct.

2.4 TECHNIQUES

Having set an understanding of the process of reasoning we needed to examine the process that will take place within each step. The techniques are examined as follows:

Shewart (Demming) See Appendix 2

Through the original work of Demming the Shewart cycle has gained wide recognition (particularly in Japan) as a live model for learning. Figure 6 examines the basic steps as follows:

- | | | |
|--------|---|--|
| Plan | - | Plan what needs to be done |
| Do | - | Take the action planned |
| Check | - | Check the results of the action against what has been planned. |
| Action | - | Establish the changes necessary and implement |

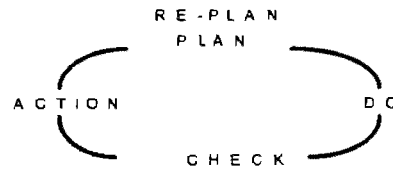


Figure 6

Although demonstrating a closed model it is in theory a never-ending spiral leading to continuous improvement.

HANDY (See Appendix 3)

Handy states that the theory of learning is examined as being the method of continually answering questions posed and not just the transfer of knowledge^③. He also generates a learning wheel which whilst using different terminology has the same basic steps of the P.D.C.A cycle as seen in figure 7.

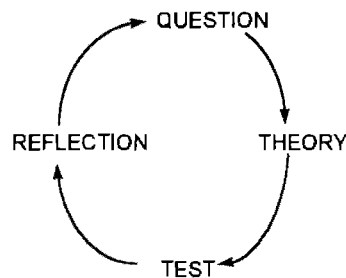


Figure 7

During the questioning stage one would need to plan and whilst establishing the theory the Do activities would be required. Testing or checking become the same activities and during reflection the re-establishment of actions would need to take place.

MUMFORD (See appendix 4)

Whilst defining learning styles Mumford refer to Kolbs research regarding the learning wheel as seen in figure 8.

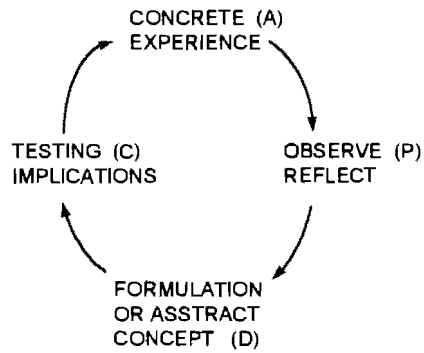


Figure 8

Although rotated at 90° the 4 stages of the wheel again can be clearly related to the P.D.C.A cycle. Kolb states 4 main points in relation to learning styles:

- It begins with a here and now experience.
- It follows with a collection of data and observations.
- It contains an analysis of that data.
- It reaches the final stage with modification of behaviour or belief.

Again re-confirming the P.D.C.A 4 stage activity of learning. So within each area of abductive, deductive and inductive phase we will follow the following process:

- a) Plan the route to be taken
- b) Observe and collate the facts
- c) Check the observable facts against expectations
- d) Analyse and formulate an action on how to proceed.

This is illustrated in figure 9

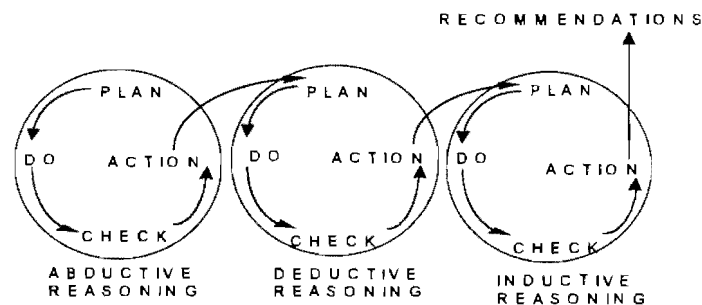


Figure 9

If the techniques examined above are inserted into the framework the final product is seen in figure 10.

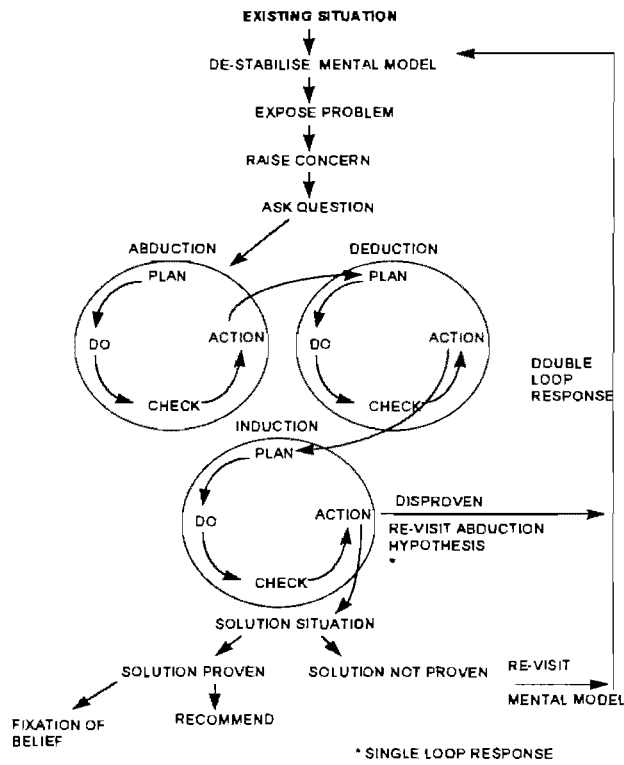


Figure 10

2.5 SUMMARY

In figure 11 we can examine the basic principles behind the framework to be used.

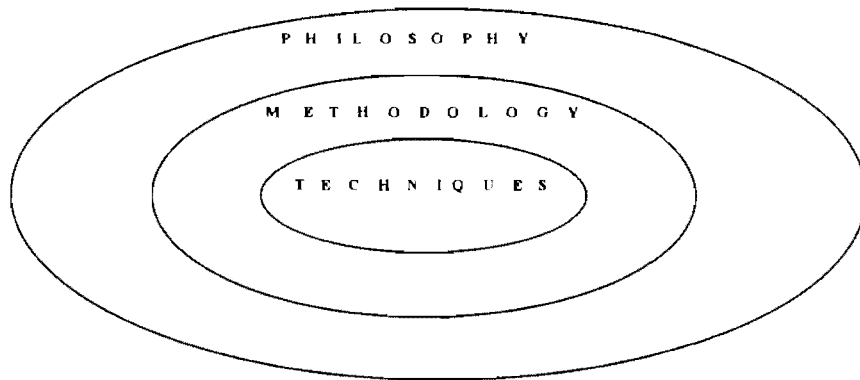


Figure 11

The following sections will lead to a solution to the basic problem exposed which is profits are too low.

The steps to be used will be to proceed logically through the Abductive, Deductive and Inductive phases of reasoning using the techniques demonstrated in the framework.

Finally recommendations will be put forward in proven areas where problems occur. If areas are not proven to be the case of the problem a re-visit to the original mental model must occur to re-examine the whole concept in question.

It is not the intention to disprove the framework as this will now be used in total confidence.

CHAPTER 3

ABDUCTIVE REASONING

3.1 INTRODUCTION

A Framework is now established to enable the inquiry process to begin. If we consider the result that profits are low we need to establish how this could be occurring i.e. the rules to be applied. We can then search for the most probable rules after testing and present them as hypothesis. The following process will be followed:

Plan	-	Determine the techniques and approach to be taken
Do	-	Collect the observable facts
Check	-	Test with techniques available
Analyse	-	Analyse and propose further actions

From this procedure the hypotheses will be selected through a process of abductive reasoning.

3.2 PLANNING

The techniques to be applied have been selected to produce the hypotheses with the most potential for success as a cause of low profits. This will be applied as follows:

- a) The suitability of an hypothesis will be rated as seen in Charles Peirce's theory of scientific methods- Francis Reilly (1970).^①
- b) To understand the vertical relationship and grouping of ideas an affinity diagram will be constructed.
- c) To understand the influence of the relationships of ideas an Interrelationship digraph will be drawn. This will then be transferred to a matrix diagram to highlight these relationships.
- d) A Questionnaire will be constructed and distributed to the key personnel to determine ratings on their thoughts of causes for low profits.
- e) All ratings from the previous four processes will be summarised for final hypotheses to be selected.

We can now proceed to collect observable data.

3.3 DO (DETERMINATION OF RULES)

At this stage an infinite number of reasons for low profits can be considered to be present. The task on hand therefore is to determine a number of the most probable for examination.

The objective at this stage is to search for the 3 most probable hypotheses from a selection that gives the best representation. The decision was taken to form a team for selection purpose comprising of a x-section of members within the organisation as follows:^④

P Elliott	General Manager
W Möller	Plant Engineer
K Berndt	Logistics Manager
J Roztocil	Production Manager
T Kucera	Chief Inspector
P Mabena	Tool Setter

The General Manager (the Author) chaired a series of meetings in an attempt to generate open thinking. The group finally determined that 24 hypothetical reasons should be analysed. These are as follows:

- a) No return investments into people
- b) Wrong business to be in
- c) Wrong Organisation
- d) Expectations too high
- e) Productivity is low
- f) Costing methods wrong
- g) Age of workforce
- h) Bad customer service/relations
- i) Stock too high
- j) Education of workforce too low
- k) Insufficient feedback via visual management
- l) Low motivation
- m) Stock flow wrong (bad planning)
- n) Insufficient training
- o) Bad attitude to suppliers
- p) Old technology
- q) Lack of purchasing control
- r) Environment
- s) Bad management
- t) Material usage not controlled
- u) Excessive breakdowns
- v) Unreasonable legislation
- w) Wrong materials used
- x) Business mix is wrong

These are not in order of priority, but were deemed to be the most probable causes by a process of consensus.

3.4 CHECK (APPLY TECHNIQUES)

3.4.1 Hypothesis Suitability

To test the suitability of the 24 causes established the techniques previously described in regarding Peirces thoughts on the subject were utilised. He states that a hypothesis must have the following qualities.

- a) Must have testability/verifiability. - It must be of such a nature in its content that it can be tested.

- b) Must have resources available. - The means the resources required to test the hypotheses must be available whether that is time, money etc.
- c) Must have a chance of being proven false. - It has not been selected because it is known to be a certainty.
- d) Must have a relevance to other elements. - It must not stand in isolation, but if proven it must have effects on other systems.
- e) It is broken into its smallest elements. - It can be examined as a whole without further breakdown of elements. If it needs to be broken down it cannot be tested as a whole.
- f) It leaves open a great field of possibility. - It has various means of testability therefore increasing its potential for that testability.
- g) It is based on common-sense.
- h) It contains an element of generalisation. - It has the opportunity to change or expand if required.
- i) It is beyond the control of reason that it is not the total necessary conclusion of an inference. - That is to say that the hypotheses is deemed to be correct due to decisions taken before testing.
- j) It has some newness or originality.
- k) It is interpretative. - It describes clearly what it contains and the role it plays in the larger picture.

Using these as a criteria a matrix was formed (See Appendix 5) Each proposed hypotheses was rated as 1 if suitable or 0 if not. The following results were obtain.

<u>Score</u>	<u>Description</u>
11	Wrong Organisation Productivity is low Stocks too high Stocks flow wrong (bad planning) Insufficient feedback loops
10	Costing methods wrong Age of workforce Bad Customer Service Education low Low motivation Lack of purchasing control Usage not controlled Wrong materials used

- 9 No return investment into people
Excessive breakdowns
Unreasonable legislation
Excessive scrap
Excessive rework
- 8 Expectations too high
Insufficient training
Old Technology
Environment unsuitable
Business mix is wrong
- 7 Bad Management
- 6 Wrong business to be in
Bad attitude to Suppliers

It is important to note at this point that the successful rating of an idea as a hypothesis has been tested and not the idea itself.

3.4.2 Affinity Diagram (See Appendix 6)

The basic process to be applied is as follows:

- a) Form team (formed at observation stage)
- b) Generate ideas (completed in observation phase)
- c) Create cards and organise in groups - (See Appendix 7)
- d) Create header cards for each group
- e) Draw final affinity diagram - (See Appendix 8)

The objective here is to determine how the 24 hypotheses fall into categories. When this is established the category can be determined as follows:

- a) The external environment
- b) Stock flow wrong
- c) Quality problems
- d) People problems
- e) Wrong business to be in
- f) Maintenance problems
- g) Bad Management
- h) Loner - Costing method is wrong

If we consider there are 24 hypothesis put forward we can see the number applied in each group.

- a) 4
- b) 3
- c) 3
- d) 6
- e) 1

- f) 2
 - g) 4
 - h) 1
- 24**

This information or result will be used in the final summary as a weighted factor therefore the weighting percentage are as follows:

a)	The External Environment	=	16,7%
b)	Stock flow wrong	=	12,5%
c)	Quality Problems	=	12,5%
d)	People Problems	=	2,5%
e)	Wrong business to be in	=	4,2%
f)	Maintenance problems	=	8,4%
g)	Bad Management	=	16,7%
h)	Loner - Cost	=	4,2%

3.4.3 Interrelationship Digraph

The issue here is to determine the importance ranking of each hypothesis due to the degree of influence on others. The following criteria need to be fulfilled.

- a) The issue would need to be sufficiently complex that relationships are difficult to determine - with the establishment of 24 possible hypothesis this is certainly the case.
- b) The correct sequencing of management actions would be critical - not really so in the case, but important.
- c) There needs to be a feeling present that the problem under discussion is only a symptom - if we still consider low profits as the driving factors and the result then yes these are the possible causes of the symptom.
- d) There needs to be ample time available for the I.D to be done, reviewing it, modifying, and reviewing it again. Whilst it must be appreciated that Demmings Plan, Do, Check, Action cycle is continuous we can still assume that the time exists to complete and I.D. of sufficient accuracy for our purpose. As such the I.D. requirements are met in at least 3 of the 4 areas of this study and we continued from this point.

Assemble the right team

After re-examining the credentials of the team used for the affinity diagram the decision was taken to retain the same members.

Agreed upon issues/problems

With the problems already being identified we took the following course of action:

- 1) Remove header cards from affinity diagram exercise if they were created as unique from the 1st cut.
- 2) Re-confirm from the A.D. exercise if any feeling permeated that items should be removed, the concerns being NO.
- 3) Re-check if any additional items should now come into the exercise - the answer also being NO.

Display the completed cards

This action was not taken on a specific basis as the 1st cut affinity diagram was available and could be used in a blown-up format as the picture formed. This also negated the need to distribute the cards on a random basis as the possible items with the greatest relationship were close to each other. The potential then exists to keep the I.D. as tidy as possible.

Unlike the A.D. at this stage intense discussion took place, but with a controlled time span regarding the relationships involved.

Drawing of relationships

Here the pure relationship of the cause \longrightarrow effect theory was applied. Starting at the top left corner the question was asked of the first items what other item do I cause? and what other items has an effect on me?. As these points were asked of each item the relationship connectors and arrows were put in place as shown on the I.D (see Appendix 9)

Analysis

We then proceeded as follows to list the items involved and count the arrows coming into and out of each item (see Appendix 10)

We then examined the priority listing by cause and effect.

<u>By cause (Out)</u>		<u>By Total</u>	
1)	Stock flow wrong (11)	1)	Stock flow wrong (11)
2)	Wrong material used (6)	2)	Low productivity 910)
	No return investment on people	3)	Low motivation (8)
	Insufficient Training (6)	4)	Bad Management (7)
3)	Expectations too high (4)	5)	Material usage not controlled (6)
	Lack of Purchasing Control (4)		Wrong materials usage (6)
	Material usage not controlled (4)		No return investment in people (6)
	Low Motivation (4)		Wrong business to be in (6)
	Unsuitable Environment (4)		
	Business mix is wrong (4)		
	Bad Management (4)		
	Insufficient Feedback loops (4)		

If priority is given to items by cause the first 3 items to concentrate on became clear. If we determine that 7 items should be pursued then the first 3 stand-alone items should be extracted from the total listing to determine items 4,5,6 & 7. As such the items in priority would be:

- 1) Stock flow wrong
- 2) Wrong materials used
- 3) No return investment on people.
- 4) Insufficient training
- 5) Low Productivity
- 6) Low Motivation
- 7) Bad Management

3.4.4 Prioritisation Matrices

This technique is used when the following requirements need to be met.

- a) Key issues have been identified and options must be narrowed down i.e. to establish ± 7 sound hypothesis from the generated listing of 24.
- b) The criteria for good solutions have been agreed, but their priority cannot be reached by consensus. This is sound in fact if the 24 ideas could already be narrowed down to 3 then further studies would not be required.
- c) There are limited resources available - the desire to reduce the items to 3 follows within the limitations of time existing in the study.
- d) The options generated have strong interrelationships, this has been proven during the ID process.
- e) Generating options that have to be done, the formatting of the hypothetical premise must be acceptable to enable the deductive phase of the study to be commenced.

The full analytical criteria method

During the stages of agreeing on the ultimate goal the major premises set regarding profits are low is determined.

A group discussion then took place to determine the criteria that the options should meet with the following outcome:

- a) It must be cost effective.
- b) It must be easily solvable.
It must be important to the stakeholders i.e.:
- c) Clients
- d) Owners
- e) Actors
- f) It should be effected as soon as possible

The weighted importance of each criteria to each other was then established through a matrix using the following standards

1	=	Equally Important
5	=	Significantly more important
10	=	Extremely more important
1/5	=	Significantly less important
1/10	=	Extremely less important

This was then tabulated for examination -(See Appendix 11). From this point the matrix can be converted to a decimalized system (See Appendix 12)

The following process took place:

All columns were added and then the sub totals added for the grand total. All the rows were then added and taken as a percentage of the grand total. It can be noted that the % figures are virtually the same as the row total - this is due to the co-incidence of the grand total being almost 100.

The items by priority were then listed:

1st	Important to the owners	29%
2nd	Important to the Actors	26%
3rd	It must be cost effective	24%
4th	Important by the Client	8%
5th	It should be effected A.S.A.P.	3%
6th	It must be easily solvable	2%

Due to the very low rating involved in the 4th, 5th and 6th position it was decided to drop these three criteria from further consideration.

From this point a matrix was produced to examine the importance of each subject to another in light of the criteria being considered. The first step being to establish a listing of options as used previously.

The rules for each matrix were read across row A rating to B read column as inverse B rating to A.

A matrix was then formed for:

Importance to Owners (See Appendix 13)
 Importance to Actors (See Appendix 14)
 Cost Effectiveness (See Appendix 15)

With the exercise completed for the criteria and the options/subjects against the criteria the next stage was approached. The matrix was now produced that 2 lists all the options on the vertical scale and the criteria across the horizontal scale. (See Appendix 16)

The percentage ratings from Appendices 13, 14 & 15 can be entered into the relevant column and multiplied by the weighting factor from Appendix 12. The figures were then totalled to produce a final % of the grand total produced from totalling the columns. At this point the % were also converted to decimals. The list was then scanned to identify the seven top qualifying options by order.

	Item	Rating
1)	Costing method is wrong	(.07)
2)	Wrong Organisation	(.07)
3)	Low Productivity	(.07)
4)	Low motivation	(.06)
5)	Excessive scrap	(.05)
6)	Insufficient Training	(.05)
7)	Wrong business to be in	(0.044)

3.4.5 Questionnaire Procedure

To generate an understanding of the world views that existed in the company a questionnaire was developed, and issued to the following parties.

Directors

J van Heerden	Purchasing
P Hood	Quality
T Godycki	Engineering
B Moore	Human Resources
K Kruger	Finance
E Todd	Manufacturing (Satellite Plant include Stamping Plant)
P Riley	Manufacturing Main Assembly Plant

General Managers

A Cramb	Nissan Plant Management System Introduction
N Weber	Body and Paint
T Laycock	Overseas Purchases
P Redhead	Purchasing
J Mentz	Project Management
P Best	Training
C Dinham	Finance
T Vente	Trim and Mechanical
E Wilson	Quality Control
M Lowe	Trim Plant

Managers

P Harding	ISO 9002
D Sneygans	Body and Metal Finish
L Kapp	Purchasing Agent
A Smith	Inventory Control
J Claassen	Supervisor - Industrial Engineering
J Roztocil	Production Manager - Stamping Plant
J Weideman	Paint Shop

Of the 24 questionnaires sent out a total of 21 were received back demonstrating not only support for the thesis, but also the potential plight of Stamping Plant's future.

Three of the 21 returned were done on a confidential basis, but if one is allocated per area the percentage returns looked as follows:

	<u>Issued</u>	<u>Returned</u>	<u>%</u>
Directors	7	6	86
General Managers	10	9	90
Managers	7	6	86
Total	24	21	88

Therefore, the results of the questionnaire can be deemed to be representative of the target population.

Logic would say that when all the blocks were attempted to be filled each item has the same choice or probability of being chosen - all blocks filled will be added to the outcome, the data are as follows:

By Importance

		A	B	C	D	E	F
1	Bad Management	1	1	2	3	1	3
2	Wrong Organisation		1	2	1	1	0
3	Age of Workforce	2	3	2	3	1	0
4	Educational Levels	3	3	1	2	1	2
5	Insufficient Training	0	11	2	2	1	1
6	No Motivation	1	1	2	1	2	0
7	Expectations too high	1	1	2	1	2	0
8	No return investment into people	0	1	3	1	2	3
9	Bad Customer Relations	0	1	3	1	2	3
10	Bad Customer Attitude to suppliers	0	0	4	1	2	1
11	Old Technology	2	3	1	5	2	1
12	Excessive Breakdowns	2	2	3	1	1	1
13	Environment not suitable	1	1	2	0	5	0
14	Wrong Materials Used. (scrap/rework)	2	5	2	1	2	0
15	Lack of Purchasing Control	0	1	3	3	1	1
16	Usage not controlled	0	2	1	3	1	0
17	Stockholding too high/not controlled	0	0	4	1	2	0
18	Wrong business to be in	0	3	1	1	1	3
19	Unreasonable Legislation	0	1	3	2	3	1
20	Business mix is wrong	5	2	4	2	2	0
21	Feedback loops insufficient	1	2	1	2	1	1
22	Stock flows wrong	1	0	2	2	2	1
23	Costing incorrect by method	4	0	2	2	1	1
24	Low Productivity	2	0	2	2	1	1

If we then search for the seven items by rating we see the following results:

1	Business mix is wrong	(66)
2	Wrong materials used/inferior quality	(52)
3	Old Technology	(51)
4	Age of Workforce	(46)
5	Educational Levels	(45)
6	Costing incorrect by method	(45)
7	No motivation	(43)

3.4.6 Summary

The following techniques have been examined to search for the most suitable hypotheses to pursue.

- 1 Suitability for hypotheses criteria
- 2 Affinity Diagram

- 3 Interrelationship digraph
- 4 Full analytical criteria matrix method
- 5 Questionnaire

It is now pertinent to compare the results from item 1, 3, 4 & 5 to view the seven options that have been determined by priority. Also at this stage the % importance shown by item 2 per type of option must also be considered. The results are as follows:

Technique Position	Hypothesis Criteria	Interrelationship Digraph	Analytical Matrix	Questionnaire
1	Wrong Organisation	Stock flow wrong	Costing method is wrong	Business mix is wrong
2	Low Productivity	Wrong materials used	Wrong Organisation	Wrong materials used
3	Stock too high	No return investment	Low Productivity	Old Technology
4	Stock flow wrong	Insufficient Training	Low motivation	Age of workforce
5	Insufficient feedback loop	Low Productivity	Excessive scrap	Education levels
6		Low motivation	Insufficient training	Costing method is wrong
7		Bad Management	Wrong business to be in	Low motivation

Non

Determined	Costing method wrong	2
	Age of workforce	1
	Bad Customer Service	0
	Education low	1
	Low Motivation	3
	Lack of Purchasing Control	0
	Wrong Materials used	2
	Usage not controlled	0

Affinity Diagram

Weighting:	People Issues	=	25%
	Stock Issues	=	12,5%
	Management	=	16,7%
	Quality	=	12,5%
	Environment	=	16,7%
	Maintenance	=	8,4%
	Business	=	4,2%

To establish no 6 & 7 options of the hypothesis criteria the number of times it appears in other lists were taken into account and then weighted against the affinity diagram results as follows:

	<u>Appearing</u>	<u>Weighting</u>	<u>Results</u>
Costing method is wrong	2	.1	= 0.2
Age of Workforce	1	x0.2	= 0.2

Bad Customer Service	0	x0.06	= 0
Education Low	1	x0.2	= 0.2
Low Motivation	3	x0.2	= 0.6
Lack of Purchasing Control	0	x0.12	= 0
Wrong materials used	2	x0.12	= 0.24
Usage not controlled	0	x0.18	= 0

Position 6 & 7 could be filled by:

- a) Costing method is wrong
- b) Low motivation respectively

Whilst striving to arrive at a final hypothesis set of 3 items for further use a list was produced highlighting the positions attained and scoring 7 for position 1 down to 1 for position 7 etc. Then the weighting factor can again be applied regarding the affinity diagram results.

As shown in table 1.

Description	No. Of Appearances	Score	X	Aff. Diagram	Result
Wrong Organisation	(1x7) + (1x6)	13	x	0.25	3.250
Low Productivity	(1x6) + (1x3) + (1x5)	14	x	0.250	3.500
Stock Too High	1x5	5	x	0.125	0.625
Stock Flow Wrong	(1x4)+(1x1)	5	x	0.125	0.625
Insufficient Feedback Loops	1x3	3	x	0.250	0.750
Costing Methods Wrong	(1x2)+(1x7)+(1x2)	11	x	1	11.000
Low Motivation	(1x1)+(1x2)+(1x4)+(1x1)	8	x	0.250	2.000
Wrong Materials Used	(1x6)+(1x6)	12	x	0.042	0.504
No return Investment	(1x5)	5	x	0.250	1.250
Insufficient Training	(1x4)+(1x2)	6	x	0.250	1.500
Excessive Scrap	1x3	3	x	0.125	0.375
Wrong Business to be in	1x1	1	x	0.042	0.042
Business Mix is wrong	1x7	7	x	0.042	0.294
Old Technology	1x5	5	x	0.084	0.420
Age of Workforce	1x4	4	x	0.120	0.480
Education Levels	1x3	3	x	0.250	0.750

Table 1

The final rating scores then appear as follows:

- 1) Low productivity Men
- 2) Wrong Organisation Methods
- 3) Low motivation Men

3.5 ACTION (CONSIDER RESULTS)

This can lead to the following situations.

Proceeding through the application of techniques has allowed the 3 hypotheses with the best potential to be exposed.

The hypotheses can now be examined to determine if they are a problem in their own right predicting that will/will not be effecting the profits.

This will now be examined during the deductive reasoning in the chapter. Therefore we see the following:

1) **Profits are low**

Low profit can be caused by low productivity - check to see if productivity is low - hypothesis.

2) **Profits are low**

Low profit can be caused by a wrong organisation - check to see if organisation is wrong - hypothesis.

3) **Profits are low**

Low profits can be caused by a low motivation - check to see if motivation is low - hypothesis.

CHAPTER 4

DEDUCTIVE REASONING

4.1 INTRODUCTION

Leading from the Abductive reasoning we have established the three hypotheses with the greatest probability of success. They are not yet proven to be so, but only most plausible as highlighted by the techniques applied. The hypothesis are:

- a) Low motivation
- b) Wrong organisation
- c) Low Productivity

Referring to the framework build-up we can see the following.

Rules	a), b) or c) can cause low profits
Case	a), b) or c) are a problem
Result	There will be low profits

This section will examine by using the P.D.C.A cycle whether each of the hypotheses are seen to be a problem in their own right. This will lead to a prediction that they are affecting profits. If any are disproven then a re-selection from the original hypotheses can be made through a single loop response^⑤.

If all the original hypotheses were rejected then new reasons would need to be selected through the mental model this would be deemed a double loop response. The theory of this is seen in figure 1.

If we start with the basic proposal that something is wrong the need to check it becomes a requirement. The first alternative from that point is that it may prove not to be wrong.

This would facilitate the need to re-select another item through a single loop response to continue the cycle.

Alternately if something is proven to be wrong two results are possible i.e. it is or is not effecting the original problem (profits are low). If it is affecting profits an action plan is put into place to generate change.

The search then continues for something else that may be wrong also through a single loop response.

If at this stage all potential problems thought to effect profits are disproven a double loop response would be activated.

This would require the selection of new hypotheses thought to be causing problems or a total destabilisation of the mental model that states profits are low.

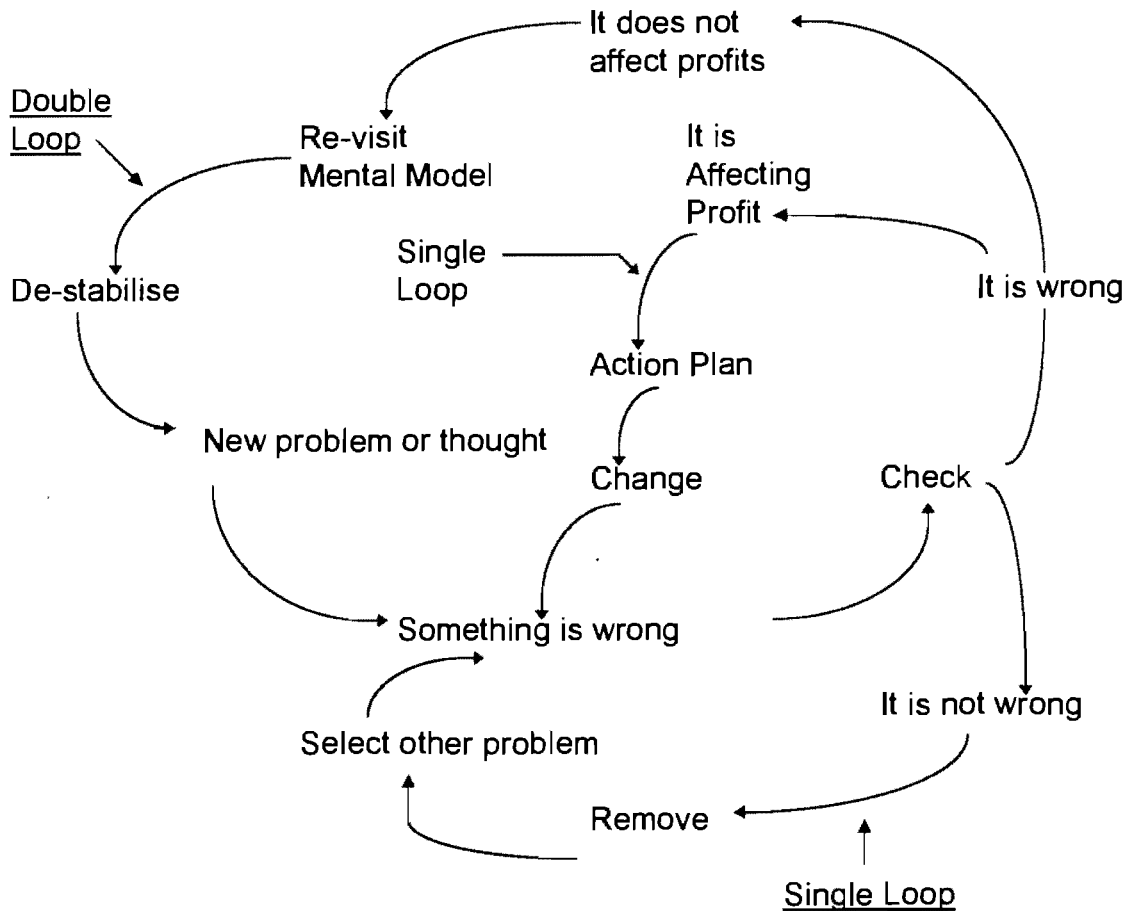


Figure 1

4.2 PLAN

Specific techniques will be applied to each hypothesis to determine and predict if they are potentially a cause of low profits as follows:

4.2.1 Low Motivation

If the question is posed "In which way would low motivation manifest itself in the operation?" we can begin to appreciate the techniques required to produce the most reliable answer.

The use of Human Performance Techniques are useful in this area. They examine if all the needs required are in place to enable, allow and motivate a person to perform.

The three major identified elements of Job performance are listed as Job design aspects, the Training & Development function and the Logistical Support that is required, as will be seen from the tetrahedron structure to be used for the model. The combination of any two of the elements supplies the desired behavioural pattern to produce optimum performance.

The logistical support which can be considered the containing whole of the system in view when combined with the Internal system present i.e. the job design generates a situation which allows the performance to be obtained.

The combinations of the logistical support and training and development function i.e. the people issue gives the individual the ability to perform.

Finally the relationship between the job design and training and development can be seen to supply the desire or motivation to perform. Figure 2 illustrates the relationship of the three elements. Training must be encompassed by logistical needs. In turn both need to operate within a well defined Job design/internal system.

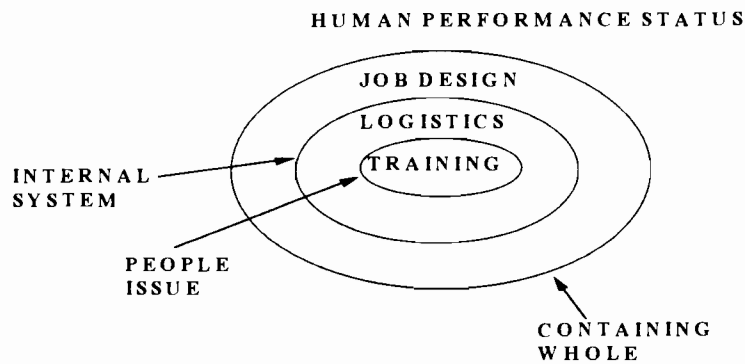


Figure 2

To examine the three elements further.

Job Design

Using the tetrahedron principle the three keys areas influencing job design are examined.

These are determined to be ergonomics (the people issue), task organising (the internal system) and the desired result or output (the containing whole). Stated otherwise this means that once an output or expectation has been set then the tasks involved can be established and ergonomically arranged to ensure optimum activity.

Logistical Support

When examining the area of logistical support the 3 key areas of influence are listed. These are personal needs (the people issue), the available resources (the internal system and the physical location (the containing whole). This is to say that once the correct physical location of the task in its external environment has been established and the necessary available resources supplied.

The personal needs of the task performance can be optimised to ensure an acceptable situation. This would lead in combination with the job design requirement to support the performance expectations.

When examining the relationships between the ends of the 3 legs it can be seen that selecting the correct physical location and supplying the resources allows

the task to take place. The relationship between the correct physical location and satisfying the personal needs creates the motivation/desire to perform the task. Finally the relationship between supplying the resources and fulfilling the personal needs give the ability to perform the task.

Training and Development

When examining the area of training and development the 3 legs of influence are listed.

These are selection criteria (the people issue), training procedures (the internal system issue) and the training policy (the containing whole). This is to say that once a training policy has been determined and established, the training materials made available for use and a suitable selection process taken place the task performance would be optimised. This would lead in combination with job design and logistical support to a total package regarding the requirement of optimal performance.

When examining the relationship between each of the 3 legs it can be seen that setting a training policy and supplying the training procedures allows the task to take place.

The relationship between the training policy and correct selection provides the motivation/desire to perform the task. Finally the relationship between supplying the training procedure required and pursuing the correct selection gives the ability to perform.

By virtue of model design each of the 9 issues discussed is also broken down into 3 legs each and the 27 (3 x 9) elements involved crucial to meet the needs or human performance.

4.2.2 Wrong Organisation

The methodology of the viable system model - (Raul Espejo in his *The V.S.M. revisited*)⁽¹⁾ has been used often to examine organisational characteristics of companies. This will be applied to the organisation of the Nissan Stamping Plant in detail. The techniques can be described as follows:

The V.S.M itself at any level of recursion is comprised of 5 basic systems. The systems 2 to 5 are not viable systems in themselves. If applied correctly they give system 1 the ability at that level to be viable in itself.

Two basic techniques that can be applied to a system to maintain that viability are as follows:

Black Box Technique

A black box can be defined as the boundaries around a series of processes and interactions. The relationship of the input and output to other black box systems in that environment need to be clearly understood.

If this is the case it is unnecessary to unravel that particular box to understand where it fits into a larger system.

Variety

It is critical for a system to be able to match the variety that is being presented to it. This can be achieved in two ways by attenuating or reducing the variety offered to it or amplifying (increasing) the variety at its disposal.

This could be achieved either by system 1's own contact with its external environment or through the effects of system 2 which is responding to S3 control which in turn is driven by system 4 which is in contact with the whole external environment at this level.

The ability of a system to have more responses of variety than are being received is termed requisite variety.

Five basic systems exist at any level of an activity and these are described as follows:

System 1

These are the systems directly concerned with the implementation of the tasks to be carried out. They carry with each black box a management function and should be as autonomous as possible.

System 2

System 2 act as monitoring function which can carry requirements from the control system (3S) and co-ordinate them between the various system S1's in an harmonious manner. It also dampens any oscillations between the various S1's. S2 activities should create understanding.

System 3

System 3 is the control system which can absorb information from system 4 and 2 and pass it into the system 1 operations. System 3 also has the benefit of an audit function which will check on the outputs of system 1 "S" and report back.

System 3 has three basic connections into the management functions of system 1. These are points of negotiation and settlement regarding resource bargaining (using system 2 input), policy guidelines (set through system 4 from system 5) and accountability (using audit function). 3 "S" activities should lead to actions.

System 4

System 4 has the ability to take policy decisions from system 5 to lower level systems.

In return it moves information up from system s 1 to 3 to system 5 in this regard it acts as a filter to protect system 5 from an overload situation.

Secondly system 4 collects all information about the total external environment and gives the organisation the ability to re-act and respond, therefore ensuring requisite variety in the organisation.

System 5

System 5 formulates policies and directs the whole enterprise. In the form of vertical integration it represents the essential qualities of the whole system through to systems 1 to 4 at a particular level of recursion and should process the ability to upwards and downwards information about those particular operating levels.

It is important to note once again that only system 1 is a viable system. Any other system from 2 to 5 must remain within its own autonomy to give itself the capability of testing its effectiveness, but it must not perceive itself as a viable system in isolation.

4.2.3 Low Productivity

The Nissan Stamping Plant has at its disposal productivity data supplied by Nissans Head Office in Japan. This displays the achievements of all Nissan Stamping Plants world-wide. If the need to be world competitive this becomes more important to the future than local competitors. Therefore this data will be used to analyse the situation regarding productivity in the operation.

We can now proceed to apply the techniques and analyse the findings.

4.3 DO & CHECK (COLLECT DATA AND APPLY)

4.3.1 Low Motivation

Before proceeding we need to examine the definition of the subject item.

Definition - Motivation - Some inner drive or impulse that causes one to act in a certain way.

Therefore, by implication low motivation would be deemed to be low or from lack of inner drive and low on the absence of an item/items that causes one to act in a certain way. If a level of acceptable motivation is to be identified then the expectation would be to determine the presence or absence of:-

An inner drive.

An impulse causing one to act in a certain way.

An acceptable organisational split within the operation by category is as follows:

- A) Senior Management - Director, General Manager
- B) Management - Managers, Supervisors, Foremen
- Technicians - Engineers, Artisans
- C) Operators - Press, Welders, Inspectors, etc.

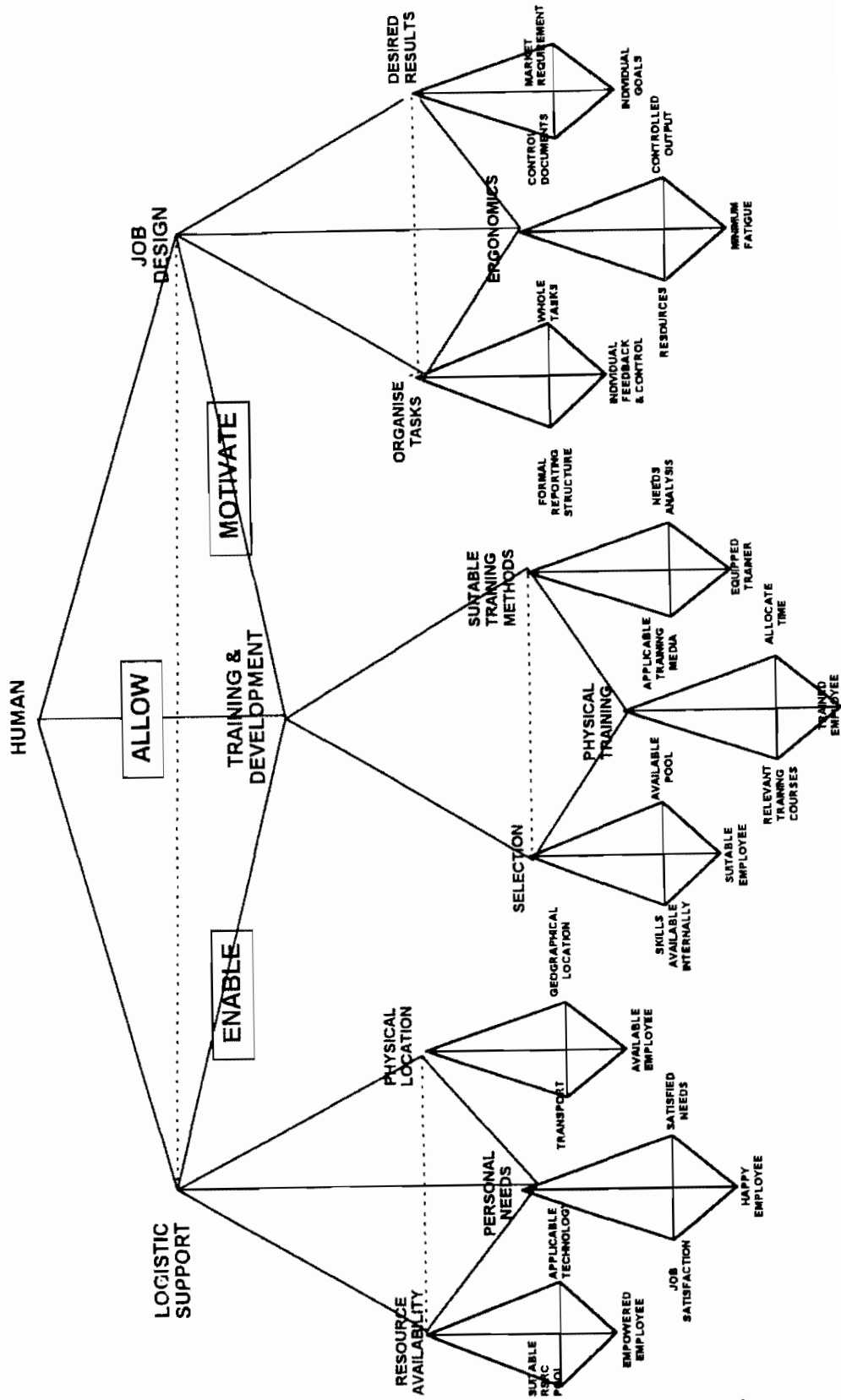
These will be examined by category using the techniques of human performance technology as laid out in figure 1. This has been created through a study conducted during previous lectures to present a case for successful human performance.

The three legs of logistical support, Job design and Training and Development were first established. This was deemed sufficient to Allow, Enable and Motivate successful Human Performance.

Each one of the three legs also needs to be supported to Allow, Enable and Motivate them to be successful in their own right. As such the three areas were identified to support each leg. Once established the procedure was repeated at a lower level to give the necessary support.

Figure 1

Human Performance Tetrahedron



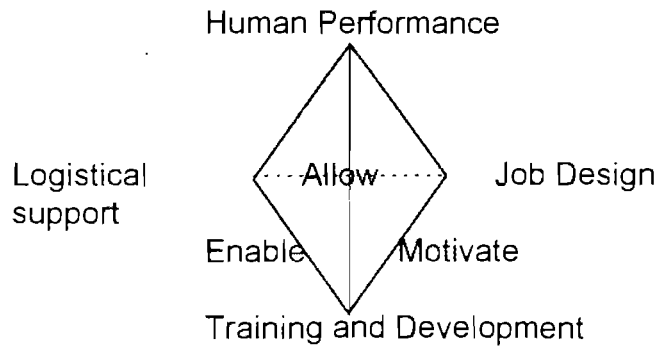


Figure 2

Using the theory of the upper level tetrahedron it can be seen in pure terms that a correct job design and training/development will generate motivation on a stand alone basis.

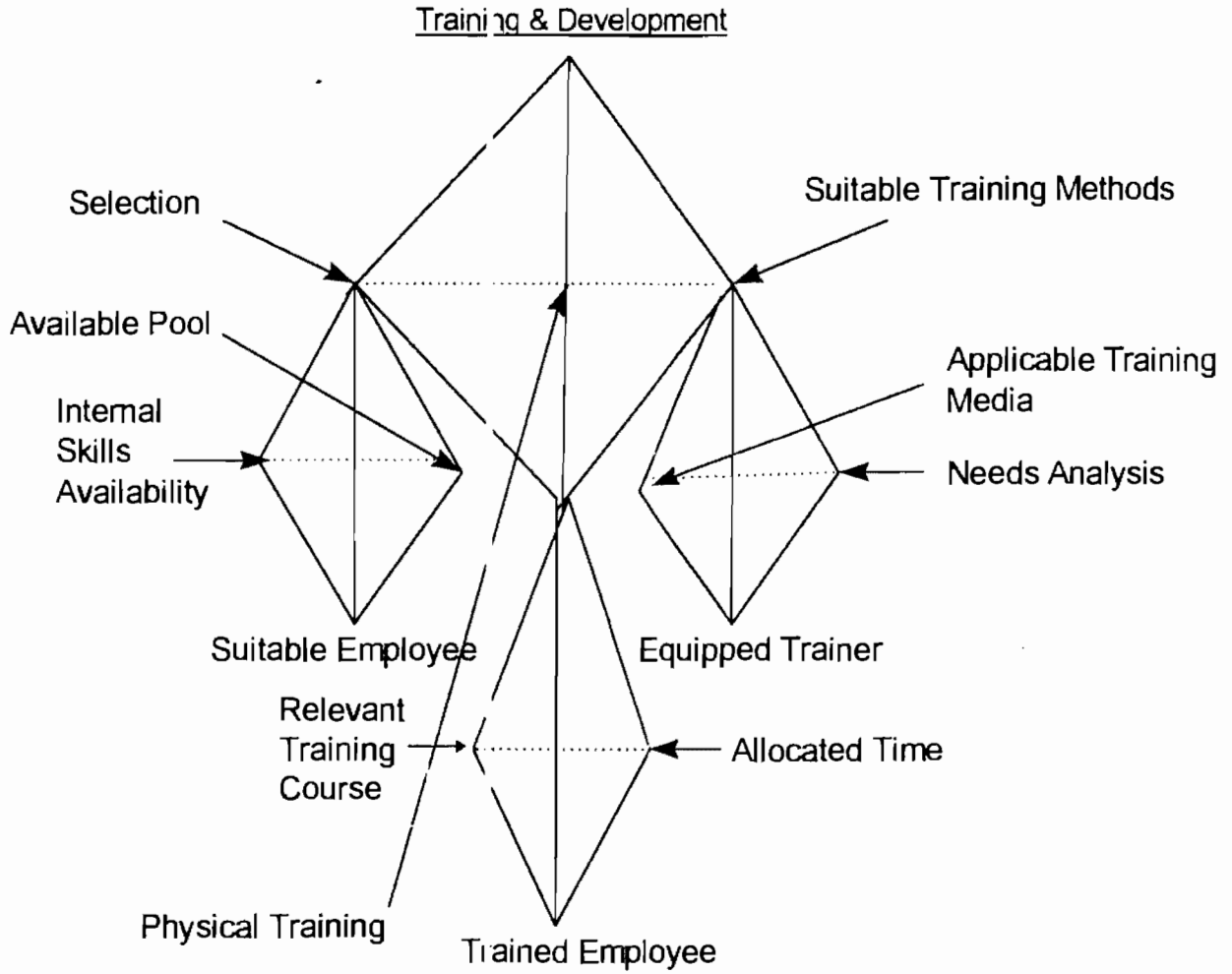
Therefore the fulfilment of the requirements for these two elements will be examined in detail by category.

A) SENIOR MANAGEMENT

As per figure 3 for a successful training and development scenario to be established the needs for correct selection, physical training and suitable training methods should be fulfilled.

Second Level of Human Performance
Tetrahedron

Figure 3



A.i) TRAINING & DEVELOPMENT (See Figure 1)

A.i.i) Selection (See figure 3)

A further breakdown shows the requirements for a successful selection strategy as in figure 4.

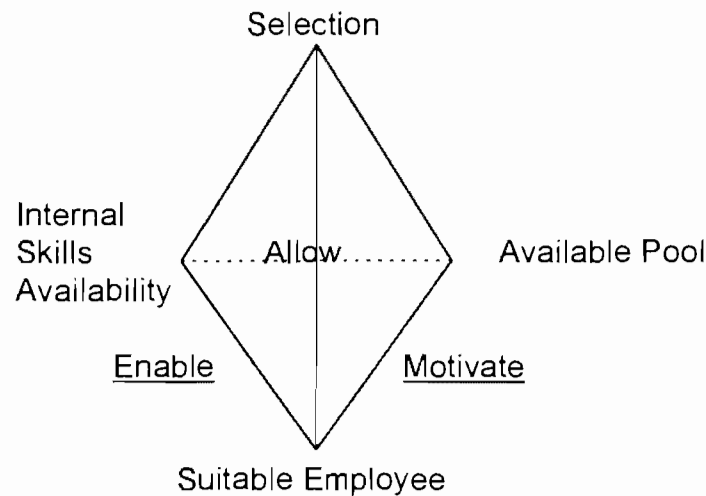


Figure 4

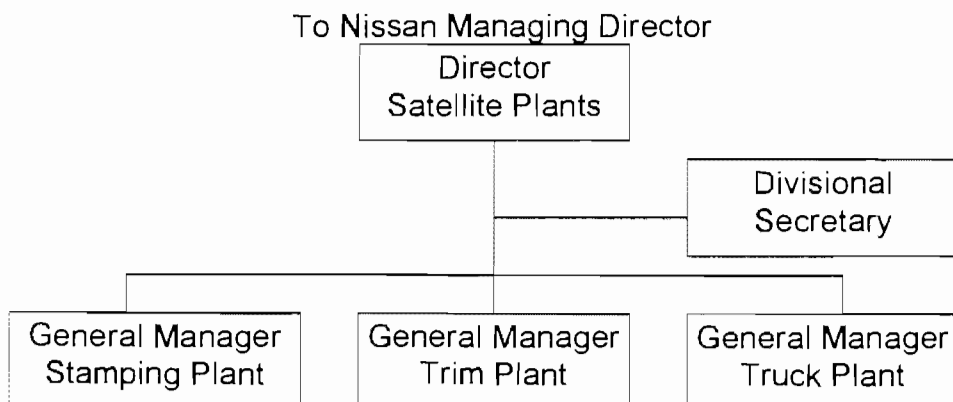
Therefore if we selected the correct employee from the skills available internally it would enable the correct selection to take place.

An Example

If that suitable employee were selected from the total external available pool a motivated employee would be in place.

If from that available pool and internal skills pool a candidate were selected then the selection would be allowed to be correct.

This category is a very personal issue as it involves 1 x Director and 1 x General Manager (the author) with an organisation as follows:



Although this area is small in number logically it has the most potential to influence the total organisation in a motivational manner.

A.i.iii) Suitable Training Methods (See figure 3)

A further breakdown shows the requirements for a successful suitable training methods as in figure 6.

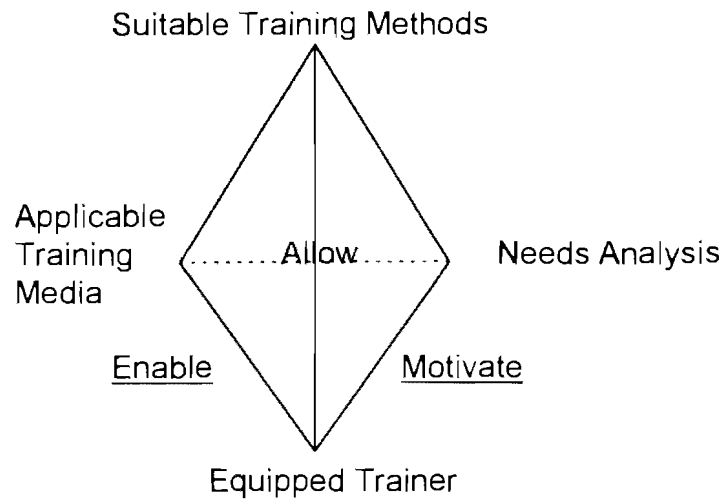


Figure 6

Upon examining the available training schedules it is apparent that the applicable training media is not entrenched on an ongoing basis. As such a needs analysis has not been performed at this level and trainers have not been equipped to pursue the necessary activities.

- * **To summarise** The motivation, enablement and allowance is not present at Director and General Manager level to present Suitable Training Methods.

A.i.iv) Training and Development Summary (See figure 2)

The next level of requirement are as shown in figure 7.

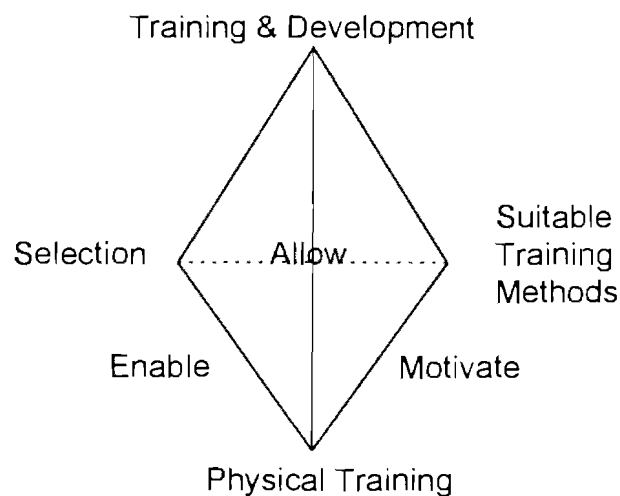


Figure 7

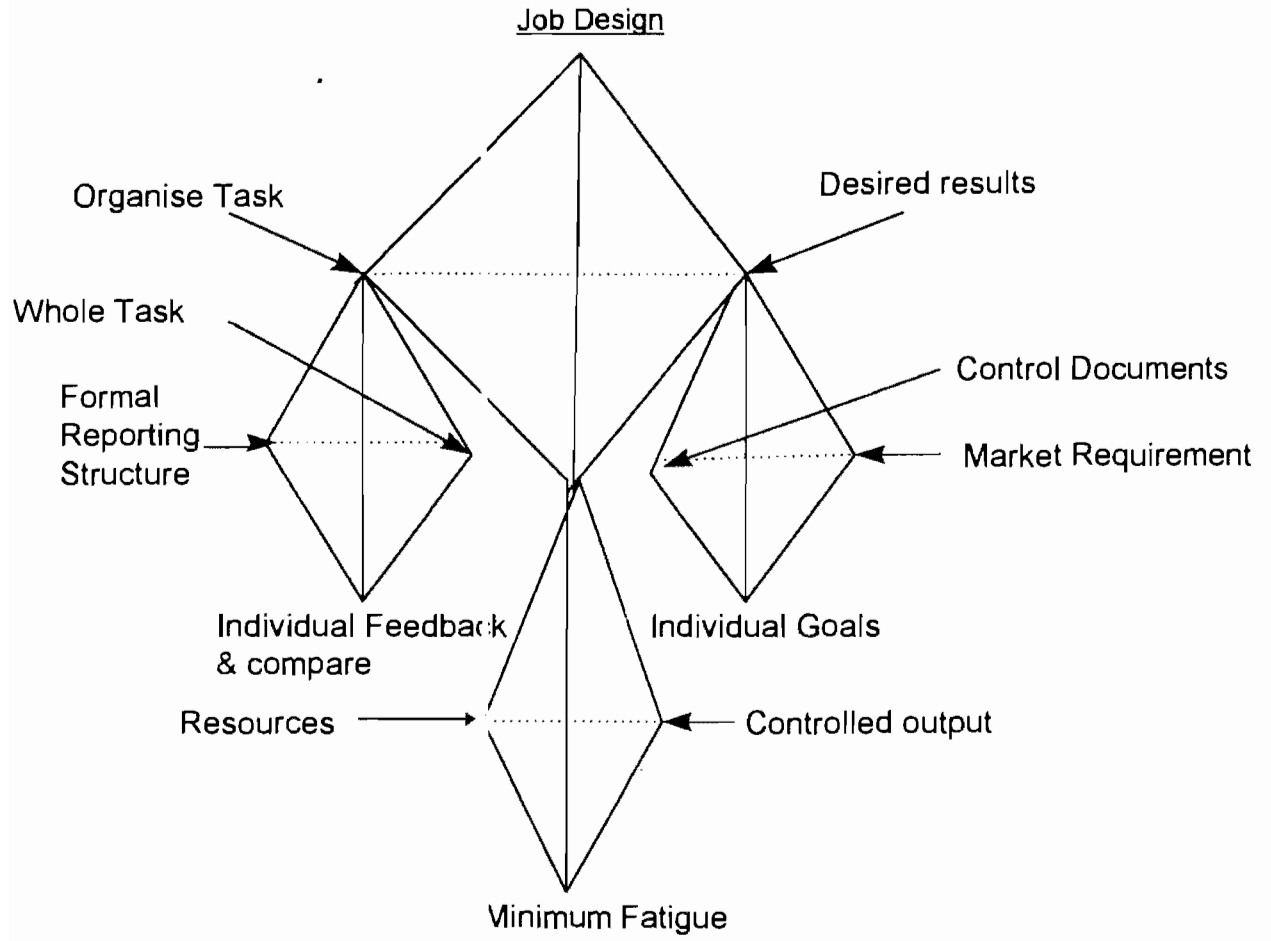
From previous summaries we have the following scenario.

- i) Selection and physical training elements are reasonably in place thereby enabling training and development to take place - it could happen.
- ii) The suitable training methods are not entrenched thereby not allowing suitable training and development to take place - even though the selection is entrenched.
- iii) Also with the suitable training methods not available although the relevant physical training is in place. Training & development is not motivated.

Therefore at this level the leg of training and development is not fully catered for in a motivational sense.

Second Level of Human Performance
Tetrahedron

Figure 8



A.ii) JOB DESIGN (SEE FIGURE 1)

A.ii.i Organise Tasks (See figure 8)

A further breakdown shows the requirements for a successful task organisation as in figure 9:

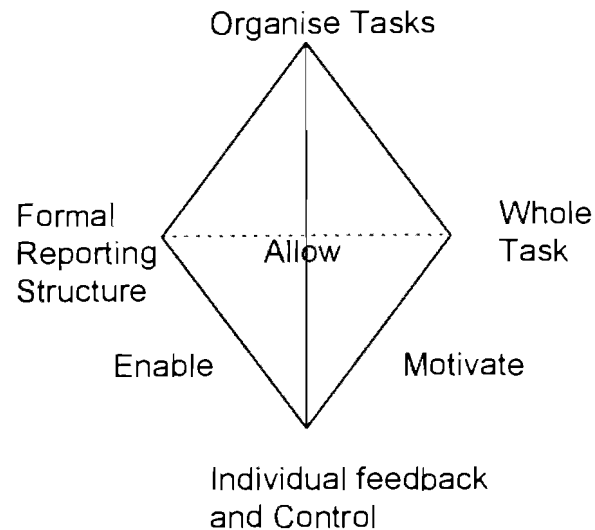


Figure 9

The organisation task element is very strong in the operation and is driven by Japanese Nissan support and involvement.

The direction of the company is driven through the stages of N.P.M.S which is the global Nissan Plant Management system.

N.P.M.S.

This system is designed to communise the activities of all overseas plants in the Nissan family and is practised and proven successfully in the Japanese local market. It is a very detailed and comprehensive system and an attempt will made here to summarise it's support for H.P.T benefits only.

What is N.P.M.S?

It is a system to ensure rules and actions are laid in place, targets set, results are examined and adjustment made if necessary i.e. the highest recursion level of Plan, Do, Check and Action, and from this we can understand the historical base of it's function through deeming influence on the Japanese quality culture.

How is the success of N.P.M.S tracked?

A Standard diagnosis sheet is established against standards, as can be seen in Appendix 23

This enables the understanding of the level of introduction if formatted as per world wide standards.

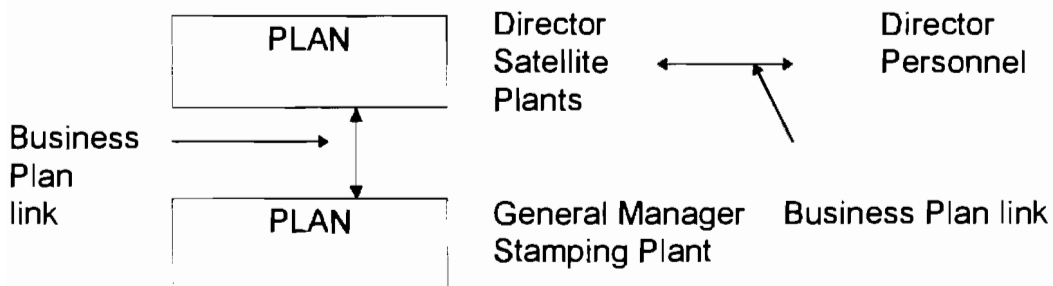
What are the elements of N.P.M.S?

For all requirements N.P.M.S standards are set i.e. New Model Introduction, Financial Procedures, Global Personnel Techniques etc., but at this stage we need to examine the operational elements. These are split into two basic areas that are:

Hoshin Kanri

This is the Japanese term for Business Management and has a basic requirement for the formulation of policies and business plans for all managerial levels.

Through this management tool both vertical and horizontal organisational performances are set and tracked.



Genba Kanri

The other leg to the control is G.K which is the Japanese term for Shop Floor Management - this will be examined in more detail at the shop floor motivational investigation. At this stage the link between H.K and G.K needs to be examined, it is an area the Japanese refer to as C & J i.e. Challenge and Jump and deemed to be the most difficult area to establish.

Via the business plan establishment a twice yearly feedback session takes place to examine success or failure. At this point decisions are made whether the original task is firm or the actions are not successful. This is a time where the mental model established could be re-de-stabilised via a double loop feedback or actions altered through a single loop process.

The whole procedure is very procedurised and give strong feedback and control. A typical control sheet ensures the responsible person is clearly identified giving good accountability for whole tasks. (See appendix 17).

Accountability vs. Responsibility

Accountability is placed on a person through the Business Plan Black dot principle i.e. he is accountable for reporting the success or failure. Also in appendix 18 an empty dot indicates that a person is responsible to support the other persons activity. That is if you control the whole task you are accountable whereas if you assist with it in part you are responsible for that particular part.

To summarise - At Director and General Manager level the elements of formal reporting, feedback control and whole tasks are firmly entrenched. This places strong ability, allowance and motivates to organise tasks.

A.ii.ii) Ergonomics (See figure 8)

A further breakdown shows the requirements for successful ergonomics as shown.

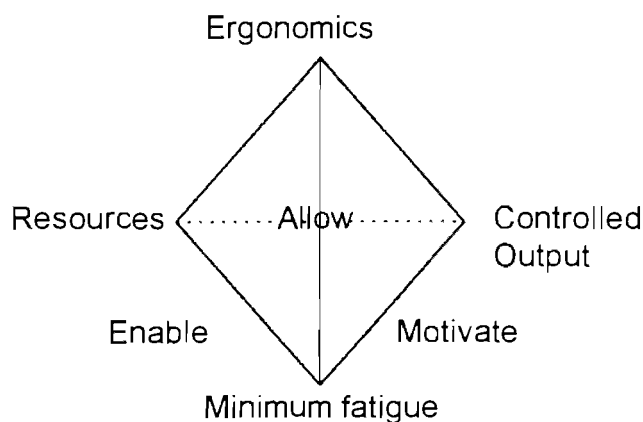


Figure 10

Ergonomically the resources required at this level would be indicated in the working environment. Very little if any regard is given in the operation to this aspect and off-line lighting, and furniture is old fashioned, money is not budgeted for heating and cooling and generally the resources are sub standard. It can surely be assumed the unnecessary fatigue is caused from the above statements and also outputs would suffer as a result of this. Also the requests for output are introduced in a hap-hazard way which also leads to undue fatigue. It's the nature of the business is a key phrase easily accepted by all.

To summarise - At Director and General Manager level there are inadequate resources, hap-hazard output and unnecessary fatigue - ergonomically they are not enabled, motivated or allowed to perform at their best.

A.ii.iii) Desired Results (See figure 8)

A further breakdown shows the requirements for success is obtaining the desired results as shown below.

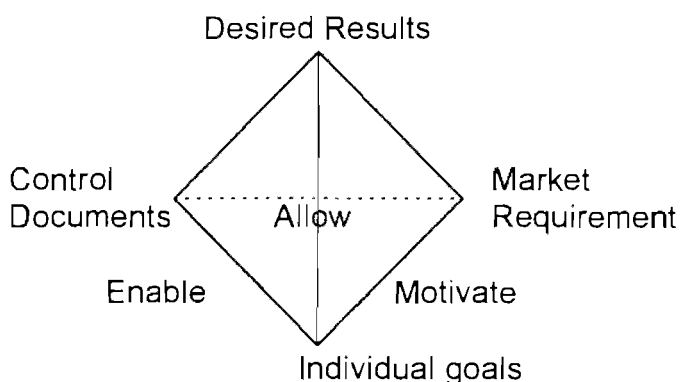


Figure 11

A similarity exists here regarding control documents and individual goals in comparison to the organisation of tasks examined previously. The NPMS is strong in entrenching these elements into the organisation. Examining the phrase market requirements one can see the need for an overall purpose within the operation - this is supplied by the :policy statements: or in the business plans and is very clear. To summarise - All elements are in place via the NPMS system at Director and General Manager level. This enables, allows and motivates the desired result to be achieved.

A.ii.iv) Job Design Summary (See figure 8)

We now need to re-examine the upper level of requirement as shown.

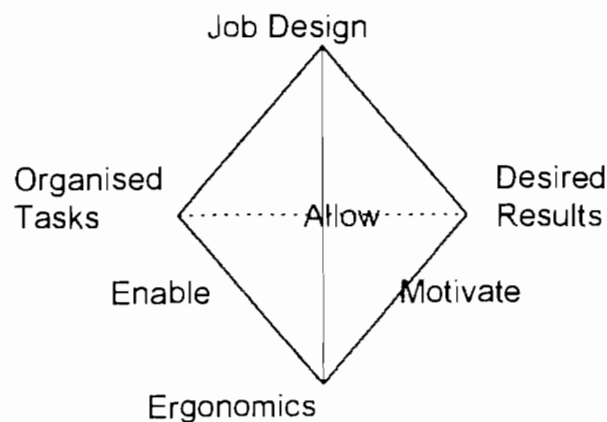


Figure 12

- i) With the element of organised tasks well entrenched, but problems indicated ergonomically the Director and General Manager are not well enabled towards job design.
- ii) Also with the desired results in place, but the problems existing with ergonomics the correct motivation is not in place.
- iii) With all the systems and tools available through organised tasks and desired results entrenched the Director and General Manager are allowed to work through the correct job design.

DIRECTOR AND GENERAL MANAGER - FINAL SUMMARY

We now need to re-examine the upper level of the HPT tetrahedron as shown.

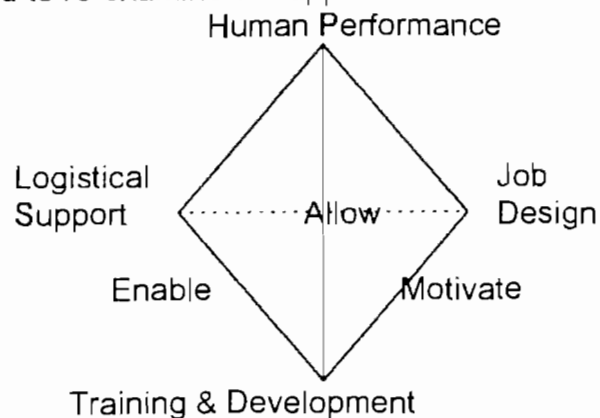


Figure 13

The 2 legs to examine for motivational purposes are job design and training & development.

Job Design

Previous summaries indicate that bad ergonomics seriously effect both the enabling and motivating of the establishment of a good job design.

Training And Development

The lack of suitable training methods causes a lack of both the allowance and motivation of suitable training and development at this level.

Conclusion

There is not a suitable level of job design or training and development, therefore sufficient motivation is not in place.

B) MANAGEMENT

The existing organisation structure can be seen in appendix 19.

By definition in this category management would refer to Managers, Superintendents and Foremen.

As previously determined to produce the required motivation for optimum human performance we need to fill the requirements for training and development and job design.

B.i) TRAINING AND DEVELOPMENT (SEE FIGURE 1)

B.ii) Selection (See figure 3)

We need 3 elements to be fulfilled for selection which are discussed as follows:

Skills available internally

With the business being very technically orientated the trend has been to promote within from the ranks of artisans into managerial positions. Also at foreman level people have been placed mostly from an internal basis.

Available Pool

For a period of 3 years via a punitive policy decision in the operation people have not been selected at all from outside leading to very narrow and constricted view of the operation.

Suitable Employee

The pure fact that the outside market has not been considered at all leads to the conclusion that the most suitable employee cannot be in place in these areas.

To summarise

Therefore the correct selection procedure is not in place and is neither allowed, enabled or motivated to take place.

B.i.ii) Physical Training (See figure 3)

The three elements needs for a successful physical training programme are as follows:

Relevant Training Courses

The available courses are listed as follows:

MANAGERS & LINE MANAGEMENT INTERNAL TRAINING COURSES	
PRESENTATION SKILLS	COST OF QUALITY
ACHIEVEMENT MOTIVATION	QUALITY PROBLEM SOLVING
TIME MANAGEMENT	STATISTICAL PROCESS CONTROL
INTERPERSONAL SKILLS	FOREMAN DEVELOPMENT PHASE 1
REPORT WRITING	FOREMAN DEVELOPMENT PHASE 2
PROBLEM SOLVING THEORY	FOREMAN DEVELOPMENT PHASE 3
NEGOTIATION SKILLS	SUPERVISOR SAFETY TRAINING
MEETING LEADING	FIRST AID TRAINING

These courses have been developed by the in-plant training department over the years through a needs analysis basis and feedback shows them to be relevant to these needs.

Allocate Time

Time is allocated and available for this category of employee to attend courses as and when needed.

Trained Employee

The employee in this category as a result of the available time and course availability is trained at the level required.

To summarise

The physical training is well entrenched through these structures and is allowed, enabled and motivated.

B.i.iii) Suitable Training Methods (See figure 3)

The three elements needed for a successful Suitable Training Methods are as follows:

Applicable Training Media

Training rooms, course literature, equipment etc. is well provided for and in place.

Needs Analysis

As previously stated needs analysis takes place on a regular basis and the company is driven by policy decision to provide 5 needs driven training days per employee per annum.

Equipped Trainer

Well trained and capable trainers are available in both the technical and managerial fields. They are stationed at the plant itself and are also trained themselves externally to keep abreast of changing techniques.

To Summarise

Suitable training methods are well positioned in all aspects at this level and allow, enable and motivate the training to take place.

B.i.iv) Training & Development Summary (See figure 1)

Having examined the 3 legs needed for the training and development leg of the H.P.T tetrahedron we can summarise as follows:

The selection criteria has not been satisfied at all and this can seriously hamper the allowance of training and development particularly development as a lack of alternative experience is not there as a base.

Also the enablement can be affected in the same sense not allowing the physical training to be related to other experiences to adopt where necessary.

Both the physical training and suitable training methods are well in place therefore producing a strong motivation towards training and development.

B.ii) JOB DESIGN (See figure 1)

B.ii.i) Organise Tasks (See figure 8)

The three elements to be fulfilled for organise tasks are as follows:

Formal Reporting Structure

As seen in Appendixes 19 this structure is very firmly in place at managerial level.

The business plan is set for the year, control charts created, action plans set and a monthly feedback meeting occurs on a formal basis. This is all structured with the Hoshin Kanri system mentioned earlier.

When we examine the foreman level i.e. the Genba Kanri activities they are much more informal and do not have direct links back to the Business Plans. Japanese assistance is presently on site to assist to put this element in place.

Whole Tasks

Again the task on hand is very evident at managerial level also with the supervisory level being in charge of work units the task is clear as well.

Individual feedback and control

The pattern is repeated here as in the reporting structure through the K.P.I's, (key performance indicators) the Managers are tracked and either a single loop feedback is obtained to re-address the action plans or a double loop feedback occurs on a 6 monthly basis to re-examine the mental model in place when choosing K.P.I areas and targets.

This understanding is not yet in place at supervisory and foreman level and feedback tends to be treated as unfair criticism rather than for positive changes.

To summarise

Through the managerial chart there appears to be a gap between the senior and more junior activities. As such the task organisation is not totally clear and is not sufficiently enabled to occur nor allowed to be finalised or motivated to be present.

B.ii.ii) Ergonomics (See figure 8)

The three elements to be fulfilled to cater for acceptable ergonomics are as follows:

Resources

The major resource requirement in these areas is the means and ability to conduct business with the group being controlled. The managers are positioned either in-plant or in the administration block and have the authority to make the choice themselves. The Japanese concept of green areas is well established, this being an area where the supervision can address their work units in a controlled fashion and share in target setting and decision making.

Minimum Fatigue

Fatigue is evident due to the sheer size of the operation as can be seen in Appendix 21.

Whilst this is not held to a minimum it could be deemed that a acceptable level is achieved through the options of patrolling the lines or working through paperwork requirements in the off-line/green area sections.

Controlled Output

This is an area of major concern, a job description is not in place for these positions and expectation can tend to vary due to pressure and varying expectations from above.

Also continuous schedule changes occur placing varying timing expectations and altered plans into the operation. Changes in policy direction are often taken without due considerations to the managerial and supervisory concerns.

To summarise

Ergonomic requirements are enabled through the control of fatigue and resources made available. Unfortunately the varying output requirements do not always allow this to remain in place, also the output variation can generate a demotivating aspect to the ergonomic activities in this task.

B.ii.iii)Desired Results (See figure 8)

The three elements required to be in position to produce the desired results are as follows:

Control Documents

The control documents are well established and visually available at managerial level. As previously stated this is lacking at the lower supervisory levels and the link to management is not yet clearly established.

Individual Goals

Again as above, clear for management, but not so at lower levels.

Market Requirement

The requirement for the company is indicated through the company mission statement and is displayed prominently for all to see as shown.



Unfortunately actions taken do not always follow the statement and therefore confusing and contradictory messages are sent out.

To summarise

Problems occur in all the areas of control documents, individual goals and market requirements thereby not enabling, allowing or motivating the achievement of desired results.

B.ii.iv) Job Design Summary (See figure 1)

Having examined the 3 legs needed for the required job design leg of the H.P.T. tetrahedron we can summarise as follows:

The organise task leg of the requirement has not been met due to a gap in the reporting chain and also the desired results are not capable of being met therefore not allowing the correct job design to be set.

Also the full ergonomic requirement is not present due to job need fluctuations and therefore the job design required is neither enabled to be set or motivated into it's correct position at this level.

Conclusion

Whilst there is a level of motivation towards training and development it is not fully allowed or enabled to take place due to the inability to achieve the desired results and ergonomic shortfalls, therefore the validity of training and development is questionable.

The job design leg is neither satisfied from an enablement, allowance or motivational view due to also a lack of adherence in the control structures. It is evident that the expected motivation of human performance could not be fully materialised at this level of the organisation.

C) OPERATORS

The job descriptions by definition in this category are as follows:

Press Operator
Welders - CO2 and spot
Fork Truck Drivers
Truck Drivers
Inspectors
Tool Setters
Re-workers
Packers
Artisan Assistants

It is pertinent to note at this stage that through historical development and Union pressures 99% of the population in question are male black Africans.

The total workforce in this area number in the region of 450 and work a day/night shift pattern. We can now proceed to examine the criteria applied previously.

C.i) **TRAINING AND DEVELOPMENT (See figure 1)**

C.i.i) **Selection (See figure 3)**

We need 3 elements to be fulfilled for selection which are discussed as follows:

Available Pool

The situation here is reciprocal to the previous statements and the external availability of skills at this level has been pursued on a zero basis.

Suitable Employee

It is difficult to establish the most suitable employee for the task on hand when all employment options have not been examined. Also here age plays a role, with the recorded average age of operators steadily increasing. It is at the time of writing standing at 45 years.

To summarise

The correct selection is not in place at all and is neither motivated, allowed to occur or enabled to proceed.

C.i.ii) **Physical Training (See figure 3)**

The three elements needed for a successful physical training are to be examined. Within these areas the physical training are considered as on the shop floor or on the Job training.

Relevant Training Courses

Here the courses are developed by the technical training department and are tabulated as follows:

OPERATOR	
<i>INTERNAL TRAINING COURSES</i>	
Co2 Welding	ISO 9002 for the shop floor
Fork Truck Driving	Customer Care
10 Ton Crane Driving	Safety Training
50 Ton Crane Driving	First Aid Training
Slinging	Fire Fighting
Single action press setting	3 "s" training
Double action press setting	Green Area Training
Gap frame press setting	Free Market System
Patrol Inspector	SHE Training
Line Inspector	Team Building

Allocate time

There is no allocation built into the headcount numbers and due to the pressures of production it is virtually impossible to release operators for training during normal hours.

To further compound this problem there are major budgeting restrictions regarding overtime costs for this activity. Consequently the allocation of people for training is at a minimum level.

Skills available Internally

With the aforementioned policy of non-employment from outside for the previous 3 years the issue of internal promotion has been high. Also the development of union pressures have controlled the operator development for almost a 10 year period. As such the internal skills have been developed and tailored to meet requirements.

Trained Employee

As can be predicted that with the restrictions discussed the opportunity to realise a suitably trained employee in this category is not achieved.

To summarise

The physical training demonstrates some possibility to be allowed and enabled due to the available training courses.

This is unfortunately negated by the time restrictions which also removes any ability or motivation for it to occur.

C.i.iii) Suitable Training Methods (See figure 3)

During this analysis the operators situation regarding class room training will be examined through the following 3 elements.

Applicable Training Media

The training class room is established next to the plant and is equipped with necessary tools identified for the purpose.

Needs Analysis

Needs analysis are conducted by the training department and updated as required on an ongoing basis.

Equipped Trainer

Trainers are well versed in their subjects, well qualified and demonstrate high capabilities in this regard.

To summarise

In this area all these elements are entrenched and as such they motivate, enable and allow for suitable training methods to be in place.

C.i.iv) Training and Development Summary (See figure 1)

The three legs of the Training and Development tetrahedron requirements can be summarised as follows:

Suitable training methods are well in place and form some degree of motivation and allowance towards the goal. The time constraints present regarding the physical training activities unfortunately remove motivation towards the goal.

The lack of additional appointments does not allow current Training and Development to take place and this combined with the lack of time allocation does not enable it to happen at all.

C.ii) JOB DESIGN (See figure 1)

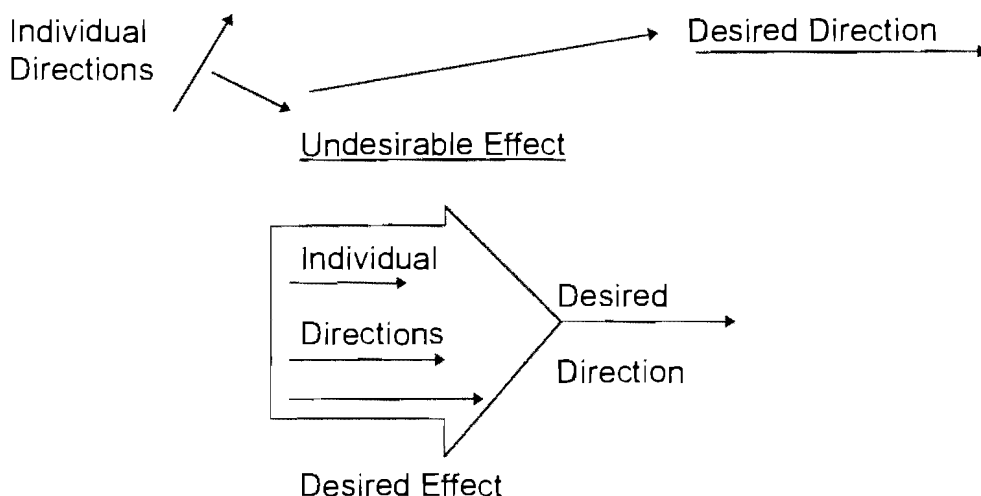
C.ii.i Organise Tasks (See figure 8)

The three elements that need to be fulfilled for this are as follows:

Formal Reporting Structure

To keep costs under control every effort is made to facilitate the use of flexible Manufacturing i.e. to move people around various tasks as required.

The introduction of multi-skilling being driven by the Unions and training committee's is further enhancing this area of activity. The downside of this activity is that the formulation of the team or tribal concept is seriously hampered. This can effect the common goal established by the foreman with his team of operators as shown.



Whole Tasks

All jobs in this environment area run on a production line basis therefore the task of an operation is complete in its own right as his identified part of the process, this process is based on the requirements of the Japanese product making plant rules (Appendix 22 refer).

Individual feedback and control

Here the operations line within the controls of the Genba Kanri - Shop Floor Management system which is presently being introduced.

This is not fully in place and if we consider this analysis as a snap shot in time the feedback is not yet in place. Both the foreman and the operator still retain a I say so - you do so mentality which is difficult to change after many years of being encouraged operating in this manner.

To summarise

The whole task is in place demonstrating possible motivation and allowance for tasks to be sufficiently organised.

The formal reporting structure and feedback are very opaque at this stage and the enablement of the task to be organised is not present. Also this presents an adverse effect on both the motivational and allowance requirements.

C.ii.ii) Ergonomics (See figure 8)

The three elements to be catered for to fulfil acceptable ergonomics are as follows:

Resources

The resources in this case are really the tools to do the job and these are available as and when requirements change. Extensive costs go into supplying these needs and a formalised structure to generate improvements.

Through the Japanese Kaizen (continuous improvement) programme all employees are both encouraged and rewarded in monetary terms to submit improvements.

Minimum Fatigue

Manning levels are set for operations to ensure that the task is not over-exerting individuals. With noise and light being identified as major contributors the levels of both are controlled via the initial setting of standards or in the case of noise via the compulsory wearing of ear protection.

Break periods are well spread and all efforts are made to reduce fatigue. To a person used to doing these activities fatigue should not be a major factor, although the age situation needs to be monitored closely.

Controlled Output

All work tasks have had standards established by Industrial Engineers with built in world standard ratings and relaxation allowances. The expectation is to work to the standards which can be deemed to be at a controlled level.

To summarise

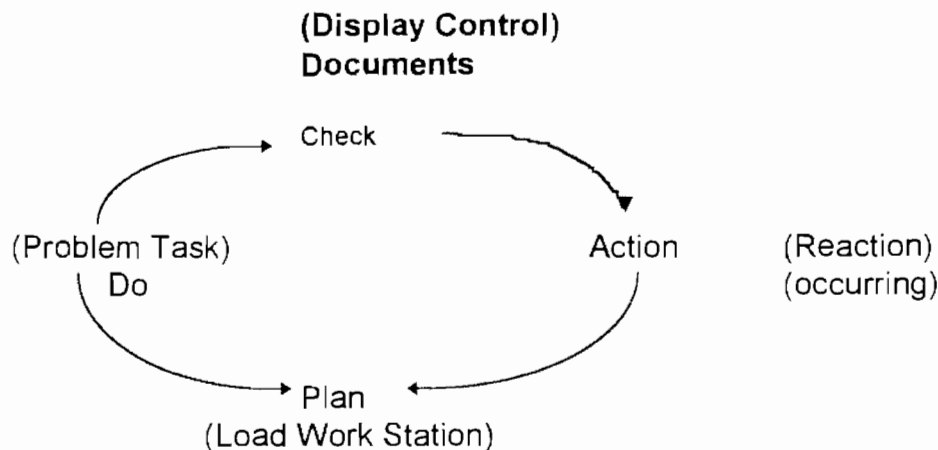
Ergonomically all three elements are in place and ergonomically the tasks are motivated, allowed and enabled.

C.ii.iii) Desired Results (See figure 8)

The three elements required to be positioned to produce desired results are as follows:

Control Documents

Again in this area of activity the Genba Kanri introduction improves this situation. Documents are displayed for the operators, but they do not generate any positive responses and re-actions as shown through a typical Shewart cycle.



Individual Goals

There are not any clearly defined individual goals apparent within the mental paradigm of the operator. Yes standards must be met, but they are perceived to belong to someone else.

Market Requirements

Communication take place once a month with the work-force in an attempt by management to keep everyone abreast with future events and requirements.

How well this is received and understood is a little unclear, but the activity takes place. Education and language is a barrier in this regard.

To summarise

On face value control documents are available and compiled with market requirements the desired results are allowed to be achieved. The lack of clarity regarding the individual goals to be achieved adversely effects the motivation and enablement in this regard.

C.i.iv) Job Design Summary (See figure 1)

Having examined the 3 needs for the requirements of this job design leg of the H.P.T tetrahedron at this level we can summarise as follows:

This appears to be a major concern at this level. Ergonomically things are in place and show an potential to both motivate and enable the correct job design. The desired results cannot be effectively actioned, therefore the motivational aspect is not realised. Major elements are missing also regarding the Organise Tasks elements and therefore the enablement is also prevented. The allowance to present an acceptable Job Design is not activated at all due to the Organise Task and Desired Result problems. The final conclusion to this analysis can be shown as follows:

HUMAN PERFORMANCE SUMMARY

Director/General Manager

CATEGORY	MOTIVATE	ENABLE	ALLOW	REASON FOR NO
Human Performance	<u>No</u>	N/A	N/A	Insufficient Training & No job design
Training & Development	<u>No</u>	Yes	<u>No</u>	Lack of suitable training & bad ergonomics
Selection	Yes	Yes	Yes	
Physical Training	Yes	Yes	Yes	
Suitable Training	<u>No</u>	<u>No</u>	<u>No</u>	Lack of needs analysis
Organise Tasks	Yes	Yes	Yes	
Ergonomics	<u>No</u>	<u>No</u>	<u>No</u>	Inadequate resources map hazard expectations

MANAGEMENT

CATEGORY	MOTIVATE	ENABLE	ALLOW	REASON FOR NO
Human performance	No	N/A	N/A	Job design leg not satisfied
Training & Development	Yes	No	No	Lack of outside expertise
Job Design	No	No	No	Expectations and requirements not clear
Selection	No	No	No	Lack of outside selection
Physical Training	Yes	Yes	Yes	
Suitable Training	Yes	Yes	Yes	
Organise Tasks	No	No	No	Clear links not evident between levels
Ergonomics	No	Yes	No	Varying output expectations
Desired Results	No	No	No	Missions statement not adhered too. Unclear expectations at lower levels

OPERATORS

CATEGORY	MOTIVATE	ENABLE	ALLOW	REASON FOR NO
Human Performance	No	N/A	N/A	Training & Development and job design not in place
Training & Development	No	No	No	Selection questionnaire & training time neglected
Job Design	No	No	No	Operator Understanding very low
Selection	No	No	No	No external employment
Physical Training	No	No	No	No time allocated
Suitable Training	Yes	Yes	Yes	
Organise Tasks	No	No	No	Feedback loops not clear or understood
Ergonomics	Yes	Yes	Yes	
Desired Result	No	No	Yes	Individual goals not present or understood

CONCLUSION

Evidence of motivation towards acceptable human performance expectations is not apparent at all levels. The reasons become evident and it seems that if the effort and requirements are not entrenched into the areas required a motivated work force cannot be expected.

Therefore:

- Rule - Low motivation can cause low profits.
- Case - Motivation is low and could be causing low profits.
- Result - Profits are too low

4.3.2 Wrong Organization

From the abductive phase of analysis it has been determined that there is a high hypothetical probability that the organisation of the NSP could be wrong. If we examine the deep meaning of organisation in itself it is important not to consider the issue of people only which can often be the case. As shown in figure 1 organisations have a very clear vertical responsibility, horizontal connection and recursion links which establish relationships between process levels. Within this framework lies the various systems links and loops that are needed for a successful organisation, this is the holistic approach to an organisation.

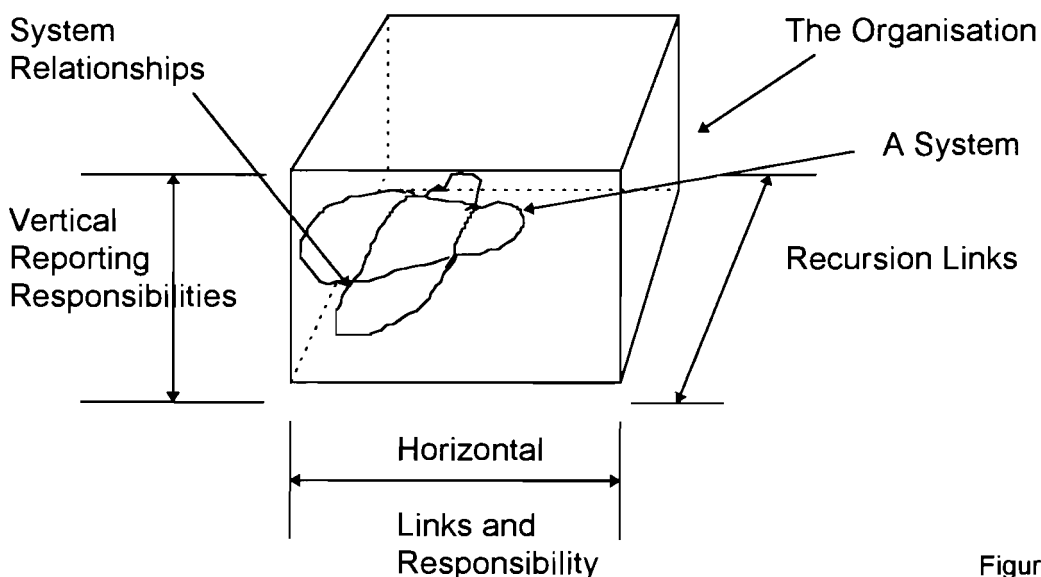


Figure 1

Next we would need to search for the meaning of a wrong organisation. This can be deemed to be an organisation that is not meeting the needs of a company. These basic needs are presented in a very clear and suitable manner through the framework of Stafford Beers Viable System Model.^⑥ & ^⑦ He states that organisations are split into levels of activities in their own right and are part of a higher level and have parts of their own at lower levels. These levels he calls recursions and each one consists of 5 very distinct systems, which are:

- System 1 - Direct Processing Activities
- System 2 - Support systems for monitoring - These perform balancing activities between system 1 activities and supply meaning.
- System 3 - Control - This activity takes S4, S5 and S2 information and controls the relationships between them. It also conducts audit functions on S1 activities to supply actions.
- System 4 - Intelligence - This activity has direct links with the external environment and whilst giving cognisance to S5 information it allows S3 to control S1 in this regard.
- System 5 - Policy - At a particular recursion level this is the longer-term policy setting activity of the other systems.

Each system also has vertical links to perform also through the recursion levels. Normally three recursions are examined at level 0, 1 and 2. The upper boundary needs to be determined the human mind is not fully capable of understanding the ultimate recursion 0 level.

The object of a successful organisation is to retain its own requisite variety in regard to its environment. Put quite simply it must have more answers than the question being asked of. The intention is to examine the N.S.P organisation via the framework of a V.S.M.^⑦

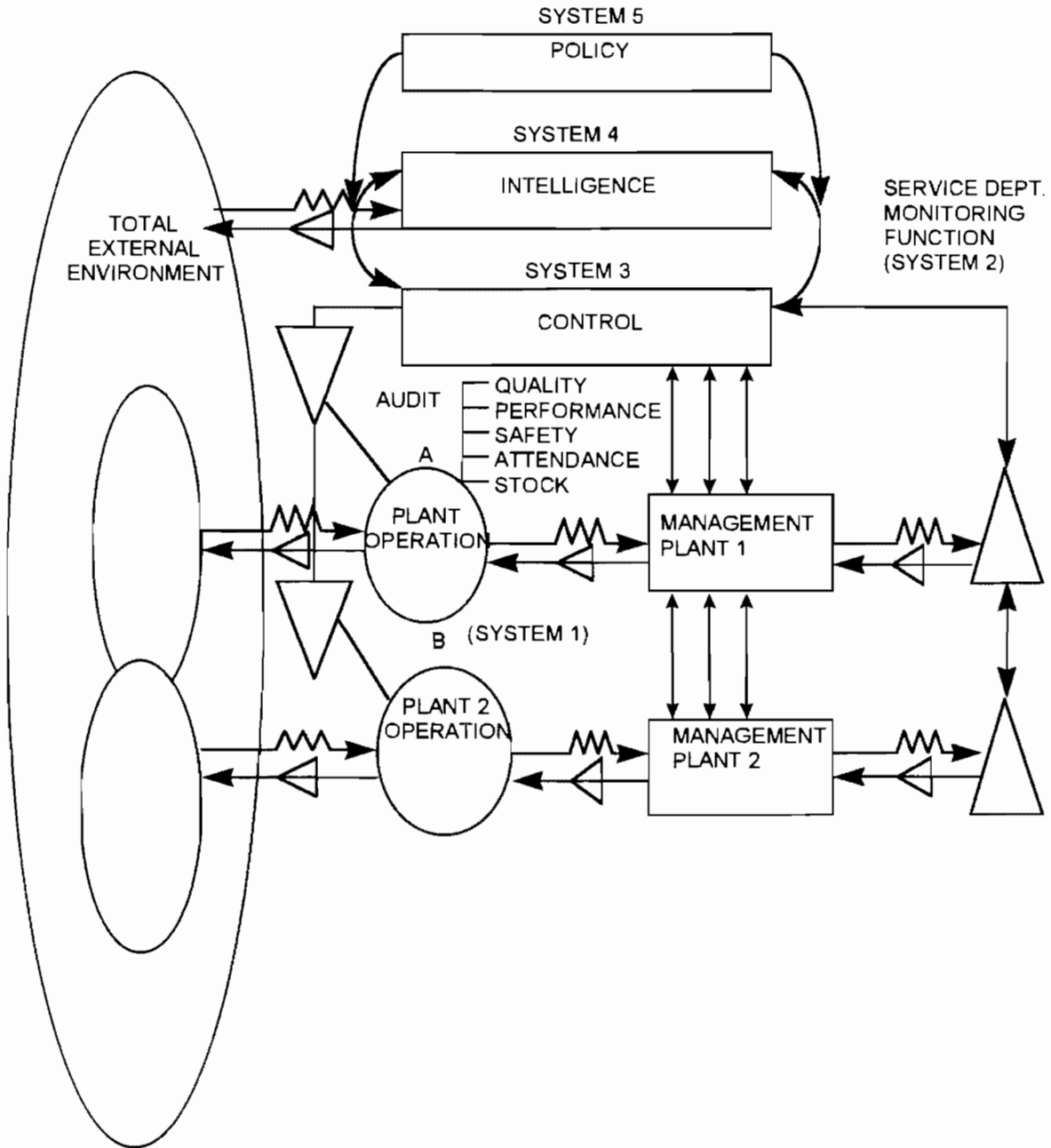
VIABLE SYSTEM MODELLING

Planning

- a) Establish a V.S.M of whole Nissan Stamping Plant operation.
- b) Layout 3.1 at recursion level 1.
- c) Consider Nissan Stamping Plant operation within whole Nissan operation.
- d) Layout 3.3 at recursion level 0.
- e) Consider system 1 areas on recursion 1.
- f) Remove one system 1 from recursion 1 to establish recursion 2.
- g) Layout total process at recursion 2 considering input and output.
- h) Use transformation process to determine "whole parts" at recursion 2.S1 level in focus.
- i) Use T.I.E.D analysis to motivate the correctness of thought at recursion 2.
- j) Diagnose S2 to S5 at recursion 2.
- k) Build V.S.M at recursion 2.
- l) Analyse recursion 2.

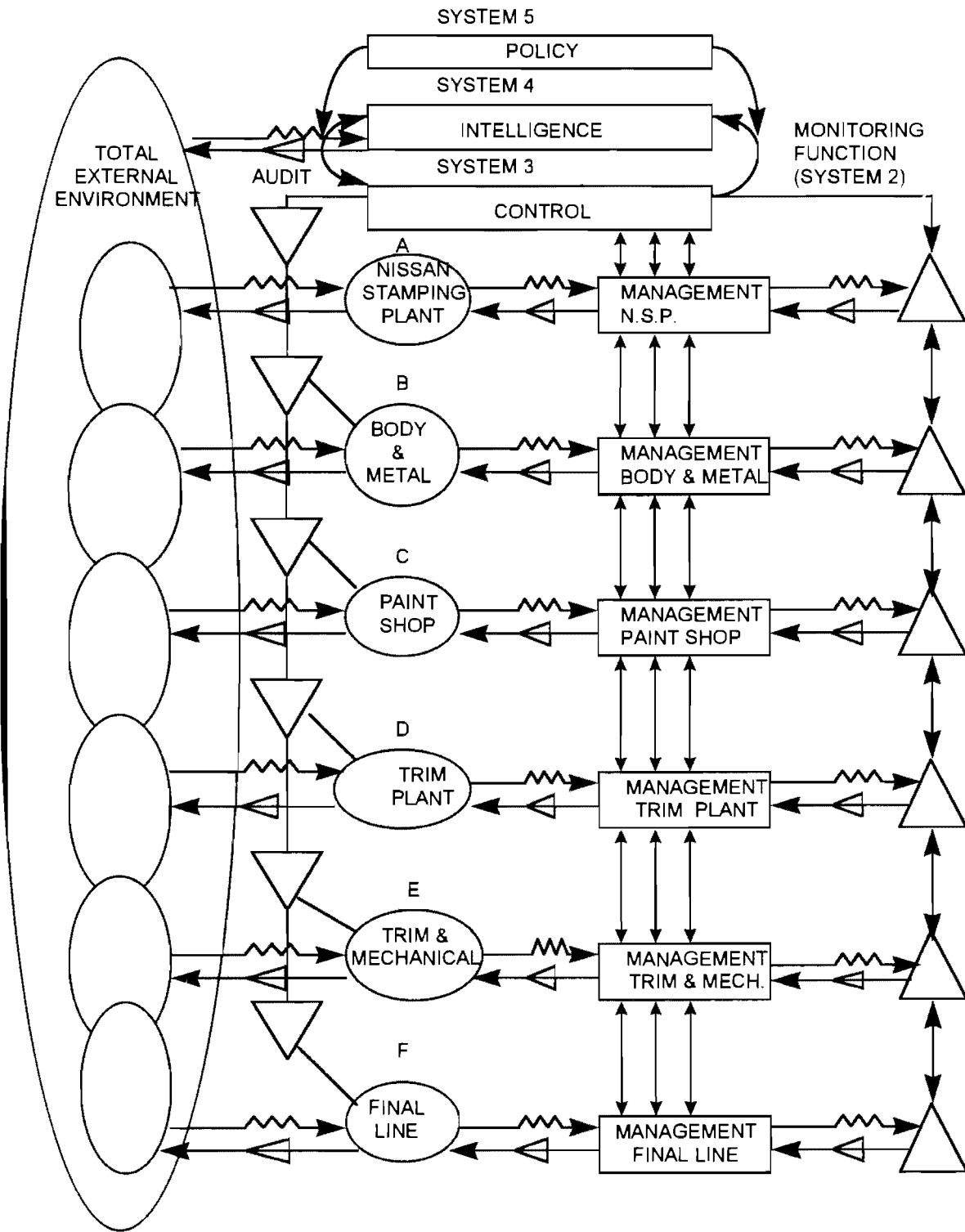
VIABLE SYSTEMS MODEL
RECURSION 1 - NISSAN STAMPING PLANT

Figure 2



VIALE SYSTEMS MODEL
RECURSION 0 - NISSAN MANUFACTURING

Figure 3



EXECUTION

The objective of this section is to diagnose and comment on the Nissan Stamping Plant operation. The basic principle adopted will be to synthesise the operation and not to analyse in detail as analysing area may lead to a complexity that will prevent the situation being re-constructed. This in turn will lead to an inability to reach sensible conclusions.

Nissan Stamping Plant

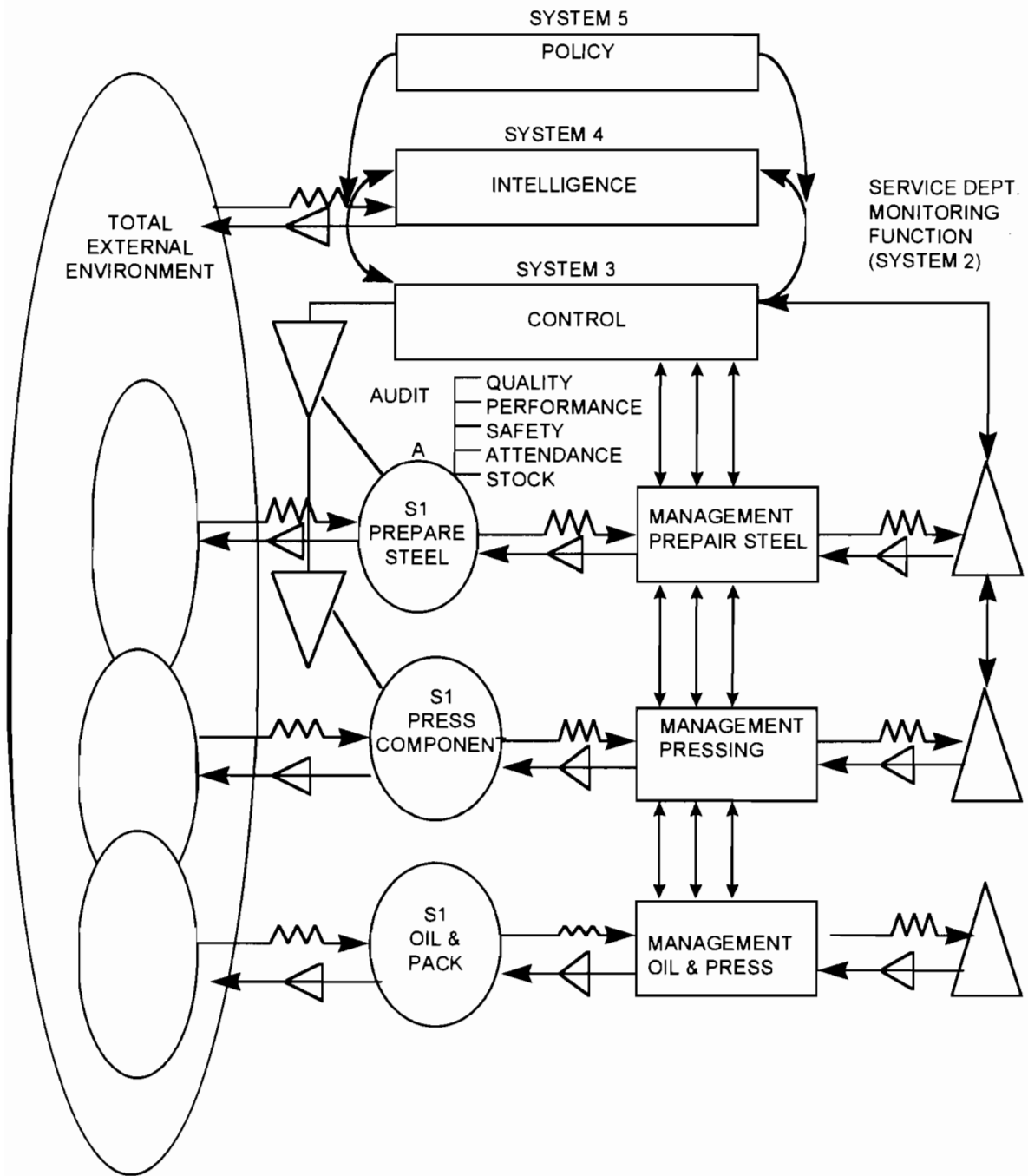
A V.S.M. of the NSP operation has been built using detailed knowledge of the operation (See figure 2).

The operation is easily split into 2 main system 1 areas with each having a definite input and out-put requirement, this model is deemed to be at Recursion 1.

By establishing the Recursion level 0 (See figure 3) it will enable vertical integration to take place during the diagnosis of the recursion in focus.

At this higher level we see how the Nissan Stamping is positioned within the Nissan System.

VIALE SYSTEMS MODEL
RECURSION 2 - PLANT 1



NISSAN STAMPING PLANT

It now becomes necessary to build a rich picture of the system 1 to 5 of recursion level 2 that is the system in focus (Figure 4 refer).

TO ESTABLISH SYSTEM 1 RECURSION 2

Firstly the whole process was laid out as follows in figure 5:

NOTE: Planning and stock control will be considered in system 2 and 5 areas.

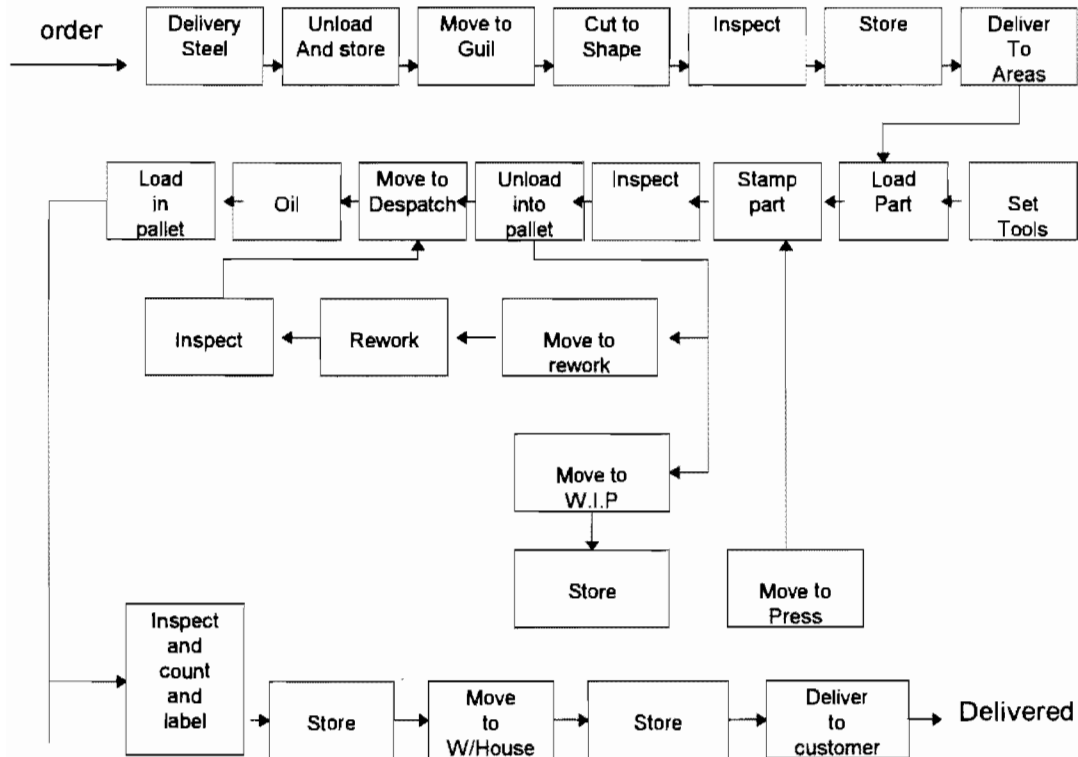
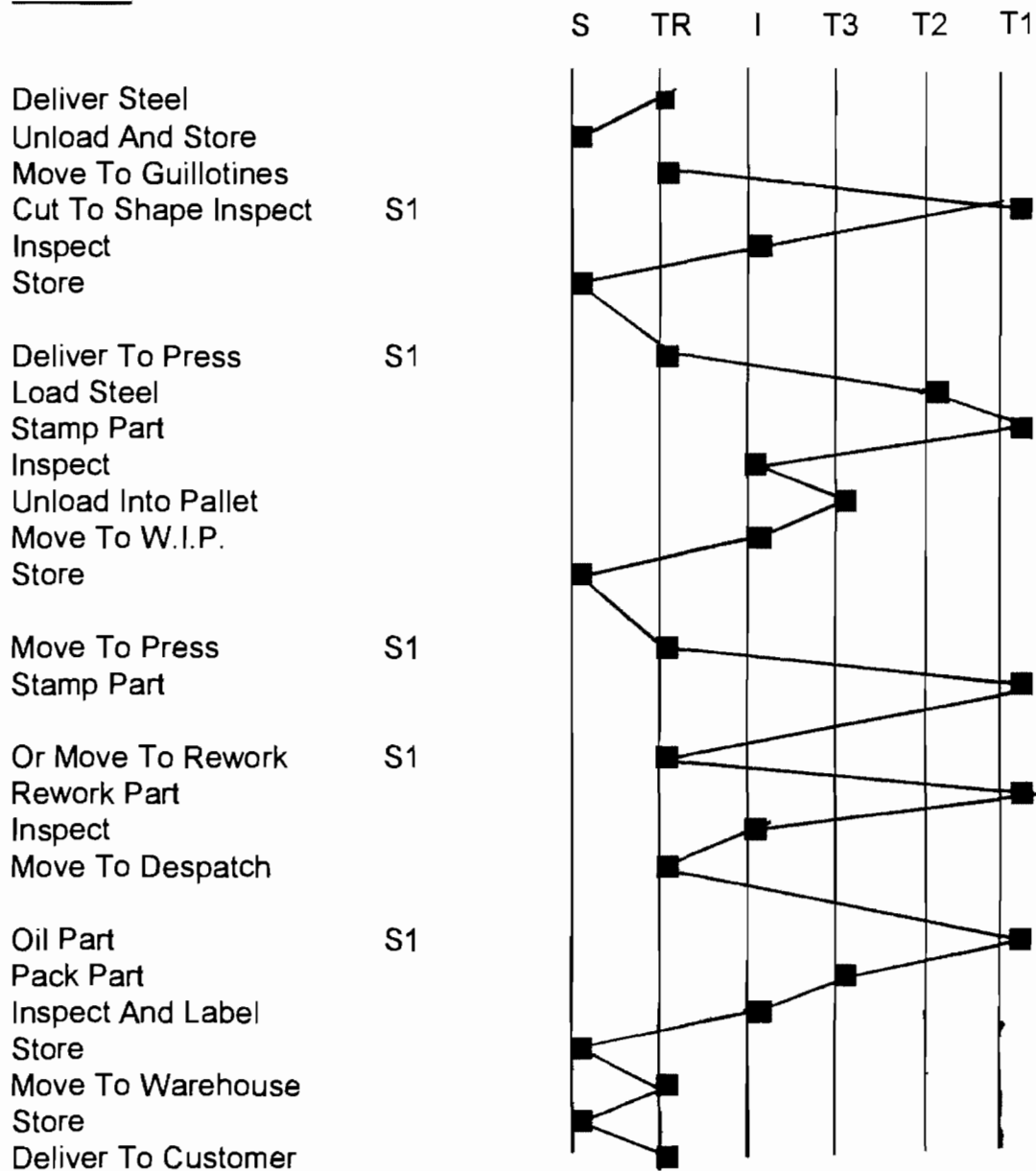


Figure 5

Once the total process was established the transformation process was applied to determine the whole tasks being performed at Recursion 2.

TRANSFORMATION PROCESS APPLIED TO RECURSION 2 EXISTING PROCEDURES

Where	T1	=	Whole Transformation (E.G. Cannot Change Back)
	T2	=	Secondary Transformation (E.G. , Prep Or Finish)
	T3	=	Slight Change (E.G. Packaging)
	I	=	Inspection
	Tr	=	Transport
	S	=	Storage

Process

Using this technique we can search for the activities occurring between low points on the scale. This is basically from storage point to storage each of these areas can be deemed a S1 or system 1 activity. We then see from the results of the transformation process 5 whole tasks or system 1 activities were identified as follows:

1. Prepare Steel
2. Stamp Finished Part From Steel
3. Stamp Finished Part From W.I.P.
4. Rework Defective Stock
5. Oiling And Packaging

This could be represented as such:

SYSTEM IDENTIFICATION

A full system identification was then undertaken to give a rich picture of the build-up of the V.S.M. at recursion 2.

SYSTEM IDENTIFICATION - RECURSION 2

System 1

To detail for each of 5 elements of system 1 their environment, operations and localised management.

DESCRIPTION	ENVIRONMENT	OPERATION	LOCAL MANAGEMENT
Prepare steel	Steel supplier And planning Section	To turn raw Material into Prepared sheets	Guillotines Foreman
Stamp finished Part from steel	Scheduling and Planning	To make a Finished Component From a sheet of steel	Press shop Superintendent
Stamp finished Part from work in process	Scheduling	As description	Press shop Superintendent
Rework Defective stock	Customer Quality Department And quality control	Remove defects For components	Superintendent tool repair
Oiling and packaging	Warehouse Weather	To oil and pack finished components	Superintendent Despatch

To list constraints imposed on each component of system 1 by higher management (system 3)

- | | | |
|--|---|-------------------------------|
| Prepare Steel | - | Level Of Stock In Steel Store |
| | - | Stock Accuracy |
| | - | Productivity |
| Stamp Finished Part
From Steel | - | Productivity |
| | - | Headcount Levels |
| | - | Safety |
| | - | Quality Levels |
| Stamp Finished Part
From W.I.P. | - | Level Of W.I.P. Store |
| | - | Machine Utilisation |
| | - | Safety |
| | - | Quality Levels |

- Rework Defective Stock**
- Level Of Rework Store
 - Quality Levels
 - Productivity
- Oiling And Packaging**
- Level Of Despatch Store
 - S.N.P. (Standard Number Packaging)
 - Quality Throughput-Quality
 - Safety

To examine how accountability is exercised for each part and what indicators of performance are taken, all performance indicators in the stamping plant operations are reported through the K.P.I. system. These are key performance indicators which start at Foreman level and are reported up to the next level of authority until it reaches the Managing director.

DESCRIPTION	PERFORMANCE AREA	UNITS	REPORTED BY	REPORTED TO	HOW	FREQUENCY
PREPARE STEEL	STOCK LEVEL	R000`S	FINANCE	GEN. MANAGER	COST REVIEW	MONTHLY
	STOCK ACCURACY	%	MAN. MATL. CONTROL	GEN. MANAGER	STOCK -TAKE	TWICE PER YEAR
	THROUGH-PUT	COST\ SHIFT	GUILLOTINE FOREMAN INDUSTRIAL ENGINEERING	MAN. MATL. CONTROL	COUNTERS	DAILY
	TIMELY AVAILABILITY	LOST HOURS		MANAGER P/SHOP	FORMAL REPORT	MONTHLY
STAMP FINISHED PART FROM STEEL	EFFICIENCY	S.P.H.	INDUSTRIAL ENG.	MANAGER P/SHOP	FORMAL REPORT	AS REQUIRED
	MACHINE UTILISATION	% OF HOURS	INDUSTRIAL ENG.	MANAGER P/SHOP	FORMAL REPORT	AS REQUIRED
STAMP FROM W.I.P.	COST OF QUALITY	% OF SALES	QUALITY MANAGER	MANAGER P/SHOP	VERBALLY/FOR MAL	DAILY
	W.I.P STOCK LEVELS	R000`S	FINANCE	MANAGER P/SHOP	COST REVIEW	MONTHLY
	HEADCOUNT	NO OF PEOPLE	INDUSTRIAL RELATIONS	MANAGER P/SHOP	PRINT-OUT	WHEN REQUESTED
REWORK DEFECTIVE STOCK	STOCK LEVEL	R`000	FINANCE	GEN. MANAGER	COST REVIEW	MONTHLY
	THOUGH-PUT	PARTS/ MAN HOUR	SUPERINTENDENT DIE REPAIR	MANAGER P/SHOP	VERBALLY	DAILY
OILING AND PACKAGING	STOCK LEVEL	R000`S	FINANCE	GEN. MANAGER	COST REVIEW	MONTHLY
	TROUGH-PUT	PANELS SHIFT	SUPERINTENDENT DESPATCH	MANAGER P/SHOP	FROM DEL. NOTES	DAILY
	CUSTOMER RETURNS	% OF PARTS PRODUCED	QUALITY MANAGER	GEN. MANAGER	REPORT	MONTHLY

System 2 (Monitoring)

To list possible sources of oscillation between parts of system 1 and their environment.

- A) Prepare Steel**
- The Over Supply Or Non-Availability Of Raw Material
 - Inadequate Lead Times From Planning To Processing of Material.

- | | | | |
|-----------|--|---|---|
| B) | Stamp Finished Parts From Steel | - | Inadequate Lead Times And Capacity Available. |
| | | - | Inadequate Tooling From Tool Manufacturers |
| | | - | Late Supply Of Steel |
| | | - | Incorrect Headcount Figures For Capacity |
| | | - | Machine Breakdowns |
| | | - | Incorrect Process |
| C) | Stamp Finished Parts From WIP. | - | As In B - Plus: |
| | | - | Lost Stock In Store |
| | | - | Miss-Identification In Store |
| | | - | Incorrect Quantities In Store |
| | | - | Scheduled In Wrong Work Centre |
| D) | Rework Defective Stock | - | Change Of Quality Standards |
| | | - | Irreparable Damages |
| | | - | Repeated Damages |
| E) | Oiling And Packaging | - | Changes In NSP Requirements |
| | | - | Humidity Leading To Rust |
| | | - | Warehousing Space |
| | | - | Late Stock Call - Off |
| | | - | Unbalanced Throughput |

To identify the elements of system 2 that have a dampening or harmonising effect.

- i) Planning by indicating changes in capacity requirement through forecasting
- ii) Material control through controlling the requirements of stock accuracy by area.
- iii) Finance by indicating budget versus actual performance by cost centre.
- iv) Industrial relations by notifying and/or pacifying any potential labour problems.
- v) Human resources by ensuring labour of the correct skills and experience are employed.
- vi) Material handling by the supply and upliftment of handling equipment/pallets, etc.
- vii) Industrial engineering by setting standards and ensuring correct manning levels.
- viii) Facility engineering by controlling capital items

- ix) Tool maintenance through efficient tool repair and preventative maintenance programmes.
- x) Plant maintenance through efficient machine repair and preventative maintenance programmes.
- xi) Process engineering by checking and improving in-plant processes.
- xii) Quality control by setting quality standards and supplying equipment and personnel to ensure compliance.
- xiii) Safety and housekeeping department by informing and motivating management and the work-force.
- xiv) Training department by identifying training needs and supplying the necessary training.

System 2 as a whole is perceived as threatening within the system 1 activities.

System 3

To list the system 3 components of the system in focus.

Quality, Cost, Delivery, People

To ask:

How does system 3 exercise authority?

By open communications

To ask:

How is the resource bargaining carried out with the parts of system 1?

By verbal and written instruction-

To ask:

Who is responsible for the performance of system 1?

The Stamping Plant Manager

To ask:

What audit functions are conducted into system 1's by s3 audit?

Quality checks

Stock audits

Performance figures

Attendance

Safety and housekeeping

System 3 is perceived to be democratic in its approach but retreats to autocratic at the first signs of conflict. System 1 elements have little freedom.

System 4

To list all the system 4 activities of the system in focus.

To monitor the customers future build
Predictions and prepare for reactions

To ask:

How far ahead these activities take place?

A 5 Day Plan

A 3 Month "Firm Period"

A 12 Monthly Load Study

A 5 Year Indicator

Yes, these activities do guarantee adaptation in the future.

Yes, system 4 is monitoring what is happening to the environment and is monitoring trends.

Yes, system 4 is open to novelty.

No, system 4 does not have a management/operations room which could provide an environment for decision - this activity does take place in the training centre.

Yes, system 4 does have facilities to alert system 5 to urgent developments via direct contact.

System 5

To ask:

Who is on the board and how does it act?

The board at this level is the General Manager - Nissan Stamping Plant who takes reference in a vertically integrated manner from the directorship.

Yes, system 5 supplies a suitable identity for the system (recursion) in focus.

The ethos set by system 5 leads to an emphasis on change between system 3 and 4.

Yes, system 5 does share a close identity with system 1's.

LIST OF SUPPORT ROLE PLAYERS IN PLANT 1 OPERATION

1. Planning
2. Scheduling
3. Material Control (Inventory)
4. Supply
5. Purchasing
6. Finance
7. Industrial Relations
8. Human Resources
9. Material Handling
10. Industrial Engineering
11. Facility Engineering

12. Tool Maintenance
13. Plant Maintenance
14. Process Engineering
15. Quality Control
16. Safety And Housekeeping
17. Training

From all this detailed collection of data using the various techniques V.S.M. of recursion 2 was build (See figure 3).

Headcount requirements are generated through system 1 management in system 3 control and system 2 industrial engineering will verify and report labour increase/decrease and movement with system 3 control using system 4 who have information on customer build schedules. Industrial engineering will then present this to the board at a level which is at least 1 recursion higher than the indicated recursion 0 in this study. The authority in this regard is so divorced in level from the requirement that the delays caused generate imbalance and fluctuations in system 1 activities. Material handling requirements generated from system 3 decisions regarding system 4 has input into the requirements regarding customer volumes. The requirements are then authorised at general manager or director's level and fed into the areas via system 2.

A.2) PLANNING AND SUPPLY

Planning take information from system 4 regarding build volumes of the customers - Nissan, Export, etc.

It is interesting to note that the customer for recursion 2 is the Nissan stamping plant warehouse but the orders are not generated from this area.

Planning proceed to order steel and notify prepare steel on delivery dates. Produce finished components from steel have an order released on them and they then request steel. If components are finished from WIP the order cards remain and it becomes the responsibility of system 1 management to complete the order. This is acceptable as the same superintendent controls the two system 1 activities. If delays occur planning will prompt the stamping plant to complete WIP via the 24 hour schedule

When stock passes into the rework section any long-term planning stops and an order or schedule is not placed on the superintendent tool repair and only urgent last minute prompting of stock requirements generates any co-ordinated call-off. Most supply problems and shortages are generated through this area as planning do not co-ordinate and dampen the fluctuations that occur.

Oiling and packing as previously stated seem to work in isolation. Again a 24 hour schedule is generated that calls for 5.00 a.m. critical orders but apart from this priorities are not determined. The lack of standards, capacity management and flow of requirements from system 3 create unnecessary needs and panic in this area. It is critical that the different departments in system 2 give each other the opportunity to service system 1 management correctly .

A.2.1) Purchasing & Stores

The purchasing function reports through to the Nissan main plant whilst the stores in the stamping plant fall within the responsibility of the manager Planning & Inventory Control. If an item is required by S1 management it is requested on a stock requisition from the stores and authorised at the appropriate level. Copies go to finance for control purposes and a copy remains with the originator for budget control, this arrangement works successfully.

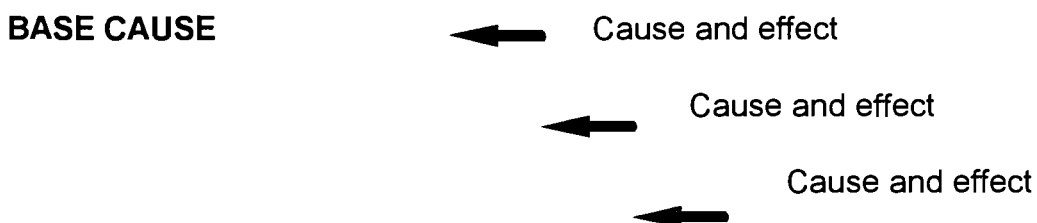
Again if capital equipment is required a purchase request is raised by the originator and authorised by his superior depending on the value involved. The signing levels by value have gradually been increased during the last 2 years and it seems that the responsibilities are being handed down and are showing savings. The requisition then receives on site financial approval, the need for this is being considered as it gives the originator the feeling that finance are controlling the budget.

The purchase requisition then goes to the purchasing department with one copy remaining with the stores supervisor for expediting.

A.3) HUMAN RESOURCES

The major harmonising effect of the human resources function is to obtain policies, rules and regulations from system 5 via the channels and ensure that all system 1 management work to the same criteria. Training is also a major element in this area and the situation is presently being handled by the industrial relations officer on site leading to a successful firm but fair approach - the key with people is consistency.

Minor personnel problems are handled by 1.2. and reported back to system 1 thereby averting major problems from minor issues. The cause and effect procedure comes into play here significantly and the following tracing procedure is vital to find the real problem cause to effect



The appointment of labour is handled centrally at Nissan and as such does not form part of system 3 control but relies heavily on the industrial engineering activities. It is the responsibility of system 3 control to take industrial engineering input, generate the paperwork, obtain all necessary approvals and deliver the documentation the H.R. Department.

The restrictive measures placed on employment do not make this role possible and ensuring requisite variety in this regard for system 1 is not possible, therefore other avenues such as casual labour and excessive overtime are pursued.

A.4) QUALITY ENGINEERING

The quality control and process engineering functions have recently been combined to form the Quality Engineering Department under the control of the Quality Engineering Manager.

The monitoring function on the inspection side is to set standards and ensure compliance to them to protect the next customer in system 1. This is carried out successfully. The company is listed with the S.A.B.S for ISO 9002 approval and as such all standards and procedures are in place.

The process engineers again concentrate only on the process involved in prepared steel into finished stock and not any of the other 4 system 1's or the relationships between them. As such they should be redirected in their pursuits or maybe assigned to tool maintenance as tooling Engineers.

A.5) S.H.E. DEPARTMENT

As a system 2 function this department ensures that levels are maintained in operational areas. This takes the form of courses, seminars, lectures, videos and supplied equipment.

The success of this operation can be seen by the fact that in 1994 the Nissan Stamping Plant became a N.O.S.C.A.R. rated company for the first time in it's history.

A.6) MAINTENANCE

A.6.1) Tool Maintenance

The dampening effect of tool maintenance exists between the system 1 areas of finished stock and rework as previously stated. The better the tool the less the rework and this is operating well. Also the system 1 management have accountability for performance to system 3 and tool capability can produce this. System 3 allocates also to tool maintenance allowances for non-efficiencies and these also are maintained.

A.6.2) Plant Maintenance

A major problem for Plant Maintenance is the allocation of machinery for the plant engineers P.M. programme. This is where system 3 and 4 must work in a more controlled and responsible manner to ensure this availability.

The time must be scheduled in by planning for these activities and system 1 management must realise the machinery as instructed. Consequently a process of breakdown maintenance now occurs.

A production meeting takes place daily where all elements of system 1, 2, 3 & 4 are presented i.e. production, services, management & planning. All items mentioned above are open for discussion in this forum.

B SYSTEM 3 - AUDIT

It must be noted here that audit leads to actions. System 3 audit function requires close examination as it provides the control function basically with measurements of the operation. The areas being audited are as follows:

B.1) Quality

The quality control function in the quality engineering department is operating as the audit function. Via statistical process control data the quality performance is monitored and reported daily.

Also B1-annual audits are conducted by the S.A.B.S. to ensure conformance to the I.S.O. quality management system and non-conformance's are noted and must be closed out by the next audit.

B.2) Stock Control

This is a very weak area at this stage due to manpower restrictions, stock audits are not taking place and this needs to be implemented on an urgent basis. The basic planning of the operation cannot take place without accurate stock figures. It should be in the region of 98% and is presently registering $\pm 95\%$.

B.3) Performance

Again the performance reporting structure concentrates on the S1 function of produced finished stock only and ignores the other system activities to a great extent. To give system 3 the opportunity to expect system 2 to balance the processes of the performance auditing must be expanded.

B.4) Attendance

Industrial relations monitor daily the absenteeism figure and feed the information into system 3. This gives the control function the opportunity to balance headcount through system 2 on a short term basis. This happens successfully within the operation.

Long term results are less encouraging as the trends are recorded and evident but pro-active plans do not seem to materialise regarding the problems indicated.

B.5) S.H.E (Safety Health And Environment)

A monthly audit is conducted on the plant and it's operation by a qualified auditor from Nissan.

The plant is then scored via the N.O.S.A (National Occupational Safety Association) system and shortfalls highlighted through a monthly S.H.E. meeting. The chairman of the meeting is the General Manager who is designated the responsible person and in turn he attends the central safety meeting on a monthly basis also.

This system is very successful and proves itself via the very low incidents of serious accidents in the operation. Also Japanese management systems are evident here via the 3”S” diagnosis sheets. This asks do we need it? Is there a place for it? Is it in the right place?

B) SYSTEM 3 - CONTROL

The system 3 control function on this level is controlled daily through the Management Meeting which takes place at shift end every day. The attendees are Stamping Plant Manager, Q.C. Manager, Manager Planning, Plant Engineer, Manager Material Logistics, Supervisor Industrial Engineering and Industrial Relations Officer. The meeting is chaired by the General Manager or his nominee who gives all parties the opportunity to discuss any activities pertaining to the operation.

The role of this meeting needs to be clearly defined and the understanding through the V.S.M. needs to be outlined by the participants. The General Manager is really operating out of system 5 and should only facilitate the meeting and offer policy input if required.

The Manager Logistics is the system 4 connection and should clearly understand his input regarding the external environment issues that needs to be tabled. It would appear this forum was created out of need and with minor adjustments is conducting the control function at this recursion level.

C) SYSTEM 4

As stated previously the Manager Logistics is the major player in system 4. The policy decision regarding system 5 come through the management meeting and the flow upwards also facilitated in this environment. The Manager Logistics is the direct customer contact and is regarded as the window of the company. As such he reports the short and long term build plans of the customers and any changes in quality requirements, work patterns, etc.

Again this happens naturally, but the Manager Logistics clearly needs to fully understand what his role is in the operation. Any contact regarding engineering development, quoting etc. is handled at system 5 but this seems to be working on an acceptable basis.

D) SYSTEM 5

This area at recursion 2 is the sole task of the General Manager Stamping Plant. Reference is taken from system 3 and regarding the requirements of the internal operation and from system 4 in relation to the way the Nissan group is operating. The internal situation is relatively straight forward to control but external information channels can be slow and even forgotten on occasions also sudden and haphazard changes can occur at higher recursion levels which are communicated virtually down the system 5 channels, a constant watch has to be conducted to check for these occurrences.

System 5 tend to collapse into system 3 due to weaknesses in system 4 at this stage.

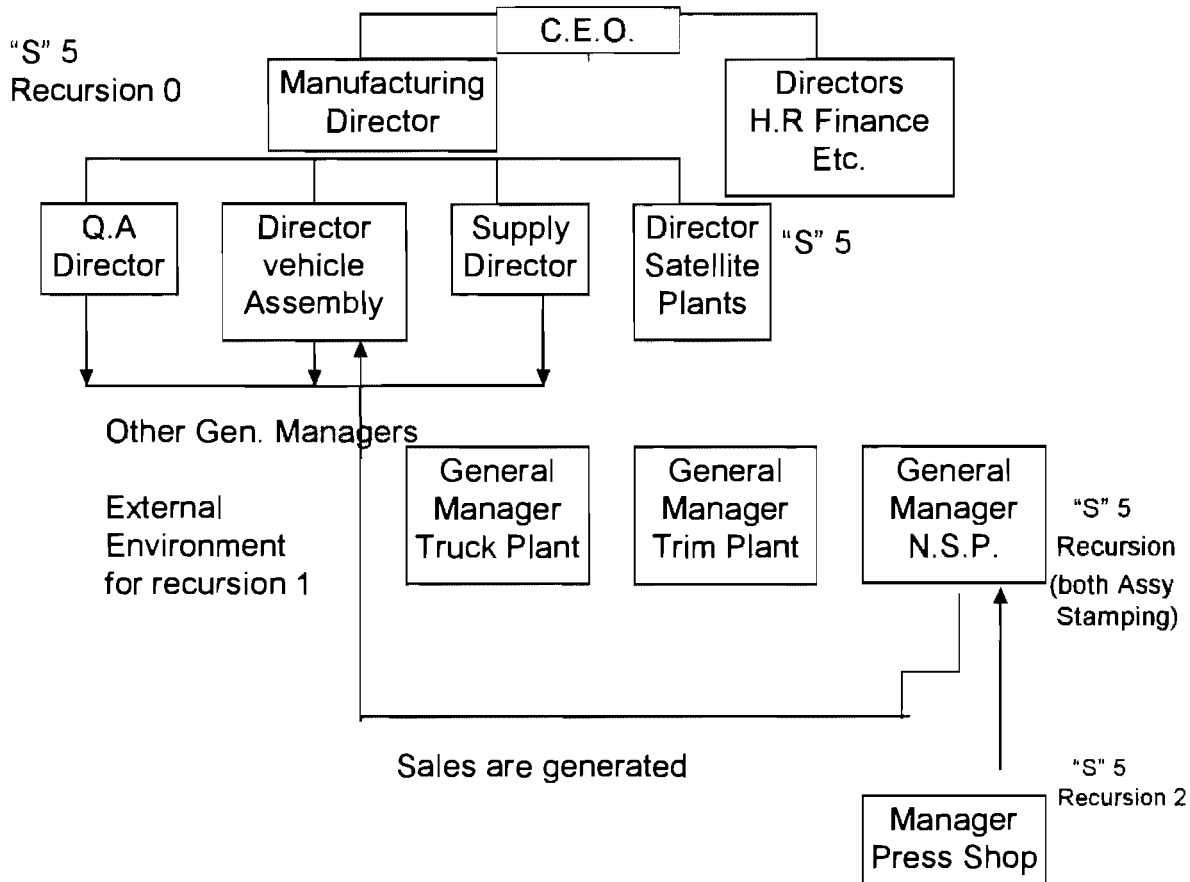
CONCLUSION

The viable system model shows a clear definition of system 1 activities at recursion 0, 1 and 2. System 3 auditing functions are in place at the recursion in focus - R2 and actions are generated through the Q.C, SHE and financial functions.

Function 4 at recursion 2 has direct contact with the external environment who is really the customer who is also residing in system 5 at recursion 0 and 1 which is not a healthy situation.

This break in the needs of the V.S.M leads to autocratic decisions being passed down through the recursional levels.

The following existing organisational structure supports that type of decision.



As indicated a level exists that appears to live on a recursional mezzanine at "S" 5 which is really generated by having a customer N.S.P. with its own income statement and balance sheet) who is also part of your own recursional structure. Finally examining the "S" 2 monitoring function at recursion 2 a lack of co-ordination is apparent which prevents system 3 ability to take the correct decisions.

All I.E, Planning and other support systems seem only to recognise one "S" 1 activity and therefore the reactions between that and the others are not sufficiently examined.

There appears to be organisational problems on a recursional basis and within the recursion in focus - R2.

Therefore

- | | | |
|--------|---|---|
| Rule | - | Wrong Organisation can cause low profits. |
| Case | - | Organisation is wrong and could be causing low profits. |
| Result | - | Profits are low. |

4.3.3 Low Productivity

Productivity by definition is output that is the most effective use of resources applied to an input to produce that output.⑨ The ultimate goal being a 100% result which leads itself into the realms of perpetual motion.

Whilst the need for productivity and the use of the word are widespread the underlying need for it to be sufficient or improvement is used from a philosophical stand point.

George Kinally summarises it very clearly as follows in his guide to Work Study.

For a society or a Nation to raise the standard of living of its population, it must strive to maximise the return from its resources to improve productivity so that the economy can grow and sustain a better quality of life.

Maybe he could have expanded to say a better quality of life compared to prior and to the average of other individuals.

If we infer that productivity is too low then the question needs to be posed too low compared to what/who.

Three basic requirements are really resident in this area and are as follows:

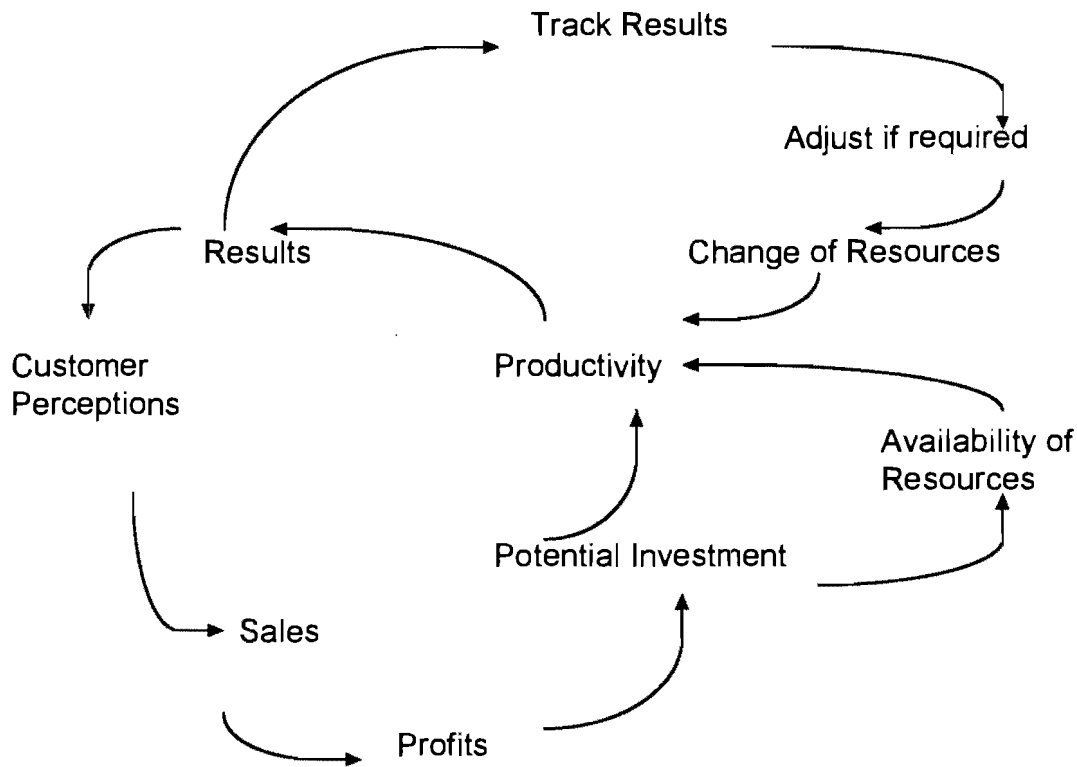
- a) Is productivity too low for the customers?
- b) Is productivity low compared to similar operations in the rest of the world?
- c) Are the resources being managed correctly?

During the examination of the criteria it must be assumed that productivity would need to be suitable in all three areas.

This is particularly pertinent for point b) as the operation is now continually quoting for export projects with our Japanese and Italian counterparts.

The effective use of resources are a major contributor to productivity and as such the elements of Men, Materials, Machinery, and Methods should be examined in detail.

A) **The effect on the Customer can be modelled as follows:**



The level of productivity generates the results, i.e. the success or lack of it regarding customers delivery requirements. This has a serious effect on the perception of the customers regarding the business and can or cannot generate sales.

The level of sales can influence again the profit or non profit of the operation generating potential investments, which can generate the availability of required resources¹⁰.

If generating productivity or not then results will become apparent and these can be tracked and adjustments made regarding how the resources are used - this in term influences the level of productivity.

The theory of C.A.P do is very evident here:-

Track Results	-	(C)	Check
Adjust if required	-	(A)	Action
How to use resource	-	(P)	Plan
Achieve Productivity	-	(D)	Do

In this area then the success of productivity improvements would surely be reflected in the amount of sales generated via the perception and interest generated with the customer.

Figure 1 shows the sales/turnover generated by the company over the last 5 years with the effect of inflation removed. It should be noted that the volume fluctuations of these customers would also effect the data , but this must also be termed as a secondary customer perception generated through the original productivity performance.

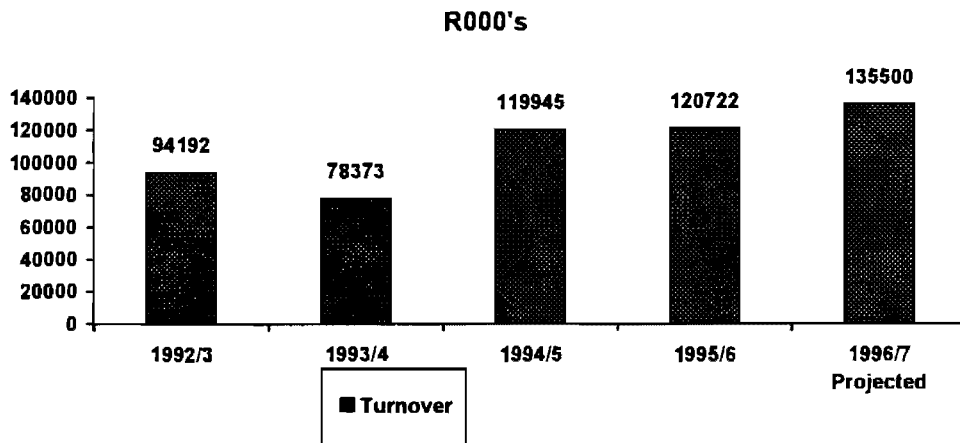


Figure 1

It can be seen from the data on turnover that the customers perception has been maintained and therefore a productivity problem has not been reflected.

B) Is Productivity Low Compared To The Rest Of The Word?

It is inherently very difficult to benchmark performance results against opposition organisations who are in a competitive mode with the enquirer. The N.S.P operation is fortunate in this regard as it belongs to the Nissan Global Family and as such has access to this type of data.

The Nissan head office in Tokyo has a department called B90 which is dedicated to the computation, distribution and improvement of productivity results world wide. This data shows the productivity capability die setting and quality performance of Stamping operations world wide and is received monthly (See Appendix 23 and 24).

Also data is supplied on a monthly basis to Japan in the format shown in Appendix 25 detailing the performance of the operation.

The main criteria for monitoring the performance of a Stamping Plant is determined as the strokes per hour.

This is broken down into two elements i.e. firstly the utilisation of time available as per figure 2

Maximum time (24 hours per day)					
					Not worked
					18.75%
Hours clocked (available)			Unavailable time		
Normal working hours (Day & Night shift)	Overtime	Management time	Sick Leave	Paid Pub. Hol.	Annual leave
		6.38%	6.50%		
Hours clocked NPT (worked)	Idle time	Ancillary time	Down time		
	0%	6.47%	13.97%		
Hours Earned	Ineffective time				
		11.08%			
68.48%		31.52%			
36.35%		63.55%			

BASIC ELEMENTS:

Maximum time is the maximum possible time during which an operator or a group of operators could work within a given period, e.g. 24 hours in one day.

Hours Paid is the time for which an operator or a group of operators are actually paid for divided by the manning level.

Hours Clocked (Available) is the time during which a machine could work based on attendance time. I.e. working day or week plus overtime.

$$= (\text{Heads} - \text{Absentees}) \times \text{Shift length} + \text{Overtime} / \text{Manning level}$$

Hours Clocked - Non-productive time (Worked) is the time during which an operator or group of operators is actually operating i.e. the hours clocked divided by the manning level less any down time, idle time, or ancillary time.

$$= (\text{Head} - \text{Absentees}) \times \text{Shift Length} + \text{Overtime} / \text{Manning level} - \text{Downtime}$$

Hours Earned is the time that should be incurred in producing the output if the operator or group of operators are working according to standard under optimum conditions.

$$= \text{Volume produced} \times (\text{Bottleneck machine/labour standard} \times \text{Number of operations})$$

VARIANCE ELEMENTS:

Not Worked is the time outside normal shift hours e.g. time between shifts, lunch time.

Management time is the time allowed by management for operators to perform other functions than production, e.g. green area meeting, early leaving at end of shift, tea time.

Idle time is the time during which a machine is available for production or ancillary work, but is not used due to shortage of work, materials or workers, including the time that the plant is out of balance.

Ancillary time is the time when a operator is temporarily out of production use due to change-ovens, setting, cleaning, etc.

Down time is the time during which a operator cannot be operated on production or ancillary work due to breakdown, maintenance requirements, for other similar reasons.

Machine/Labour (Direct):

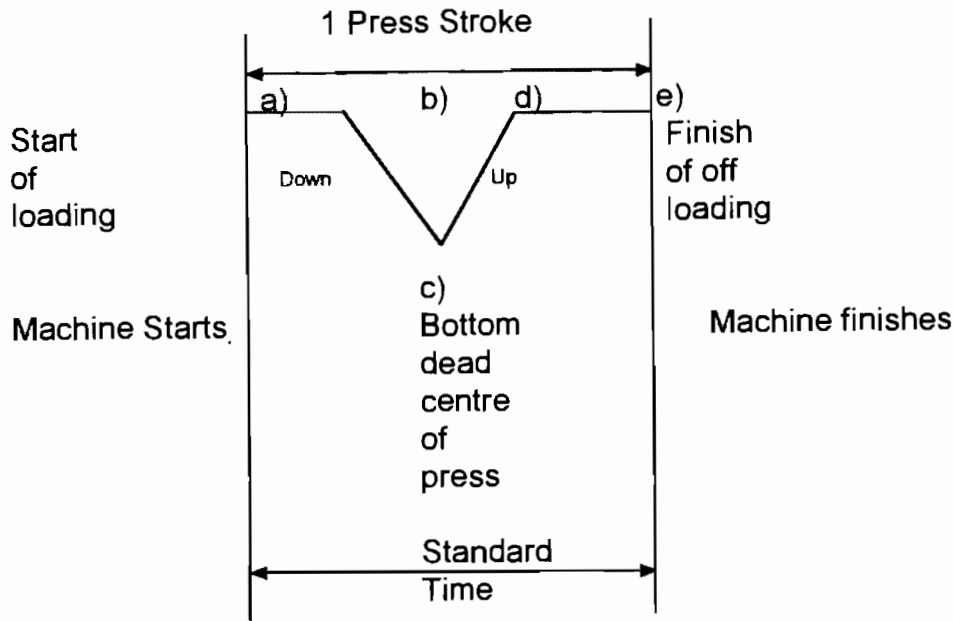
Utilisation = $\frac{\text{Worked}}{\text{Avail}}$

Efficiency = $\frac{\text{Earned}}{\text{Worked}}$

Performance = $\frac{\text{Earned}}{\text{Avail}}$

Productivity = $\frac{\text{Earned}}{\text{Paid}}$

The second factor is the performance of the Machine Cycle time which is termed the strokes per minute and is measured during the running time of a press as depicted below.



The S.P.M. starts when a sheet of steel is selected to be loaded at point a), once in the machine the start button is activated at b) and the machine goes down and up resting at d) during this phase the stamping operation is performed when passing through point c). After d) the part is off-loaded and placed in a pallet at point e).

The period of time from point a) to e) is the standard operating time and the more activities of a) to b) and d) to e) that can be performed between b) and d) improves the productivity.

When the maximum amount of activities occur between b and d) then the operation is normally automated or at least mechanised in its own right.

To summarise the indicated productivity is indicated by two factors: utilisation - how often does it run? and efficiency - how well does it run when it is running?

As can be seen from Appendixes 23 & 24 the South African operation does not compare favourably in either category compared to overseas competitors.

C) Are The Resources Being Managed Properly?

Productivity in an enterprise is affected by a series of external factors that are extremely difficult to control with internal Management.

This could consist of availability of raw materials, skilled labour at competitive prices, government legislation. A enterprise should make every effort as part of an industry to influence these factors, but cannot individually alter them.

Other factors, however, are under the control of an enterprise i.e. the internal management and an indication of how well these factors are managed indicate the company's ability to return requisite variety through acceptable productivity maintenance and improvements.

A typical operation will be gauged in its output in terms of a product or service being rendered and basic work study techniques will show that this success or otherwise of the output is dependent on the management of the following resources.

i) **Land and Buildings**

The question to raise here is whether the correct geographical location has been chosen and if the buildings are environmentally and ergonomically friendly?

Following examines the position of the operation in relation to the customers, and materials supply.

N.S.P to Nissan	=	2 Km
N.S.P to B.M.W	=	2 Km
N.S.P to Samcor	=	40 Km
N.S.P to Iscor	=	120 Km
N.S.P to Others	=	1000 km

The situation regarding the physical location and availability of employees has been analysed and tabulated (See Appendix 26).

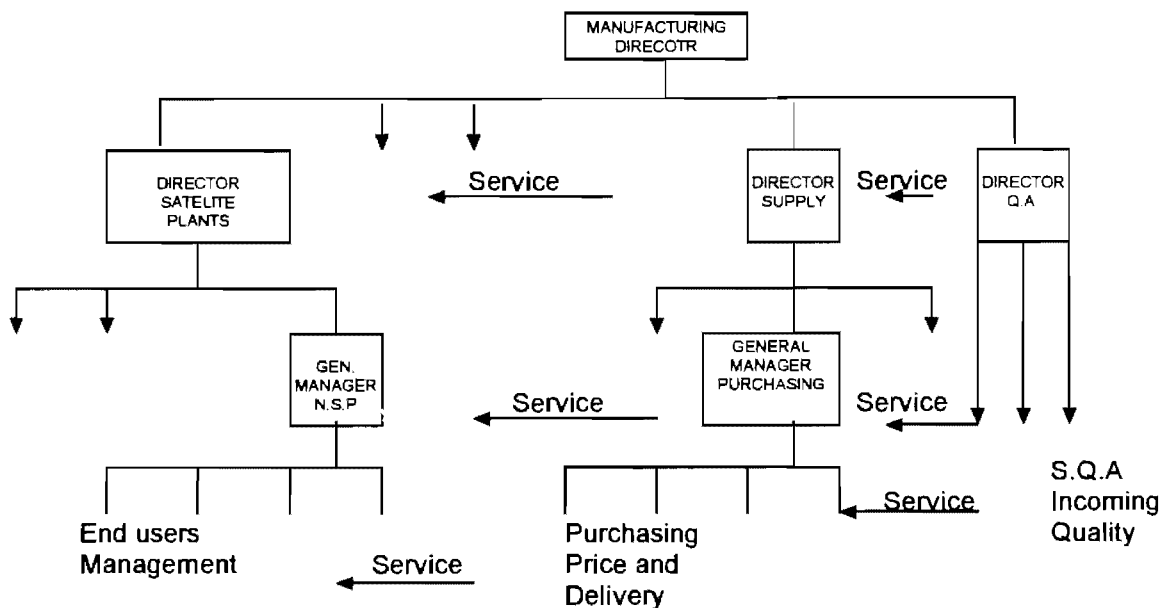
If reference is taken to the motivational section regarding H.P.T in the previous section it can be seen that the environmental elements of the operation are reasonably acceptable.

ii) **Materials**

To examine how well the use of materials are managed we need to list the major contributions.

Sheet Steel	-	Direct Processing Material
Drawing Compound	-)	Direct Consumable
Safety equipment	-)	
Telephone)	
Stationery)	Overhead expenses
Cleaning)	
Faxes etc.)	

The success of material usage can surely be gauged on an overall basis of good quality, on time and the best price. In this area major problems occur due to the responsibility of the above activities being centralised off-site and not in the control of the user as seen in the following organogram.



The particular organisation as viewed makes any positive effects on productivity reside in the reactive phase only and not in a proactive manner.

iii) Energy/Utilities

The major utility in use is electricity. This not only drives the direct machinery such as presses etc., but also services the compressors to produce compressed air. The whole operation is dependant totally on the supply of compressed air at a maintained and adjustable line flow pressure.

This has been clearly identified in the past via Risk Management activities. As a result a back-up main has been installed to ensure continuation of supply of electricity. Also stand-by compressors are installed to kick-in if a breakdown occurs on the compressors. The performance is tracked monthly (See Appendix 27).

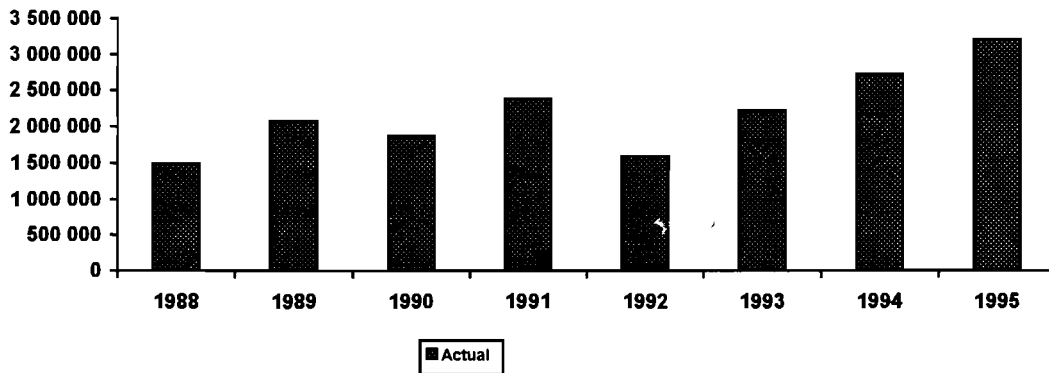
iv) Machines and equipment

South African Stamping operations are referred to by overseas companies as Museums (refer Industrial Development Council Report on Downstream Carbon Clusters 1996).

The average age of equipment in the operation is between 25 to 30 years and there has not been any major introduction of technology into the pressing operation over a 15 year period.

Technology requires capital investment and the following graph tracks the capital budget approved by the Board over the last 10 years (records are not available before that stage).

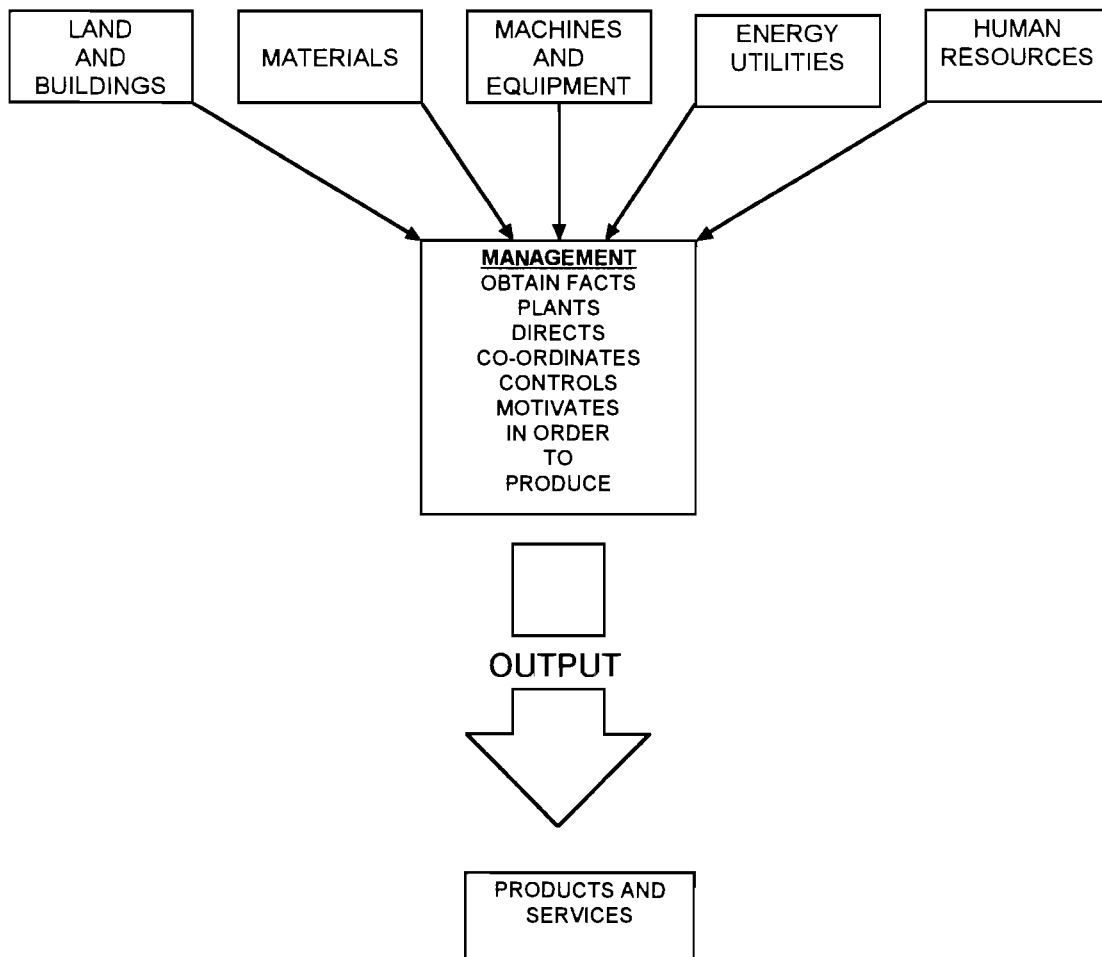
CAPITAL EXPENDITURE N.S.P.



If we view this from the point that at present stage costs a new press line would amount to \pm R9 million and to fully automate 1 line in the region of R6 million we can see that the technological contribution to productivity has been minimal. Even though capital outlay has increased it still only remains at R3 000 000.

v) Human Resources

Very little in-depth investigation is required into this area. The average age of the workforce is 45 years, additional people have not been employed for over 3 years. The average education level is at Standard 5 and whilst intensive training has commenced over the last 2 years it surely is too little, too late. The management in this area has been sadly lacking over the years and productivity improvements were just expected to happen. The use made of all these resources combined determines the productivity of an enterprise as shown.



It has been determined through analysis that the effective management of input resources is handled as follows:

SUBJECT	FINDINGS
Land and Buildings	Satisfactory
Materials	Not managed effectively
Machinery and equipment	Not managed effectively
Energy	Well managed
Human resources	Not managed effectively

Generally the available resources are not managed well to cater for an acceptably productive situation.

Previously three questions were posed.

- a) Is the productivity level acceptable to the customer? If the sales are tracked as an indicator of customer perception. The answer is no.
- b) Is productivity low compared to the rest of the world by examining data available through our Nissan Head office the answer is yes.
- c) Are the resources being managed properly? If we examine the situation through the techniques applied by operations management and work study the answer is no.

4.3.4 Conclusion

To reach this stage the potential of each rule being a problem in own right has been rigorously examined. Via the technique of human performance technology a problem has been confirmed regarding motivation within the operation.

A detailed analysis of the organisation through the construction of a viable systems model also highlights areas where the organisation is not structured in the best possible manner. Through analysing performance expectations and results against comparative data a low level of productivity is very evident.

Therefore:

- Rule - Low productivity can cause low profits.
- Case - Productivity is low and could be causing low profits.
- Result - Profits are low.

4.4 ACTION

Via the collection of data and observable facts the three areas of low motivation, wrong organisation and low productivity have proven to be a problem in their own right. This gives us the confidence to predict that they will have an effect on low profit.

It is now necessary to check if those predictions are correct via inductive reasoning. This will be conducted in the following chapter.

CHAPTER 5

INDUCTIVE REASONING

5.1. INTRODUCTION

During the previous chapter the deductive phase of reasoning has established the following problems.

Motivation is low.

The organisation is wrong.

Productivity is low.

5.2 PLAN

It is now necessary to determine whether the three problem areas identified are having the expected effect on the profits.

The most practical way to observe and check this is to apply final recommendations and check for change. This will be done in future, but to close the study at this stage a means to check the effect at this point in time will be used.

Firstly a rich understanding of how costs are applied to the operation through quoted prices will be laid out. This will enable us to check into the financial performance to confirm profits are low.

For the effects of an under motivated workforce we will check for the financial costs generated for unnecessary hours of work.

The effect of a wrong organisation will be examined regarding the overall effect it has shown regarding the growth of the company.

To detect the effect of low productivity we will check the quoted performance of the product against the actual.

5.3 DO & CHECK (Collect data and apply)

If we consider that $\text{profit} = \text{sales} - \text{costs}$ then the two areas of sales and costs would, if adversely affected, demonstrate low profits.

The Nissan Stamping Plant is a make to order business and not operating in a retail environment therefore any short-term effect on sales is generated by the customer.

As stated in previous chapters a long term perception placed on the customer could influence sales, but to detect short term profit problems this area of study will concentrate on the effect on costs.

To affect profits costs would need to be more than expected.

Figure 1 shows a breakdown of a typical costing method for a stamped component.

Direct Material

$$\begin{aligned}
 \text{Blank size} \times \text{thickness} \times \text{density} &= \text{Mass} \\
 \text{Mass} \times \text{price per ton} &= X \\
 \text{Scrap allowance} &= 2\% \\
 \text{Total material cost} &= X + 2\%
 \end{aligned}$$

Operating Cost

$$\begin{aligned}
 \text{No of operations} \times \text{strokes per hour} \times \text{hourly machine rate} &= Y \\
 + \text{tool setting} = \frac{\text{Size of run} \times \text{hourly machine rate}}{\text{Die set time}} &= Z \\
 \text{Total operating cost} &= Y + Z
 \end{aligned}$$

$$\text{Mark-up/Profit} = [(x + 2\%) + (y + z)] \times .15 = P$$

$$\text{Total price} = (2 + 2\%) + (Y + Z) + P$$

Figure 1

The budget for the 1995/96 financial year indicates a profit expectation of R3 558 000. (See Appendix 28).

In the final financial statement for the 1995/1996 year we see an actual profit generation of R984,000.00 and therefore a shortfall of R2 574 000 (See Appendix 29).

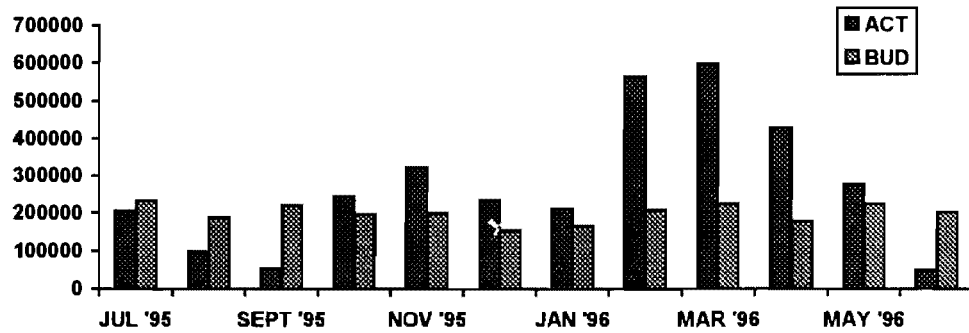
This is basis of the major premise - profits are low - we now need to examine the causes.

5.3.1 Low Motivation

As a cost item the lack of motivation manifest itself most directly through overtime worked in excess of budget.

The overtime hours budgeted vs. hours worked per month during the financial year 1995/96 in both variable and fixed areas clearly shows on-costs which should not been required. This is clearly seen in the following table.

STAMPING PLANT OVERTIME



Overtime in excess of budgeted plans is a direct result of tasks not being performed in all areas in a timely and motivated manner.

Therefore we see the following:

Case	Motivation is low
Results	Profit is low
Rule	Low motivation is causing low profits.

5.3.2 Wrong Organisation

During the study of the Nissan Stamping Plant operation in chapter II the emphasis was placed on the operations regarding its requisite variety.

That is its ability to respond to the variety posed to it from the external environment. Although indicating recursion problems in the reporting structures turnover figures show a steady increase in business/turnover over the last 5 years reflecting a good response to the external market this has increased from R800 mil. in 1992 to R140 mil. in 1996.

Whilst the organisation problems present a degree of awkwardness in the day to day activities taken place through the S2, and S3 systems the S1 system is clearly identified. In its own right upon examining the costing model in figure 1 an area of direct influence cannot be detected from an organisation sense if viewed as system and not purely as in an organ or grammatical sense.

Therefore we see the following:

Case	The organisation is wrong.
Result	Profits are low
Rule	The wrong organisation is not causing low profits.

5.3.3 Productivity Is Low

The operation cost depicted in figure 1 can be extracted as follows: Number of operations x strokes per hour x hourly machine rate.

a) **Number of Operations**

Each component requires its own number of moulds/dies to produce a finished part. This is determined by the Engineers at the tool design stage e.g. front fender =

Draw	O.P.	10
Trim Partial		20
Flange and Cam Flange		30
Final Trim and pierce		40
Restrike and Flange		50

or side re-enforcement	Blank	O.P.	5
	Form		10

Although the number of operations varies considerably per component once set it cannot change.

b) **Strokes per hour**

This is the potential number of times a press will go through its stroke (down and up) to produce that particular parts operation.

e.g. Front fender	150 strokes per hour (parts)
or side re-enforcement	250 strokes per hour (parts)

It should be noted that the stroke is activated by an operator pressing a button and stops automatically ready for the next stroke. The S.P.H is set at quotation stage and areas from the historical data on similar parts and by examining the complexity of that particular component. A large factor is how well or how quick the part can be loaded and unloaded.

If we take a cross section of 12 components we can see the following:

NO	COMPONENT NAME	MODEL	ITEM NO	QUOTED RATE	ACTUAL RATE	DIFF.
1	Brkt Battery	B140	230	300	169	-131
2	Panel Front fender LH	UNO	44	300	184	-116
3	W/house outer RH	ES	88/89	273	138	-135
4	Strut RR Inner RH	AW	65	316	212	-104
5	Brkt Ins Mtg. upper "A"	B140	57	375	188	-187
6	Strut RR Inner LH	AW	64	316	182	-134
7	Pillar Ctr Inner lwr RH	ES	124	171	100	-71
8	Dash Upper	AW	146	300	91	-209
9	Hoodledge RH/LH	AW	213	250	132	-118
10	Panel RR Gate Outer	AW	84	207	187	-20
11	Front fender LH	ES	49	273	150	-123
12	Panel Floor RR/RH	AW	111	400	225	-175

Most components can be seen to be running below their quoted rates.

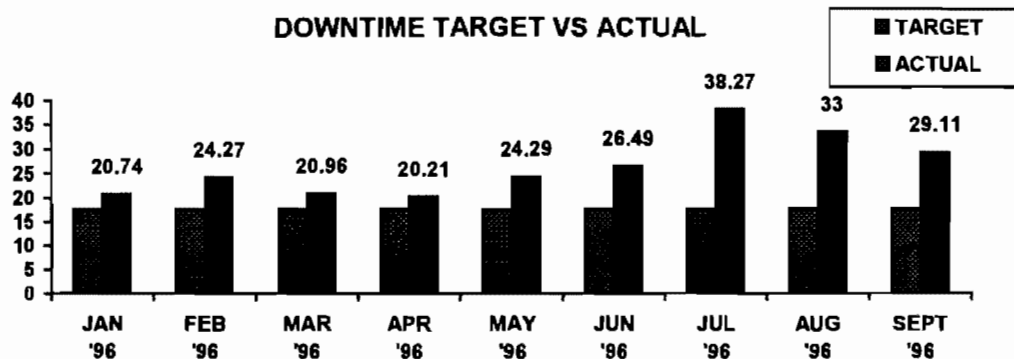
c) **Hourly machine rate**

This rate shown in figure 6 is calculated for the year by taking all budgeted costs and all hours that can potentially be created and arriving at an average hourly rate.

i.e. $\frac{\text{All costs (less materials)}}{\text{Available M/C hours}}$

A weighting factor is then applied by machine for distributing i.e. an 800 ton press will carry twice the hourly rate compared to a 400 ton machine.

There are two changes here firstly that actual costs for the year are higher than budgeted which can be seen as fact in appendix 33. Secondly the available hours are not utilised due to excessive downtime as shown below.



A problem regarding utilised time can also be seen here. Therefore we detect the following:

Case	Productivity is low
Result	Profit is low
Rule	Low productivity is causing low profits.

5.3.4 Summary

Having confirmed previously that:-

Motivations is low
 The organisation is wrong
 Productivity is low

5.4 ACTION

We have proceeded to determine their effect on the major established mental model that profits are low.

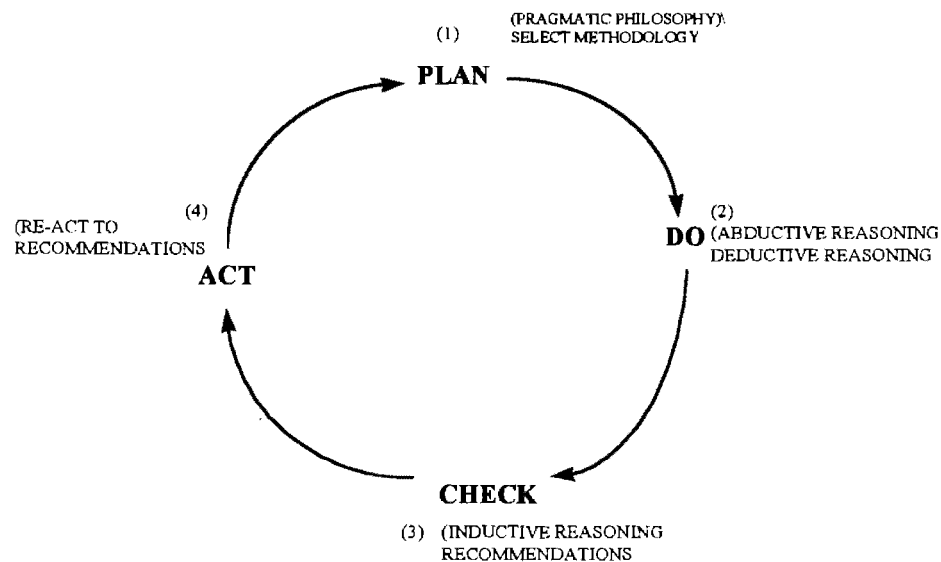
Through analysing the additional unbudgeted overtime hours that have been generated we can detect problems. The desire to perform the tasks successfully within the time allocated is lacking as such showing self motivational problems. This results is on-cost which in turn is detrimental to the profit.

Some organisational problems are identified which could lead to future effects. The direct on-cost effecting profits can not be determined at this stage and does not show direct influence on the profits.

If the study were to proceed further a single-loop response would take place to re-examine the criteria selection in the abductive phase. A direct comparison between quoted or expected productivity levels and the actual performance very clearly shows problems.

If the running cost of producing components is higher than the recovery in the selling price the profits will be lowered.

The cost incurred on a monthly basis for direct processing material is consistently higher than budgeted. The effects occur from not only pure cost of the product, but the back-lash of resultant delivery and quality concerns. Again the unexpected on-cost has a direct effect on the profitability of the operation. To summarise the needs of the study to the benefit of the operation we now see the following requirements for ongoing pragmatic improvements. This is not a stationery condition, but needs to remain active to meet the moving goal post syndrome.



This study has proceeded through steps 1, 2 and 3 it is now in the hands of the stakeholders to determine the actual event of step 4. This will effectively close the highest recursion loop that is established.

CHAPTER 6

CONCLUSIONS

RECOMMENDATIONS

1. MOTIVATION

Having proven that there is a definite problem with motivation in the operation and also that it has a direct effect on the profitability of the business it is vital to approach solutions in the correct areas. Human Performance Technology techniques highlight problems in the employment policy of the company and a lack of incentive to perform.

A 5 to 10 year plan needs to be prepared to inject outside expertise into the necessary areas in a controlled manner to uplift the skills required. Also a general policy needs to be built into the plan to reduce the identified average age of the workforce from the identified level of 45 years.

Once prepared it is critical that the plan is presented to the board for discussion and that the senior decision makers sign-off the agreement and also the expectations of the final benefits.

Whilst there are many incentive schemes available world wide and also under the scrutiny of the company we need to give careful consideration to their suitability of our environment - many have failed elsewhere or had limited success.

The motivation required should be through the involvement and increased responsibility of all employees.

The global Nissan Plant Management System (N.P.M.S) is a proven and acceptable method of achieving these requirements. As such the initial introduction of this into the plant must be fully supported by senior Management and complete introduction must be obtained.

2. ORGANISATION

Whilst problems were identified in the company's organisation a direct effect on profitability could not be exposed. The potential for an effect to materialise through the profits generated must be high and as such the organisational problems can not be ignored.

Responsibility at recursional levels were proven to be vague and confusing and it did not appear logical for a few areas to be decentralised.

The finance and purchasing activities should be brought back into the operation so that their role in S2 monitoring and S3 control activities can be clearly seen and understood. System 5 policy activities should also be re-adjusted with the reporting structure through to the senior executives to be direct and not through the Nissan Vehicle Assembly Division.

This would facilitate independent policy decision making at S5 R0 from the Nissan Stamping Plant operating itself.

3) LOW PRODUCTIVITY

Productivity is clearly seen to be substantially lower to every comparison that was drawn. Also the effect on profitability is very direct and clearly identified.

The same criteria needs to be applied here that has been previously mentioned for organisational problems.

The basis of N.P.M.S is Hoshin Kanri and Genba Kanri which are respectively translated as Business Management and Shop Floor Management. Both techniques use a basis of the Plan, Do, Check and Action Loop. Whilst the H.K activities have been entrenched in the company for ± 5 years G.K has not been present.

The G.K. activities must be firmly driven into the operation as a mandatory way of life therefore placing performance expectations on all employees. They must also be involved in the decision process at all required levels.

Some Managers have been to Nissan Tokyo for formal training in this regard and also that programme must be actively pursued.

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My family who accepted my absence at a time when least expected.

My secretary who dedicated many hours that might have been used otherwise. She not only deciphered my scrawl, but helped make sense of it.

REVANS - THE MANAGERIAL ALPHABET (Appendix 1)

Revans states that the behaviour of an enterprise is a total entity and it is determined by the most powerful coalition inside it. In managerial terms we may say that the first task of the coalition is constantly to review its goals the second to direct the enterprise towards them. Also he states that those who would influence the world must in their turn be influenced by it, therefore maintaining requisite variety for the entity.

Managerial Tasks

Flexible causes of action demand the following:

- a) An evaluation of the outcome of the action is an hypothesis, to be aware of difficulties to surmount.
- b) A direction that resources can be found to deal with outcome - pre-planning.
- c) Adequate knowledge and information on the above.

When evaluating managerial values related to the external system the needs of the Owner and Clients need to be clearly understood. When examining the Internal System on hand the relationship between Actor, Owner, Client and Resources needs to be clearly understood. The design of a Management System or strategy demands information on 3 things.

- ✦ Value System of Managers.
- ✦ External System they exploit
- ✦ Internal System by which they exploit it.

Thereby we create a System Alpha Paradigm which states that values, External Systems and Internal Systems mean different things to different players. When we examine the needs and relationships between the elements of System Alpha the complete system is referred to as System Beta. There are 4 areas of content - Data Bank, Value System, Internal System and External System and the cycle of negotiations between them or System Beta can be described as follows:

- a) A survey stage of design elements of 3 system Alpha's (observation).
- b) A trial decision stage to select most suitable system Alpha design (theory).
- c) An action stage in which a trial is implemented (experiment).
- d) An inspection stage to compare A & B (evaluate).
- e) A control stage where necessary action is taken (accept or modify.)

System Beta provides the underlying logic of the fundamental processes of intelligent trial and error and thus appears in three common process - the scientific method (to be discussed later), the rational decision and the learning process (Handy and Mumford).

Decision Negotiations - System Beta

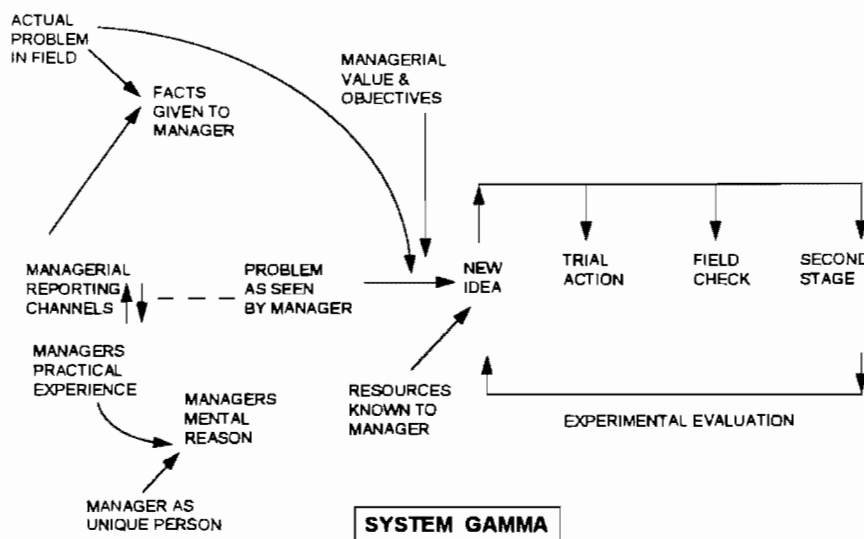
Typical questions are:

- ✦ In an analysis of what is going on what are the critical factors?

- ✦ What is likely to happen in the future?
- ✦ What is the true nature of the demand we face or in the future?
- ✦ What sets of factors would we wish to give our policies?

If System Beta is combined with the ability through the process of scientific method and learning with the ability to test ones belief then System Gamma is created. This allows for either a single or double loop response to be placed back into the actions required or belief de-stabilisation respectively.

This is depicted as follows:



REVANS MANAGEMENT AND THE SCIENTIFIC METHOD

This consists of five major steps

- ✦ Observations of the External World.
- ✦ The formulation of theories based on these observation.
- ✦ The design and conduct to test these theories.
- ✦ Comparison and the experimental results with the results predicted by these theories.
- ✦ The rejection, modification or confirmation of these theories in accordance with the results of these comparisons.

These five steps can also be deemed as a Management Strategy and strong statistical evidence should be in place before rejecting or modifying theories.

Karl Marx, William Jones and John Devey state that there is no theoretical knowledge but all knowledge to them is merely our ability to make things. The extension of the 5 step scientific method into practical examples allows for a formalised approach to problems - it can be summarised as follows:

1. Find out what needs to be done - relationship to concern.

2. Decide what needs to be done - resource availability etc.
3. Do it in what seems to be the best way.
4. Test how well it has been done.
5. Review and modify.

i.e. Observe, formulate theories, experiment, compare, adjust. Each of the above fields will carry a need for the following support activities.

1. Collect data from a given universe and classify.
2. On this data suggest what needs to be done.
3. Collect entirely different data at random from the same universe.
4. Test by statistical news if the suggestion in (2) is confirmed by (3).
5. If confirmed proceed with strategy, if not re-examine data or make new suggestions (that is believe in Hypothesis or actual results).

Revans quotes that it is the sum of art and science that makes the Manager.

Judgement And Hunches

A successful hunch using Managerial Judgement needs to transcend all the available data and information at hand. If these data were sufficient then a valid scientific hypothesis could be determined.

Revans states here that neither formal insights into subjects nor directed arguments over case-studies are redeemed to be substitutes for practical experience, they are proclaimed to be no more than aids for its interpretation.

Therefore a good experienced hunch can be based on practical experience, the managerial ability to consider probability and risk of failure, but also using the elements of the scientific approach where possible. Therefore a good hunch becomes a better one.

Fund Of Preferred Value

If we consider a law of nature to be simply our way of looking at nature we can tend to accept a situation. If we shift that paradigm or mental model we can see that situations are not as tidy and straightforward as they seem.

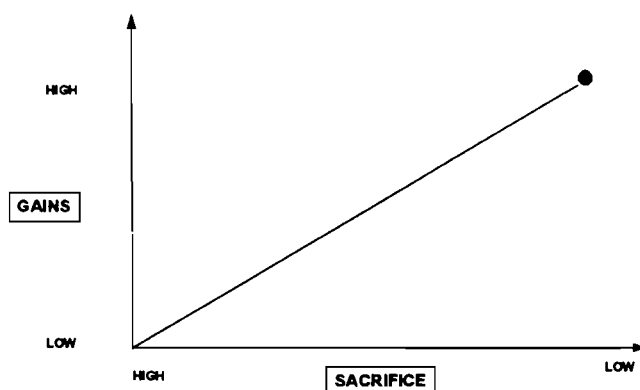
When Managerial decisions are taken and processes started to suit their actions it is important to be aware of the Human values within the process. To this end Revans states.

The Manufacturing Policy of a Firm to reduce product variety, lower cost, improve quality without raising costs, or to substitute cheaper raw material without lowering quality, or to install machinery in order to reduce manpower, should be known to all members of the Firm so that they adopt the same attitude to daily problems.

If as previously stated we shift our mental model or belief before embarking on a change process we can try to interpret the views of others - this then will lead also to an acceptance of others. If not we will at least understand why and be able to manage it.

Declaration Of Preferred Aims

This states that behind every situation in which decisions need to be taken by Management a set of preferred objectives are present. We need to ask how much can be gained in the short run and how much can be sacrificed as shown.



The gains involved should be identified and listed such as large adjustments, raw materials, quality improvements, utilisation improvements, capital demands etc. These should be ranked by priority order, but not necessarily only in economic terms. The ranked expression of these preferences is called the declaration of preferred aims.

For each decision taken a table should be produced to easily identify the losses or gains against each resource, also the purposed action and changes could be listed in the table - this could be called the estimate of alternate results.

It is then possible to compare the estimate of alternate results with the preferred aims therefore allowing decisions to be taken when selecting further actions.

Also during the examination various views can be obtained from stakeholders and the resulting input used to adjust the priority ranking in the table.

Revans states that Management frequently admit that their decisions are based on guess-work, and complain that they cannot get the facts. But this is normally because they do not know what they need.

1. SYSTEM (or situation)

A system consists of two or more interaction elements. It may exist in a self-sustaining state or may display elements of change through a generative or degenerative direction.

When an additional element is either added or taken away the system changes as a whole and also the particular elements change.

A system can be viewed in many different ways by different stakeholders who have different needs and expectations from it.

The difficulty of absolute or universal limits needs to be carefully considered as knowledge needs to be independent of the content of the system i.e. a problem needs to be examined on a higher plane of thought than it was created. The relevance of ideas regarding the system in focus makes an important contribution to the values of your ideas to others.

2. **CONCERN (Or complication)**

A concern is often brought about by a change in the situation or the environment it lives in. Useful words to describe concern are discomfort, pain, hurt, unhappiness, difficulty or mess.

Concern can also relate to the way things are managed, management should give meaning and understanding and may not exist in that system. In all cases there is a perceived need to bring about change, but the perception from stakeholders must also be considered and understood.

3. **QUESTION**

Concerns are often expressed in very general or abstract terms. Framing them into questions makes them far more concrete. A maximum of 5 questions should be considered and tested with the stakeholders where possible.

4. **REASONING**

The quality and rigour of reasoning will have a major effect on the confidence displayed regarding the answer by all involved. Understanding of the situation and concern will reveal the relevant information needed. How one proceeds from there to the answer is a product of reasoning.

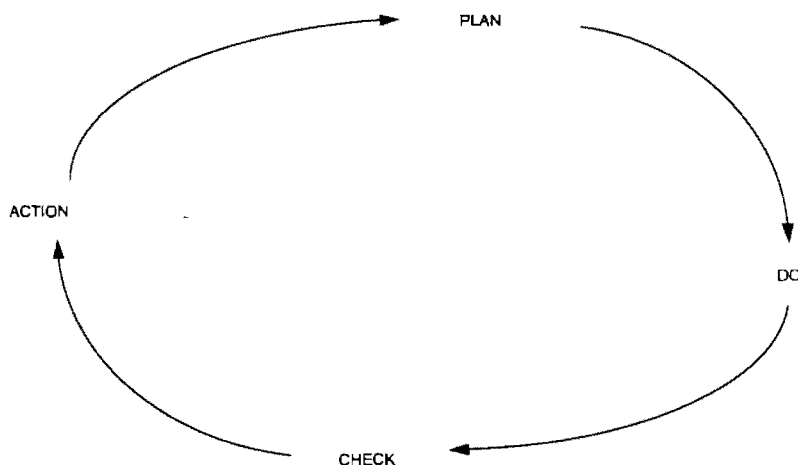
Any reasoning process contains 3 distinct elements - the system or case, the answer or rule and the concern or result. The purpose is to develop an answer (rule) that will deal with a concern (result) in a particular system (case). The process involves three modes of reasoning - deduction, induction and abduction - these will be analysed at a later stage.

5. **EVALUATION**

The ideal way of evaluating an answer is to take the actions it suggests and see if they adequately deal with the concerns of the situation existing if this is not possible it should be tested against one's experience and that of others. If an answer makes better sense of some past experience it is likely to offer something of value.

SHEWART - P.D.C.A. (Appendix 2)

This is a learning cycle widely used in Japanese Industry and can be depicted as follows:



It is not actually one closed loop but a continuing spiral of improvements. If a plan is put into place the implementation of it (do) is actioned and completed. Upon completion the result of the actions against the planned expectations are checked and analysed. This invariably leads to actions needed to make adjustments to the plan and so the spiral continues. This technique by its explanation demonstrates the process of continuous improvement within a pragmatic philosophy.

STEP 3 - TIME FRAMEWORK IN USE (Figure 2 Refer)

The framework as previously stated is based on a philosophy of pragmatism that is the desire to activity question and pursue improvements and ensure they meet their logical conclusions. An inherent Mental Model or belief is therefore set which states that change will be pursued and norms will be questioned.

TO START THE LOOP

Once the desire to start the process is in place the first elements of the S.C.Q.A.R.E. technique are used i.e. S.Q.C.A. During this process the situation or system will be examined, a search for the complications involved, the questions to be posed and firmly the formulation of hypothetical answers. The whole process will be driven by the specific Mental Model in use which will influence the hypothetical answers and generate the concerns when this Mental Model is de-stabilised. This particular Mental Model in use will be influenced by the Internal and External expectations of the stakeholders and the user of the framework.

Also strong influence will be evident from not only the personality of the user but also previous experiences of success or failures.

Whilst formulating the questions raised by the concern in the situation the values and objectives and resource availability needs to be considered and also a declaration of preferred aims should be established before commencing with activities.

THE LEARNING CYCLE

The learning cycle loop is based on Revans scientific methods. This starts with an observation of the external world and would involve the collection of data and information regarding the situation in the areas of concern identified.

Step 2 involves the formulation of theories or the facts of the observation and generates theories of what should be happening and how therefore generating a set of aims. During the course of this the strength and validity of those theories can be tested using the plan, do, check and action cycles.

Step 3 asks the question what is the real world like and is the experimental stage. The experiment can be in the form of actual action, but often time is a delaying factor in this regard.

Useful techniques here can take the form of interviews forming a world view on the issue, soft system methodology to establish the true combined picture, the use of multiple perspectives., etc. The most critical element is to capture the real essence of what is actually occurring - this can again be confirmed using the plan, do, check and action cycles.

Once the theory is established and experiments concluded a comparison takes place in step 4 to detect the result.

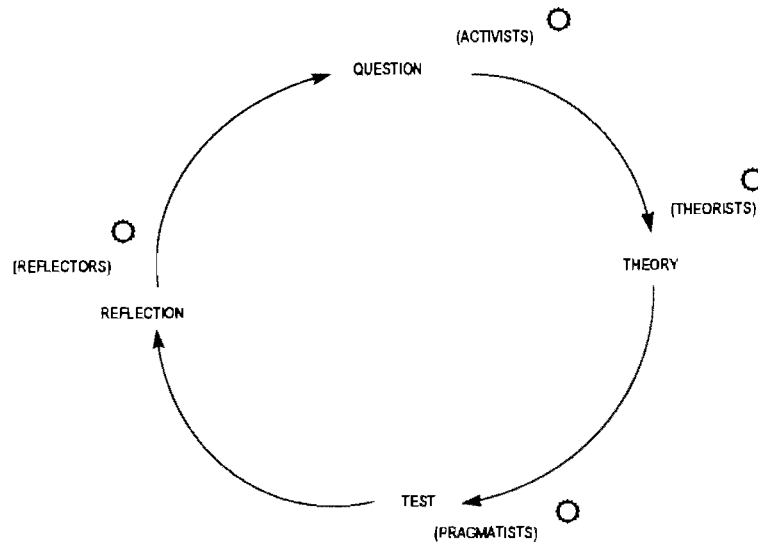
THE RESULTS

Upon comparison of step 3 and 4 two distinct events can occur. Firstly the actual result or outcome can confirm the initial desired results or hypothetical predictions in which case conclusions and recommendations could be formulated.

Secondly the actual result can disagree with the original hypothetical predictions therefore creating a gap and generating doubts. If we look at an attitude of single loop learning then the actual result would be questioned and the problem returned to the observation stage for re-evaluation. If double loop learning is applied the original hypothesis plus predictions will be questioned and the situation revisited to re-destabilise the Mental Model in use - this is the route to be pursued.

HANDY - The Learning Wheel (Appendix 3)

He generates a learning wheel as follows:



He states the following facts about learning:

- It is not just knowing answers.
- It is not the same as studying.
- It is not measured in examinations.
- It is not automatic (pragmatism)
- It is not only for intellectuals.
- It is not finding out what other people know.

Handy also discusses what he calls a proper or responsible selfishness which is a representation of a selfish attitude towards the desire to learn and those who learn best display the following:

- a) They take responsibility for themselves and their future i.e. they do not externalise their problems (the they syndrome).
- b) They have a clear vision (strategic intent).
- c) They want to make sure they get it.
- d) They believe they can.

Negative capability is deemed to be the ability to accept ones set-backs or failures and continue with the same desire. This is important if following a double-loop learning style and accepting the potential disproving of an hypothesis, although every attempt will have been made to generate successful hypothesis.

Blocks To Change

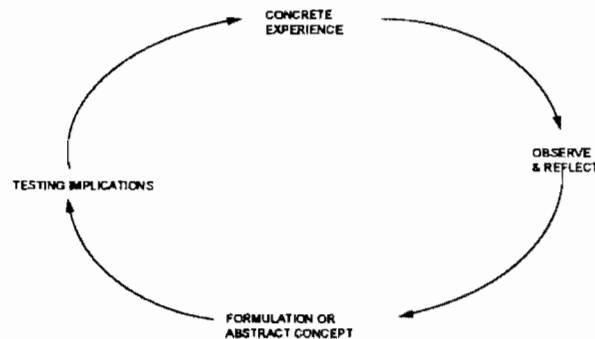
The they syndrome is an externalising of ones own problems. Fatality/humility is the acceptance to stop enquiry due to being criticised or humbled. Theft of purpose is to remove someone's goal and force your own expectations on them. The missing forgiveness is to not forgive a person for failure or mistakes - mostly to store negative stamps as detailed in transactional analysis.

MUMFORD - LEARNING STYLE AND LEARNING SKILLS (Appendix 4)

The content of learning styles is explained as follows:

The realities of managerial life have very little to do with text book theory. Most learning for most Managers most of the time occurs from job learning that is from hunches. The contribution of classroom learning without experience is meaningless.

Defining learning styles Mumford refers to Kolb's learning wheel as follows:



Kolb states the following regarding learning styles.

- ✦ It begins with a here and now experience.
- ✦ It follows with a collection of data and observations about that experience.
- ✦ It contains an analysis of that data.
- ✦ It reaches the final stage with modification of behaviour (or belief).

HYPOTHESIS SUITABILITY MATRIX

		ISSUE/IDEA																									
		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
CRITERIA RULES	1			X	X												X				X						X
	2		X	X	X												X	X	X		X	X		X			
	3			X													X	X				X					
	4																										
	5																										
	6	X			X	X												X	X		X	X		X	X		X
	7				X	X	X	X				X	X	X		X	X	X		X	X		X				
	8	X	X	X					X		X							X	X		X		X			X	X
	9																										
	10																										
	11																										
SCORE		9	9	9	6	1	8	1	1	1	1	1	1	1	1	1	8	6	8	1	8	7	1	9	9	1	8
						1	1	0	0	0	0	1	0	1	0	1				0		0		0		0	

$$X = 0$$

$$= 1$$

1 **AFFINITY DIAGRAMS (Appendix 6)**

This is a creative process but has logical steps within its own content.

When to use an AFFINITY DIAGRAM

- a) Facts or thoughts are in chaos, i.e., a destabilised mental model is present through pragmatic thinking.
- b) Breakthroughs in traditional concepts are needed - a shifting of paradigms or stabilised mental models.
- c) Support for a solution is essential for successful implementation, i.e., selection of the best hypotheses in a solution. The steps are:-

1.1 **ASSEMBLE THE RIGHT TEAM**

A vertical cross section of people who know the subject is most desirable. It should be limited to a maximum of six people. Based on the theory of 7 ± 2 this will keep the process in the creative phase.

1.2 **PHRASE THE ISSUE TO BE CONSIDERED**

This technique seems to work best when an issue is vaguely stated, e.g., What are the things that might affect profits?! The statement should then be clearly stated at the top of the page.

1.3 **GENERATE AND RECORD IDEAS**

The ideas should be generated through brainstorming.

The following rules should apply:-

- no criticism of ideas
- large number of ideas in short time
- all members to be involved
- record as spoken - do not interpret

These responses can then be recorded as separate cards or on a flip-chart. The phrases should be as concise as possible and should contain a noun and a verb to avoid ambiguity.

1.4 **DISPLAY COMPLETED CARDS**

All cards should now be mixed and spread out randomly.

1.5 **ARRANGE THE CARDS INTO RELATED GROUPING**

The sorting should be done by the whole team, but in silence to encourage unconventional thinking and prevent verbal influence by consensus.

Some cards may not fit and could/could not survive as loners. At this stage, people must react quickly and not contemplate (not a game for reflectors).

The columns created should be referred to as groupings and not categories which seems to encourage more flexible thinking.

1.6 CREATING THE HEADER CARDS

A card should now be identified that captures the central idea of all the cards in that particular grouping. Many times this does not exist and then a Header Card must be created. Header Cards should state in three to five words the essence of the grouping. A good test for a Header Card is to remove all other cards in the grouping and determine if a rich understanding of the issue still exists.

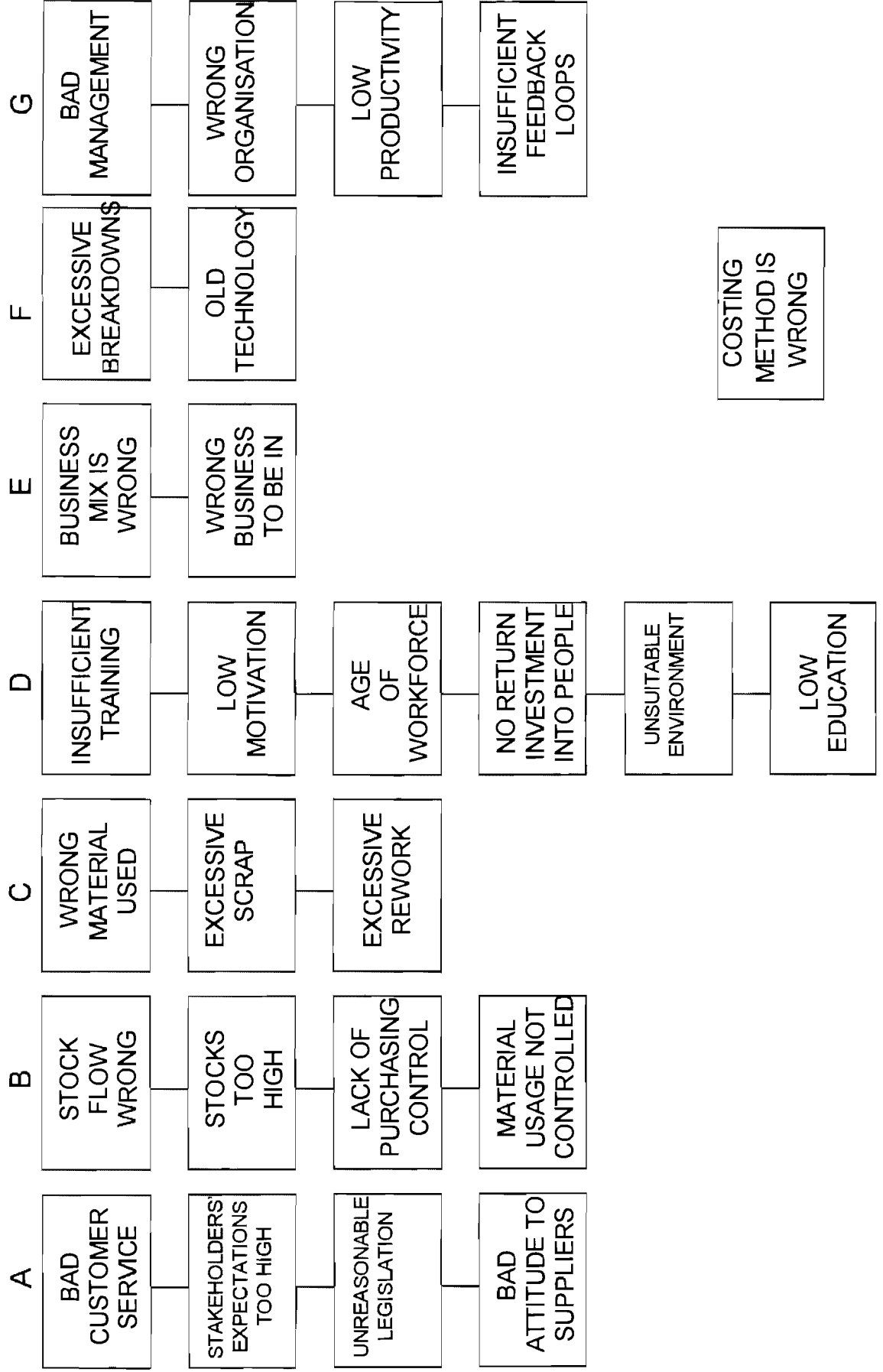
1.7 DRAWING THE FINISHED AFFINITY DIAGRAM

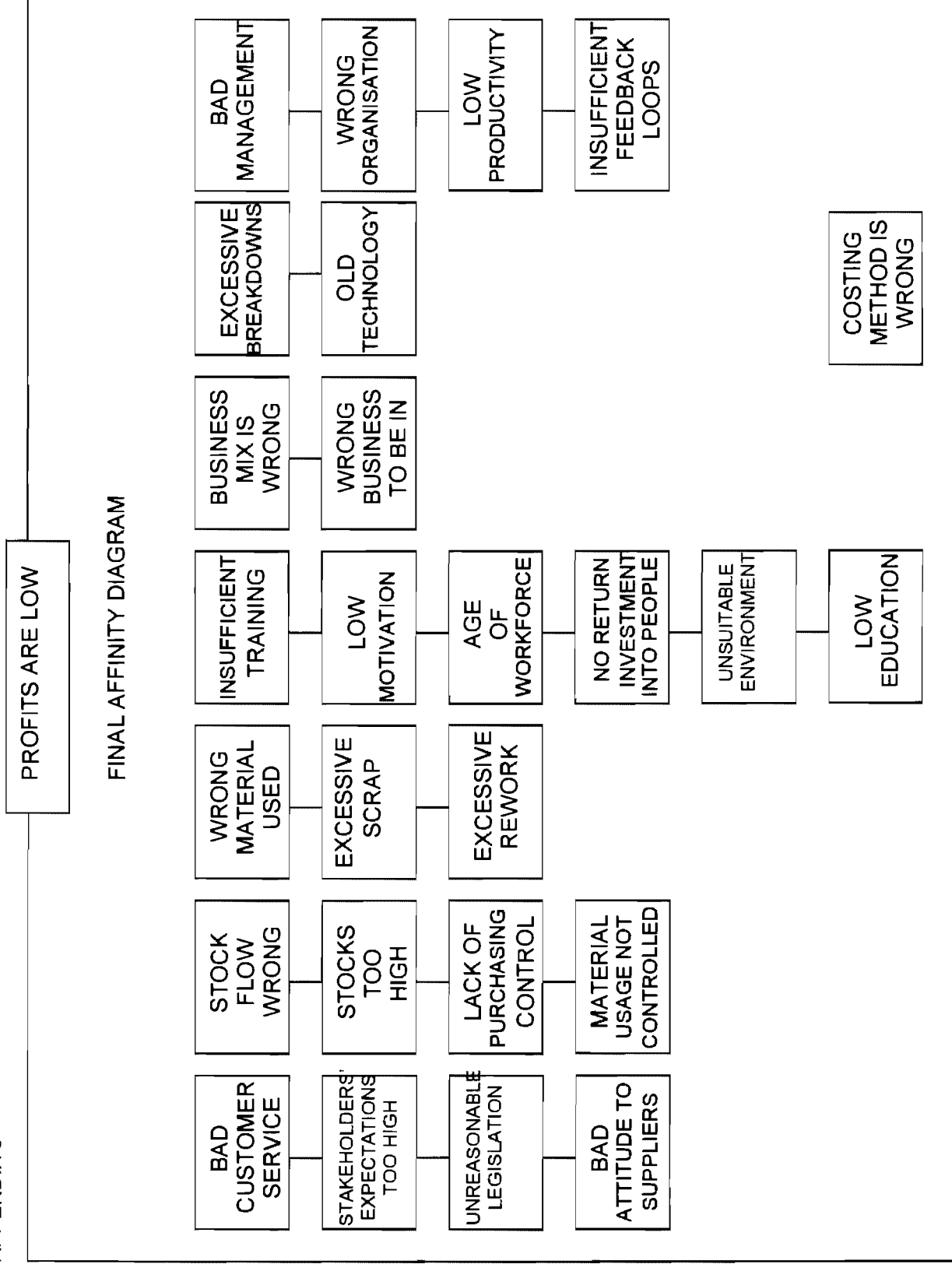
At this stage, lines should be drawn around each grouping and then related groupings placed near each other and connected by lines. This may create a new Header Card which is referred to as a Super Header.

Therefore in summary a group of data is examined and by a process of synthesis the issues are summarised back to the whole.

**AFFINITY GROUPING
FIRST CUT GROUPINGS**

GROUPING:





To rate by order of appearance

	<u>IN</u>	<u>OUT</u>	<u>TOTAL</u>
Bad Customer Service	5	0	5
Expectations too high	0	2	2
Unreasonable Legislation	0	1	1
Bad Attitude to Suppliers	1	1	2
Stock flow wrong	1	5	6
Stocks too high	1	1	2
Lack of Purchasing control	1	2	3
Material usage not controlled	2	1	3
Wrong Material used	0	3	3
Excessive scrap	3	0	3
Excessive rework	3	0	3
insufficient training	0	3	3
Low Motivation	4	2	6
Age of workforce	0	1	1
No return investment on people	0	3	3
Unsuitable environment	0	2	2
Low Education	1	2	3
Business mix is wrong	1	2	3
Wrong business to be in	2	1	3
Costing method is wrong	0	1	1
Bad Management	3	2	5
Wrong Organisation	3	1	4
Inefficient Operation	10	0	10
Insufficient feedback loops	0	2	2
Check	<u>40</u>	<u>37</u>	<u>77</u>

(In + Out should = Total)

At this stage a basic assumption was agreed upon by the team. It was agreed by consensus that a weighting factor of 2 would be introduced upon *items "causing" relationships as opposed to being "effected" by them and this resulted in the following listing.*

Weighted Listing (Out x 2)

	<u>IN</u>	<u>OUT</u>	<u>TOTAL</u>
Bad Customer Services	5	0	5
Expectations too high	0	2x2(4)	4
Unreasonable Legislation	0	1x2(2)	2
Bad attitude to Suppliers	1	1x2(2)	3
Stock flow wrong	1	5x2(10)	11
Stocks too high	1	1x2(2)	3
Lack of Purchasing control	1	2x2(4)	5
Material Usage not controlled	2	2x2(4)	6
Wrong material used	0	3x2(6)	6
Excessive Scrap	3	0	3
Excessive Rework	3	0	3
Insufficient Training	0	3x2(6)	6
Low motivation	4	2x2(4)	8
Age of workforce	0	1x2(2)	2
No return investment on people	0	3x2(6)	6
Unsuitable environment	0	2x2(4)	4
Low education	0	1x2(2)	2
Business mix is wrong	1	2x2(4)	5
Wrong business to be in	2	2x2(4)	6
Costing method is wrong	0	1x2(4)	2
Bad Management	3	2x2(4)	7
Wrong Organisation	3	1x2(2)	5
Low Productivity	10	0	10
Insufficient feedback loops	0	2x2(4)	4
CHECK	<u>40</u>	<u>114</u>	<u>154</u>

ANALYTICAL CRITERIA RESULTS

	A	B	C	D	E	F
A		5	5	1/10	1	1
B	1/5		1/10	1/10	1/10	1
C	1/5			1/5	1/5	1
D	10	10	5		1	10
E	1	10	5	1		5
F	1/10	1	1	1/10	1/5	

DECIMALIZED CRITERIA RESULTS

	A	B	C	D	E	F	TOTAL	% OR GRAND TOTAL
A	1	5	5	.1	1	10	22.1	23%
B	.2	1	.1	.1	.1	1	2.5	2.6%
C	.2	5	1	.2	.2	1	7.6	8%
D	10	10	5	1	1	10	37	39%
E	1	10	5	1	1	5	23	24%
F	.1	1	1	.1	.2	1	34	3.5%
TOTAL	11.6	32	17.1	2.5	3.5	28	94.7	GRAND TOTAL

ANALYTICAL MATRIX

THEN:

- 1 = Equal Acceptance
- 5 = Significantly more acceptance
- 10 = Extremely more acceptance
- 1/5 = Significantly less acceptance
- 1/10 = Extremely less acceptance

CRITERIA - IMPORTANCE TO OWNERS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	TOTAL	%
A	1	10	1	5	10	1/5	1/5	1	5	1/10	1/5	5	1	5	1	1	10	1	1	1/5	1	1	1/10	5	75	5,6
B	1/10	1	1/10	1/5	1	1/10	1	1/5	1/10	1/10	1/10	1	1	1	5	1	1	1/10	1/5	1/5	1	1	1/5	1	17,7	1,3
C	1	10	1	5	5	1	1	1/5	1/5	1/10	1/10	5	1	5	5	1	1/5	1	1	1/10	1/5	1/5	5	49,4	3,7	
D	1/5	5	1/5	1	5	1/5	5	5	5	10	10	5	1	5	5	5	1	1	1	1/5	1	1	5	28,8	5,9	
E	1/10	1	1/5	1/5	1	1/10	1/5	1	1/10	1/10	1/10	1	1/10	1/5	1	1/5	1/5	1/10	1/10	1/10	1/5	1/5	1	1	8,6	0,6
F	5	10	1	5	10	1	1	1	1	1/5	1/5	5	1	5	5	1	1	1/5	1/5	1/10	1	1	1	1	67,9	5,1
G	5	1	1	1/5	5	1	1	1	1	1/5	1/5	1	1/5	5	5	1/5	1	1	1/5	1/5	1	1	1/5	5	37,6	2,8
H	1	5	5	1/5	1	1	1	1	1	1/5	1/5	1/5	1/10	1/5	1	1	1/5	1/5	1/10	1	1/5	1/10	1	1	22,1	1,6
I	1/5	10	5	1/5	10	1	1	1	1	1	1	5	1	1	1	5	5	1/5	1/5	1/5	1/5	1	1	1	54,4	4,0
J	10	10	10	1/10	10	5	5	5	1	1	1	5	5	1	5	5	1	1	1/5	1/5	1/5	1	1	1	85,7	6,5
K	5	10	10	1/10	10	5	5	5	1	1	1	5	5	1	5	5	1	1	1/5	1/5	1/5	1	1	1	79,7	6,0
L	1/5	1	1/5	1/5	1	1/5	1	5	1/5	1/5	1/5	1	1	1/5	1	1	1	1/5	1/5	1	5	1	1	1	24	1,8
M	1	1	1	1	10	1	5	10	1	1/5	1/5	1	1	5	1	1	1	1/5	1/5	1/5	1	5	1	1	50	3,8
N	1/5	1	1/5	1/5	5	1/5	1/5	5	1	1	1/5	1	1/5	1	1	5	5	1	1	1	1	1/5	1/5	1	56,4	4,2
O	1	5	1/5	1/5	1	1/5	1/5	1	1	1/5	1/5	1	1	1/10	1	1/5	1/5	1/10	1/10	1/10	1	1/5	1/10	1	16,3	1,2
P	1	1	1	1/5	5	1	5	1	1/5	1/5	1/5	1	1	1/5	5	1	5	1/5	1/5	1/5	1/5	1/5	1/10	1	31,1	2,3
Q	1/10	1	5	1	5	1	1	5	1/5	1	1	1	1	1/5	5	1/5	1	1/5	1/5	1/5	1/5	1/5	1	1	31,8	2,4
R	1	10	1	1	10	5	1	5	5	1	1	5	5	1	10	5	5	1	1	1/10	1/5	1	1/5	1	77,4	5,8
S	1	5	1	1	10	5	5	10	5	5	5	5	5	1	10	5	5	1	1	1/10	1/5	1	1/5	1	88,5	6,7
T	5	5	10	5	10	10	5	1	5	5	5	1	5	1	10	5	5	1	10	1	1	5	1	10	122	9,2
U	1	1	5	1	5	1	1	5	5	5	5	1/5	1	1	1	5	5	5	5	1	1	10	5	5	76,2	5,7
V	1	1	5	1	5	1	1	5	1	1	1	1	1/5	5	5	5	5	1	1	1/5	1/10	1	1/10	1	48,6	3,7
W	10	5	10	1	10	1	5	10	5	1	1	1	1	5	10	10	10	5	5	1	1	10	1	10	129	9,1
X	1/5	1	1/5	1/5	1	1	1/5	1	1	1	1	1	1	1	1	1	1	1	1	1/10	1/5	1	1/10	1	18,2	1,1
TOTAL	57,3	111	74,3	30,2	146	43,2	60	85,4	47	35,8	39,9	62,4	40,8	51,1	109	69,8	70,8	23,7	30,3	9,8	18,5	44,6	11,1	62	1328	

ANALYTICAL MATRIX
IMPORTANCE TO THE ACTORS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	TOTAL	%	
A	1	1	5	5	5	1	5	1	1/5	1/5	1/5	1/10	1/10	1/5	1/10	1/10	1/10	1	1	1/5	1/10	1/10	1/5	1/10	1	26	1,7
B	1	1	5	5	1	1	1	1/5	1/5	1/5	1/5	1/10	1/10	1/10	1/10	1/10	1/10	5	5	1	1/5	1/5	1/5	1/5	1	28,2	1,9
C	1/5	1/5	1	1	1/5	1/5	1	1/5	1/5	1/10	1/10	1/10	1/10	1/10	1/10	1/10	1/10	1/5	1/5	1	1	1/5	1	1/5	1	8,8	0,6
D	1/5	1/5	1	1	1	1	1	1	1/5	1	1	1/10	1/10	1/10	1/10	1/10	1/10	1	1	1	1/5	1/5	1/5	1/5	13	0,9	
E	1/5	1	5	1	1	1	5	1	1	1/5	1/5	1/10	1/10	1/10	1/10	1/10	1/10	5	5	1	1/5	1/5	1/10	1/5	28,9	1,9	
F	1	1	1	1	1	1	5	1	1	1/5	1/5	1/10	1/10	1/10	1/10	1/10	1/10	5	5	1	1/5	1/5	1/10	1/5	29,7	2,0	
G	1/5	1	1	1	1/5	1/5	1	1	1	1/5	1/5	1/10	1/10	1/10	1/10	1/10	1/10	1/5	1/5	1/10	1/5	1/5	1/5	1/5	11,9	0,8	
H	1	5	5	1	1	1	1	1	1/5	1/5	1/5	1/10	1/10	1/10	1/10	1/10	1/10	5	5	1/5	1/5	1/5	1/5	1/5	28,2	1,9	
I	5	5	5	5	1	1	1	5	1	1	1	1/10	1/10	1/10	1/10	1/10	1/10	1	1	1	1/5	1/5	1/10	1/5	34,3	2,3	
J	5	5	10	1	5	5	5	5	1	1	1	1/5	1/5	1/5	1/5	1/5	1/5	1	1	1/5	1	1	1	1	51,4	3,4	
K	5	5	10	1	5	5	5	5	1	1	1	1/5	1/5	1/5	1/5	1/5	1/5	1	1	1/5	1	1	1	1	51,4	3,4	
L	10	10	10	10	10	10	10	10	10	5	5	1	1	5	1/5	5	1	10	10	5	5	5	1	1	147,2	9,8	
M	10	10	10	10	10	10	10	10	10	5	5	1	1	5	1	5	5	10	10	5	5	5	1	1	155	10,3	
N	5	10	10	10	10	10	10	10	10	5	5	1/5	1/5	1	1	1/5	10	10	10	1	5	1	1	1	136,6	9,0	
O	10	10	10	10	10	10	10	10	10	5	5	5	5	1	1	10	1	5	5	5	5	5	1	1	146	9,7	
P	10	10	10	10	10	10	10	10	10	5	5	1/5	1/5	5	1/10	1	1	1	1	1/5	1/6	1	1	1	112,9	7,5	
Q	10	10	10	10	10	10	10	10	10	5	5	1	1	1/5	1	1	1	5	5	5	1	1	1	1	1	123,3	8,2
R	1	1/5	5	1	1/5	1/5	5	1/5	1	1	1	1/10	1/10	1/10	1/5	1	1/5	1	1	1	1	1	1	1	1	24,5	1,6
S	1	1/6	5	1	1/5	1/5	5	1/5	1	1	1	1/10	1/10	1/10	1/5	1	1/6	1	1	1	1	1	1	1	1	24,5	1,6
T	5	1	1	1	1	1	10	5	1	5	5	1/5	1/5	1	1/5	5	1/5	1	1	1	5	5	1	5	61,6	4,1	
U	10	5	1	5	5	5	5	5	5	1	1	1/5	1/5	1/5	1/5	5	1	1	1	1/5	1	1	1	1	61	4,0	
V	10	5	5	5	5	5	5	5	5	1	1	1/5	1/5	1/5	1/5	1	1	1	1	1/5	1	1	1/5	1	61	4,0	
W	5	5	1	5	10	10	5	5	10	1	1	1	1	1	1	1	1	1	1	1	1	5	1	5	79	4,0	
X	10	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1/5	1	1	1/5	1	63,4	4,2	
TOTAL	116,8	106,8	136	106	106	104	131	106,8	95	46,3	46,3	12,5	7,7	22,9	8,6	38,5	24,9	73,4	73,4	32,7	36,7	36,7	15,7	24,7	1509,		
	GRAND TOTAL																										

ANALYTICAL MATRIX
COST EFFECTIVENESS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	TOTAL	%	
A	1	5	5	1/5	1/5	1/5	1/10	1	1	1/10	1/10	1/5	1/5	5	1/5	1	1	1/10	1/10	1/10	1	1	1/10	1	1	24,9	1,9
B	1/5	1	1	1/5	1/5	1/5	1/5	1/5	1/5	1/10	1/10	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/10	1/5	1/5	1/5	1/5	1	6,1	0,5
C	1/5	1	1	1/5	1/5	1/5	1/5	1/5	1/10	1/10	1/10	1	1	1	1	1/5	1	1/5	1/5	1/10	1/5	1/5	1/5	1/5	1	10	0,8
D	5	5	5	1	1	1	1	5	5	1	1	5	1	5	1	1	1	1	1	1	1	1	1	1	1	52	4,0
E	5	5	5	1	1	1	1/5	1	1	5	5	5	10	10	10	5	5	1/5	1	1/5	5	5	1/10	5	5	91,9	7,0
F	5	5	5	1	1	1	1/5	1	1	5	5	5	10	10	10	5	5	1/5	1	1/5	5	5	1/10	5	5	91,9	7,0
G	10	5	5	1	5	5	1	10	10	5	5	1	1	1	1	1	1	1	1	1/5	5	5	1	1	1	90,12	6,9
H	1	5	5	1/5	1	1	1/10	1	1	1/5	1/5	1	1	1	1	1	1	1/5	1/5	1/10	1	1	1/5	1	1	25,6	2,0
I	1	5	10	1/5	1	1	1/10	1	1	1	1	1/5	1/5	1	1	1	1/5	1/5	1/5	1/10	1	1	1/5	2	2	29,6	2,3
J	10	10	10	1	1/5	1/5	1/5	5	5	1	1	1	1/5	1	1	1	1/5	5	5	1	1	1	1	1	1	59	4,5
K	10	10	10	1	1/5	1/5	1/5	5	5	1	1	1	1/5	1	1	1	1/5	5	5	1	1	1	1	1	1	59	4,5
L	5	5	1	1/5	1/5	1/5	1/5	1	5	1	1	1	1	5	1	1	1	5	5	5	5	10	5	1	1	65,8	5,0
M	5	5	1	1	1/10	1/10	1	1	5	5	5	1	1	5	1	1	5	5	5	10	10	10	1	1	1	85,2	6,5
N	1/5	5	1	1/5	1/10	1/10	1/5	1	1	1	1	1/5	1/5	1	1/5	1/5	1/5	1/10	1/10	1/10	1	1	1	1	1	17,1	1,3
O	5	5	1	1	1/10	1/10	1	1	1	1	1	1	1	5	1	1	1	1	1	1	5	5	1	1	1	42,2	3,2
P	1	5	5	1	1/5	1/5	1	1	1	1	1	1	1	5	1	1	1	1/5	1/5	1/5	1	1	1/10	1/5	1	30,3	2,3
Q	1	1	1	1	1/5	1/5	1	1	5	5	5	1	1/5	5	1	1	1	1/5	1/5	1/5	5	5	1	1	1	47,2	3,6
R	10	5	5	1	5	5	1	5	5	1/5	1/5	1/5	1/5	10	1	5	5	1	1	1	5	5	1	1	1	78,8	6,0
S	10	5	5	1	1	1	1	5	5	1/5	1/5	1/5	1/5	10	1	5	5	1	1	1	5	5	1	1	1	78,8	6,0
T	10	10	10	1	5	5	5	10	10	1	1	1/5	1/10	10	1	5	5	1	1	1	10	10	5	1	1	118,3	9,1
U	1	5	5	1	1/5	1/5	1/5	1	1	1	1	1/5	1/10	1	5	1	1/5	1/5	1/5	1/10	1	1/10	1/10	1	1	26,8	2,1
V	1	5	5	1	1/5	1/5	1/5	1	1	1	1	1/10	1/10	1	5	1	1/5	1/5	1/5	1/10	10	1	1/10	1	1	36,6	2,8
W	10	5	5	1	10	10	1	5	5	1	1	1/5	1	1	1	10	1	1	1	1/5	10	10	1	10	1	105	8,1
X	1	5	5	1	1/5	1/5	1	1	1	1	1	1	1	1	1	5	1	1	1	1	1	1	10	1	1	43	3,3
TOTAL	108,6	127	118	18,2	33,4	33,4	17,3	64,4	64,4	38,9	38,9	31,9	32,1	100,2	48,6	54,6	42,4	30,2	30,2	25	90,4	85,5	32,4	38,6	1304,6	GRAND TOTAL	

RANKING OPTIONS BY CRITERIA					
	EVALUATION CRITERIA	IMPORTANT	IMPORTANT	COST	ROW TOTAL
	OPTIONS	TO OWNERS	TO ACTORS	EFFECTIVENESS	(% OF)
					GRAND TOTAL
A	Bad Customer Services	$0.056 \times .39 = .021$	$.017 \times .26 = .004$	$.019 \times .24 = .005$	0.03 (.03)
B	Expectations too high	$0.013 \times .39 = .005$	$.019 \times .26 = .005$	$.005 \times .24 = .001$	0.011 (.01)
C	Unreasonable Legislation	$0.037 \times .39 = .014$	$.006 \times .26 = .002$	$.008 \times .24 = .002$	0.018 (.02)
D	Bad attitude to Suppliers	$0.059 \times .39 = .023$	$.009 \times .26 = .002$	$.040 \times .24 = .010$	0.035 (.04)
E	Stock flow wrong	$0.006 \times .39 = .002$	$.019 \times .26 = .005$	$.070 \times .24 = .017$	0.024 (.02)
F	Stock too high	$0.051 \times .39 = .019$	$.02 \times .26 = .005$	$.070 \times .24 = .017$	0.041 (.04)
G	Lack of Purchasing control	$0.028 \times .39 = .011$	$.008 \times .26 = .002$	$.069 \times .24 = .017$	0.03 (.03)
H	Material usage not controlled	$0.016 \times .39 = .006$	$.019 \times .26 = .005$	$.020 \times .24 = .005$	0.016 (.03)
I	Wrong matf. Interior quality	$0.04 \times .39 = .016$	$.023 \times .26 = .006$	$.023 \times .24 = .006$	0.028 (.03)
J	Excessive scrap	$0.065 \times .39 = .025$	$.034 \times .26 = .009$	$.045 \times .24 = .011$	0.045 (.05)
K	Excessive rework	$0.06 \times .39 = .023$	$.034 \times .26 = .009$	$.045 \times .24 = .011$	0.043 (.04)
L	Insufficient Training	$0.018 \times .39 = .007$	$.098 \times .26 = .026$	$.050 \times .24 = .012$	0.045 (.05)
M	Low motivation	$0.038 \times .39 = .015$	$.103 \times .26 = .027$	$.065 \times .24 = .016$	0.058 (.06)
N	Age of Workforce	$0.042 \times .39 = .016$	$.090 \times .26 = .024$	$.013 \times .24 = .003$	0.043 (.04)
O	No return investment - people	$0.012 \times .39 = .005$	$.097 \times .26 = .025$	$.032 \times .24 = .008$	0.038 (.04)
P	Unsuitable Environment	$0.023 \times .39 = .009$	$.075 \times .26 = .002$	$.023 \times .24 = .006$	0.017 (.02)
Q	Low Education	$0.024 \times .39 = .009$	$.082 \times .26 = .021$	$.036 \times .24 = .009$	0.039 (.04)
R	Business mix wrong	$0.058 \times .39 = .023$	$.016 \times .26 = .004$	$.060 \times .24 = .014$	0.041 (.04)
S	Wrong business to be in	$0.067 \times .39 = .026$	$.016 \times .26 = .004$	$.060 \times .24 = .014$	0.044 (.04)
T	Costing method is wrong	$0.092 \times .39 = .036$	$.041 \times .26 = .011$	$.091 \times .24 = .022$	0.069 (.07)
U	Bad Management	$0.057 \times .39 = .022$	$.040 \times .26 = .010$	$.021 \times .24 = .005$	0.037 (.04)
V	Wrong Organisation	$0.037 \times .39 = .014$	$.040 \times .26 = .010$	$.028 \times .24 = .007$	0.068 (.07)
W	Low Productivity	$0.007 \times .39 = .003$	$.052 \times .26 = .011$	$.035 \times .24 = .008$	0.024 (.02)
X	Insufficient feedback loops	$0.014 \times .39 = .005$	$.042 \times .26 = .011$	$.035 \times .24 = .008$	0.024 (.02)
i	Column Total	0.39	0.253	0.245	Grand
					Total
					0.888



NISSAN SA MANUFACTURING

STANDARD OPERATION SHEET

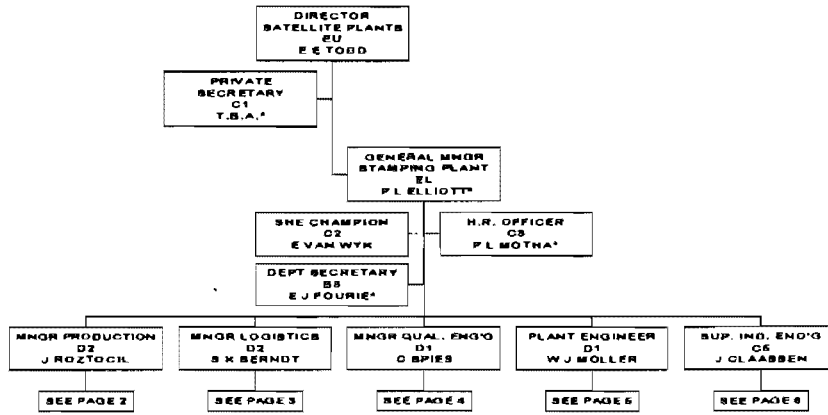
OPERATION SHEET

NO	ISSUE LEVEL	DATE	SUPR	OPERATION NO	OPERATION NAME	VITAL	ASSURED	ZONE:	SHEET	OF
				AND 82/3 - 20	TO SUITE TIM	✓		LINE 4	1	1
								DEPT	DATE	
								PREPARED BY:	10/7/96	
								PRINT:	F. SPIES	
								SIGNATURE:		

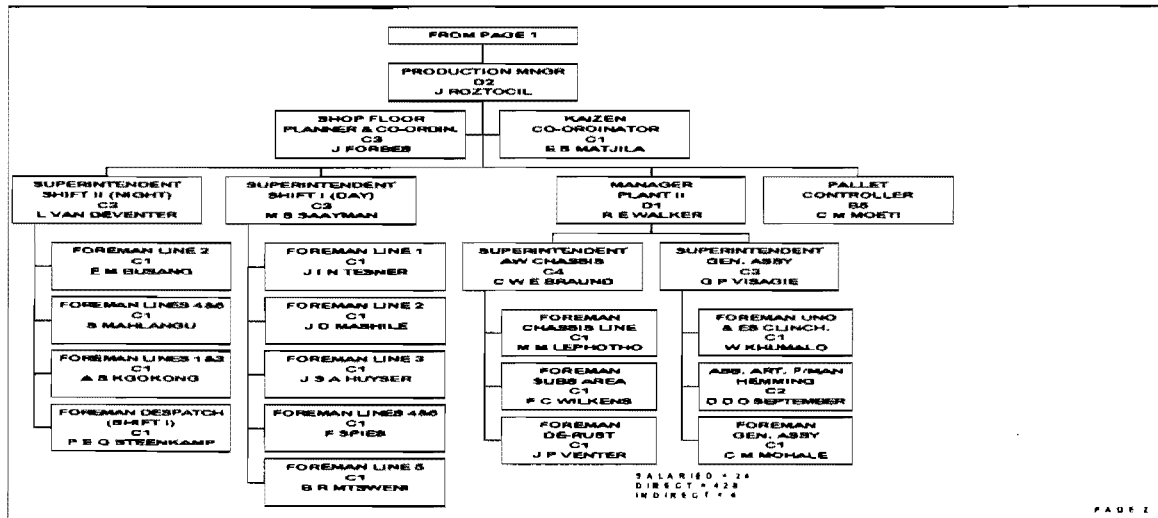
NO	OPERATION DESCRIPTION	MAIN STEPS	KEY POINTS	REASON FOR KEY POINTS, SKETCH, ETC.
1	PUSH BLANK THROUGH USING MACHINE OPERATOR No 1.	By USING BOTH HANDS LIFT BLANK AND PUSH IT THROUGH OIL MACHINE	TO PREVENT PART FOR SPALLING. THIS PART MUST RUN IN FLOW. (ALL OPERATIONS)	
2	LOAD BLANK ONTO DRAW TOOL OPERATOR No 2 + 3	By USING BOTH HANDS PICK UP BLANK AND LOAD AGAINST LOCATIONS.	ENSURE BLANK IS LOADED FULLY AGAINST LOCATIONS.	
3	ACTIVATE PRESS TO CYCLES OPERATOR No 2.	PRESS BOTH PUSH BUTTONS WITH BOTH HANDS AND HAND UNTIL PRESS CAM IS PASSED ADC.	ENSURE SAFETY LIGHTS ARE OPERATIONAL.	
4	REMOVE DRAWN PART OPERATOR No 2, 3, 4	Pick UP PARTS WITH BOTH HANDS PART OVER AND LOAD ONTO CONVEYOR. CHECK FOR SPLITS AND SCORE MARKS.	OPERATOR No 2, 3 AND 4 MUST LIFT PART UP TOGETHER	

CODE	PROTECTIVE CLOTHING	JIGS/TOOLS/FACILITY	REQUIRED CHECKS	TRAINING COMMENTS	AUTHORISATION
	GLOVES OVERALLS SAFETY SHOES EYE PROTECTION	PRESS 19 OR 29.	EVERY 15 MINUTES		SUPERVISOR: PRINT: VAN DEVENTER SIGNATURE:

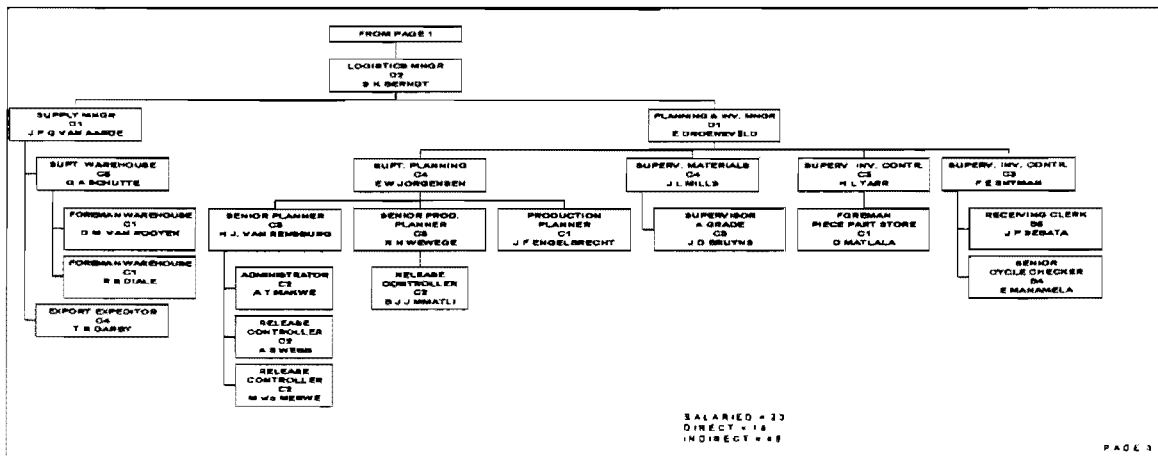
SALARIED = 118
 INDIRECT = 84
 DIRECT = 467
 TOTAL = 671



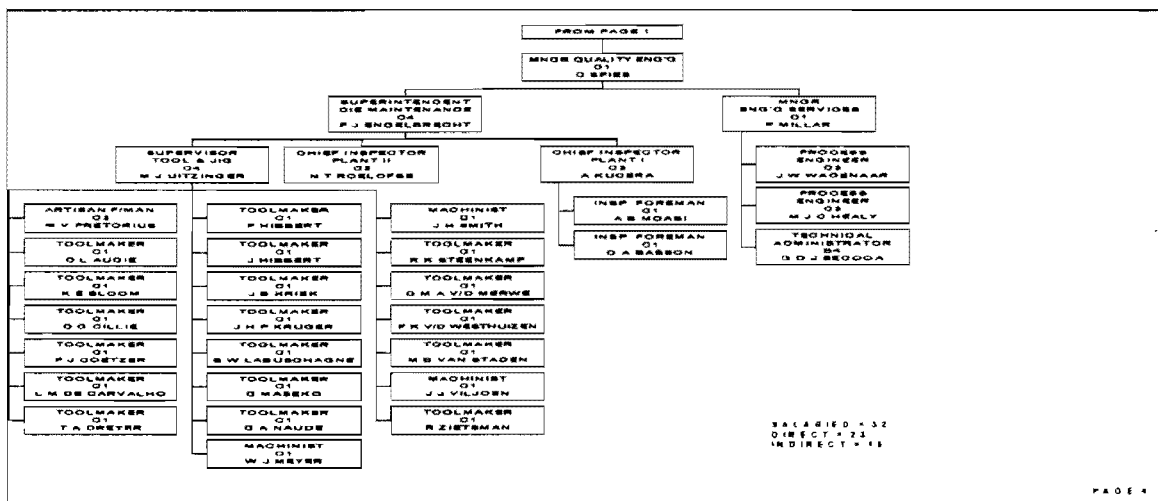
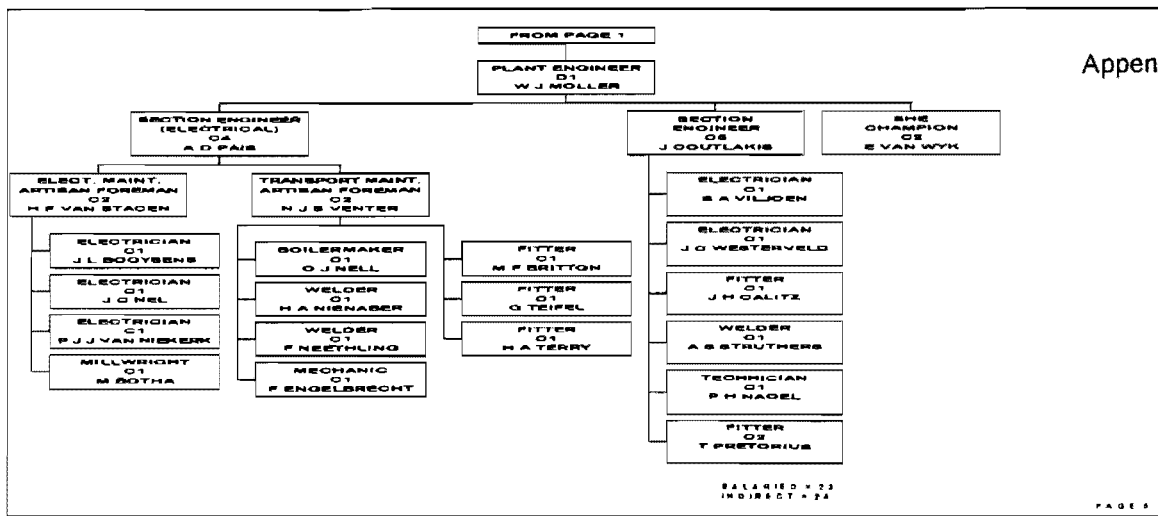
SALARIED = 47

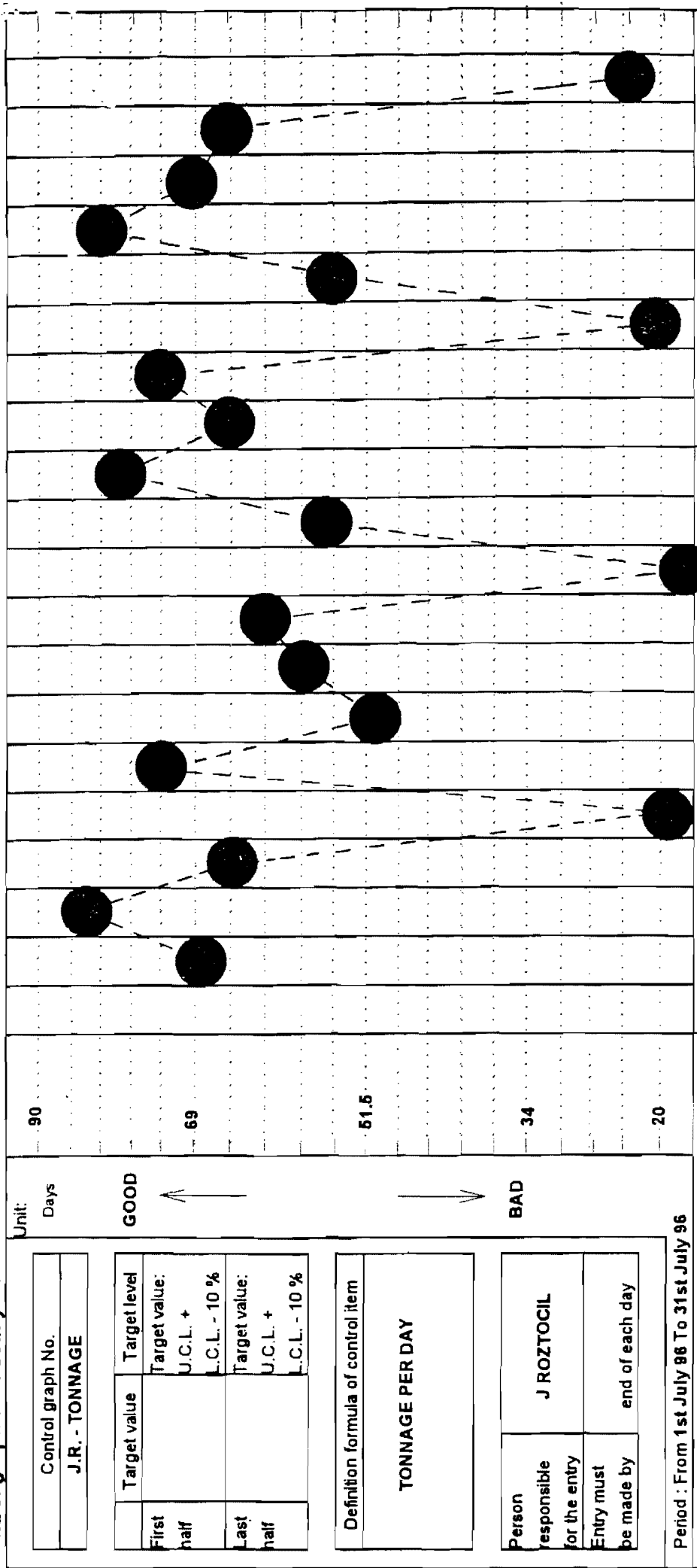


SALARIED = 24
 DIRECT = 124
 INDIRECT = 4



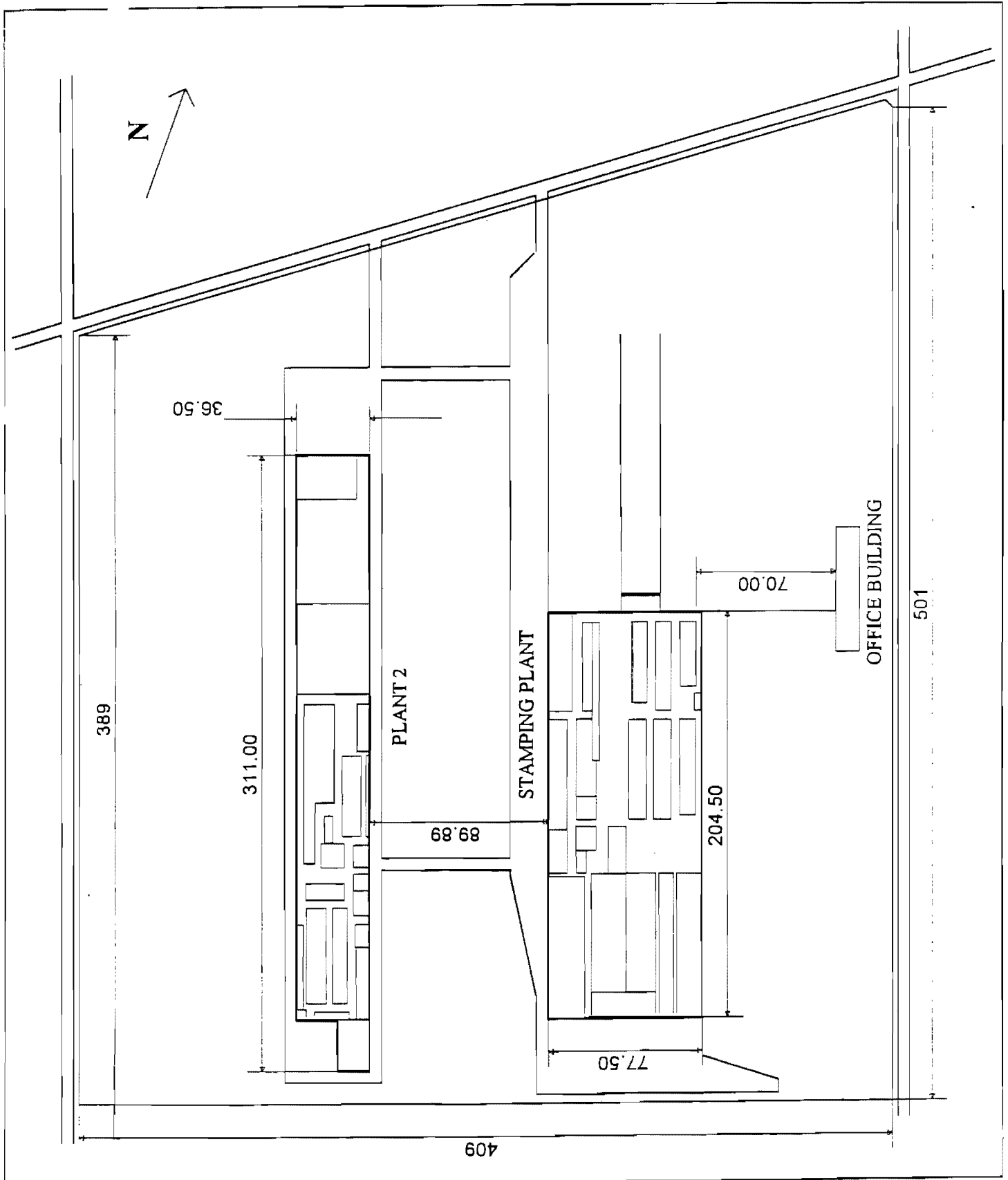
SALARIED = 33
 DIRECT = 14
 INDIRECT = 48





Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26					
Target value	75	65	85	70	80	60	75	85	70	80	65	75	85	60	70	80	75	85	65	75	85	70	80	90	75	85	60	70	80	90	75
Act result value	75	65	85	70	80	60	75	85	70	80	65	75	85	60	70	80	75	85	65	75	85	70	80	90	75	85	60	70	80	90	75

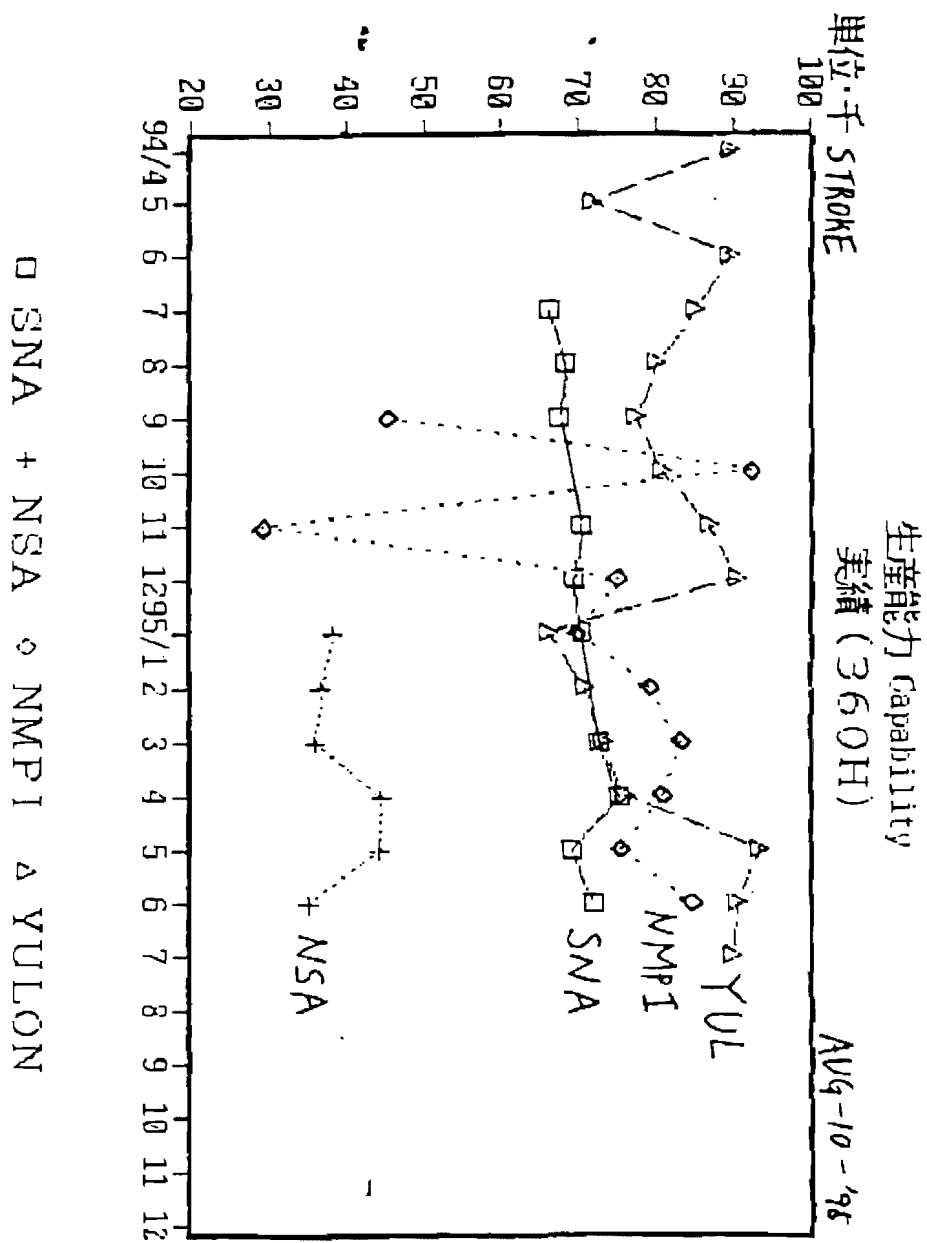
● = Below Target (Outside Limits)
 ○ = Below Target (Inside Limits)
 ● = On or Better than Target



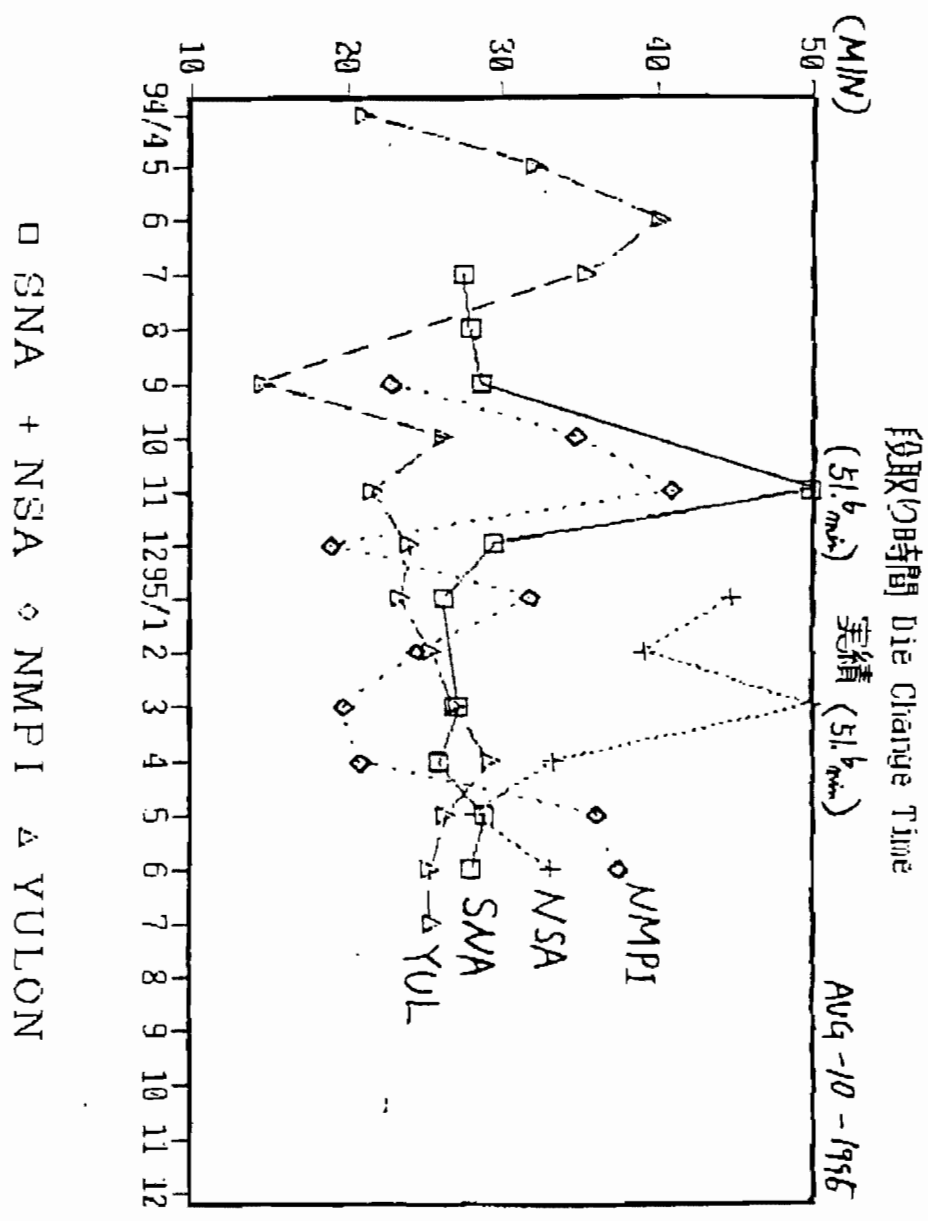
Establishment of Strong "Product-Making" Plant (STEP diagnosis standard)

	1st Step		2nd Step		3rd Step		4th Step		5th Step	
	a(0.5)	b(1.0)	a(0.5)	b(1.0)	a(0.5)	b(1.0)	a(0.5)	b(1.0)	a(0.5)	b(1.0)
Role of each class	Role of Top Management and its execution.	Role of General Manager and its execution.	Role of Manager and its execution	Role of Foreman and its execution	Role of each worker and its execution					
	You can get 2nd STEP a when Top Management has negotiated successfully with related departments to support the stated objective.	You can get 3rd STEP a when General Manager has negotiated successfully with related departments to support the stated objective.	You can get 4th STEP a when a Manager acts as leader to have related departments take action	You can get 5th STEP a when Foreman acts as leader to have related departments take action						
(Cooperation among related depts) →	This process of maturity is recorded in minutes and shows the measures taken and that Top Management has taken the lead.	This process of maturity is recorded in minutes and shows the measures taken and that General Manager has taken the lead.	Manager is taking the leadership to improve QCD Engineering is preparing C/J for QCD improvement activity and execute.	Foreman Executed GK activity in his own responsible range.	Kaizen activities are carried out under the participation of the most workers.					

- a. Procedure as system or documentation is compiled.
- b. Job defined by the above "procedure" is being executed.



5/4



FACSIMILE

ATTENTION : MR SATO

DATE : 08-Oct-96

X : 0981 335 452328

NISSAN SOUTH AFRICASTAMPING PLANT PRODUCTIVITY DATA - 1996LINE 3 - ROVETTA MACHINES

PARAMETERS	JUL	AUG	SEP	OCT	NOV	DEC
TOTAL WORKING TIME (HRS)	987.5	1483.5	792			
POSSIBLE PRESS RUN (HRS)	922.789	1385.36	772.92			
SCHEDULED STOP (HRS)	64.7115	98.1387	19.08			
ACTUAL PRESS RUN (HRS)	540.77	698.48	398.8			
DOWNTIME (HRS)	382.019	686.881	374.12			
DIE SETTING TIME (HRS)	136.88	174.98	95.283			
RUN POSSIBLE RATIO (%) [2/1]	93.4469	93.3847	97.5909			
OP. EFFICIENCY RATIO (%) [4/1]	54.7615	47.0832	50.3535			
ACTUAL OP. RATIO (%) [4/2]	58.6017	50.4186	51.5965			
DOWNTIME RATIO (%) [5/2]	41.3983	49.5814	48.4035			
PRODUCTION QUANTITY (STROKES)	129809	172014	86513			
360 HR CAPABILITY (STROKES) [11/2*360]	50641.3	44699.6	40294.8			
AVERAGE STROKES (SPM) [(11/4)/60]	4.00	4.10	3.62			
NUMBER OF DIE CHANGES	147	159	101			
AVE. DIE CHANGE TIME (MIN) [6/14]	55.87	66.03	56.60			

LINE 4 - WILKINS & MITCHELL MACHINES

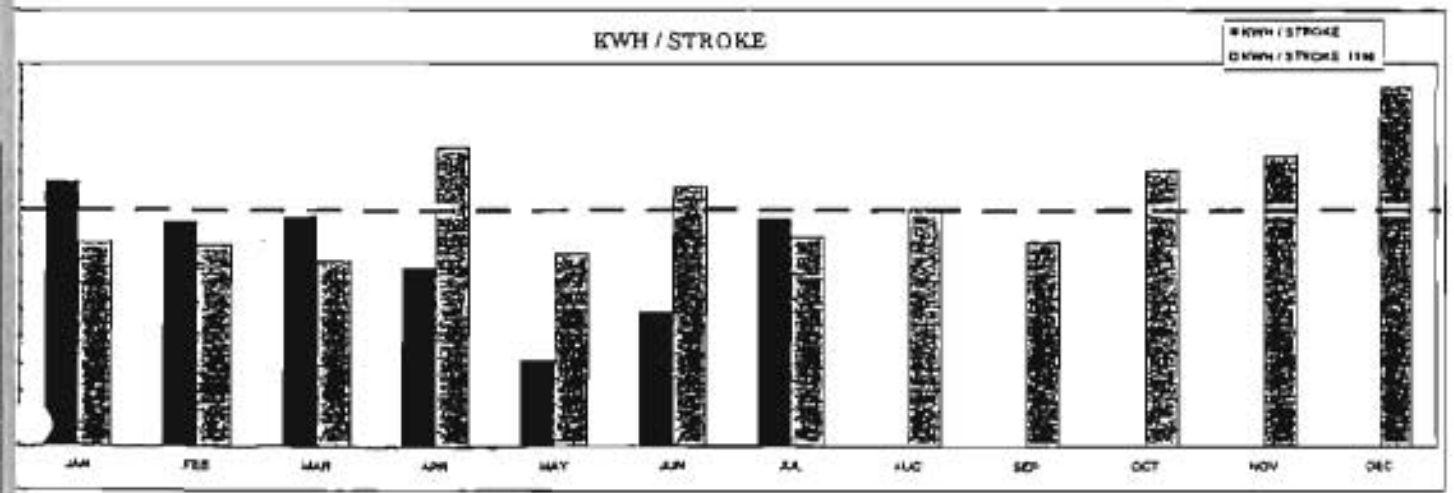
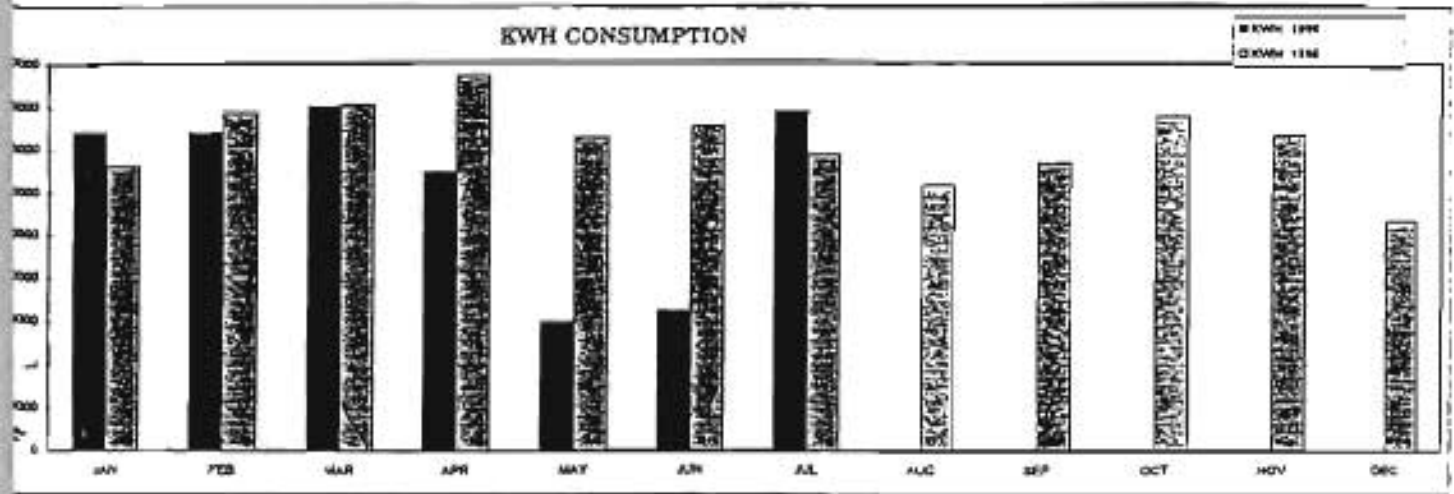
PARAMETERS	JUL	AUG	SEP	OCT	NOV	DEC
TOTAL WORKING TIME (HRS)	1106	1260	612			
POSSIBLE PRESS RUN (HRS)	1032.47	1175.58	571.17			
SCHEDULED STOP (HRS)	73.53	84.4223	40.83			
ACTUAL PRESS RUN (HRS)	627.73	636.33	419.2			
DOWNTIME (HRS)	404.74	539.248	151.97			
DIE SETTING TIME (HRS)	110.87	120.9	54.533			
RUN POSSIBLE RATIO (%) [2/1]	93.3517	93.2998	93.3284			
OP. EFFICIENCY RATIO (%) [4/1]	56.7568	50.5024	68.4967			
ACTUAL OP. RATIO (%) [4/2]	60.7989	54.1291	73.3932			
DOWNTIME RATIO (%) [5/2]	39.2011	45.8709	26.6068			
PRODUCTION QUANTITY (STROKES)	131399	136609	83481			
360 HR CAPABILITY (STROKES) [11/2*360]	45816	41834.1	52616.8			
AVERAGE STROKES (SPM) [(11/4)/60]	3.49	3.58	3.32			
NUMBER OF DIE CHANGES	108	123	68			
AVE. DIE CHANGE TIME (MIN) (6/14)	61.59	58.98	48.12			

NISSAN STAMPING PLANT

TOTAL HEADCOUNT - 565

SECTION	NUMBER OF EMPLOYEES	PERCENTAGE	RESIDENCE DISTANCE	MODE OF TRANSPORT
Press Shop	251	44,42%	Soshanguve & Bethanie Mabopane & Klipgat Ga-Rankuwa (52 Km)	Train, Bus, Taxi & Lift Club
Metal Finish	11	1,94%	Soshanguve & Mabopane (18 Km)	Taxi & Lift Club
Guillotine	12	2,12%	Ga-Rankuwa & Mabopane (16 Km)	Bus, Taxi & Lift Club
Hemming Areas	20	3,53%	Mamelodi & Mabopane (36 Km)	Bus & Taxi
Warehouse	16	2,83%	Lethabile, Ga-Rankuwa & Mabopane (25 Km)	Bus & Taxi
Plant Maintenance	27	4,77%	Madidi, Klipgat, Ga-Rankuwa & Mabopane (16 Km)	Train, Bus & Taxi
Tool & Die Maintenance	2	0,35%	Ga-Rankuwa & Lethabile (25 Km)	Car (Own Transport)
Inventory Control	26	4,60%	Soshanguve, Mabopane, Ga-Rankuwa & Mothuting (27 Km)	Bus & Taxi
Planning	10	1,76%	Ga-Rankuwa, Madidi & Klipgat (16 Km)	Bus, Taxi & Lift Club
Quality Eng.	27	4,77%	Hammanskraal, Soshanguve & Mabopane (42 Km)	Train, Bus & Taxi
Assembly Product	74	13,09%	Mabopane, Ga-Rankuwa, Soshanguve & Klipgat (18 Km)	Train, Bus & Taxi
Oiling & Packing	43	7,61%	Soshanguve, Ga-Rankuwa & Mabopane (18 Km)	Bus, Taxi & Lift Club
AW Chassis	46	8,14%	Soshanguve, Ga-Rankuwa & Mabopane (18 Km)	Bus, Taxi & Lift Club

ELECTRICITY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
H. 1996	744000	741000	801000	648000	300000	324000	789000					
H / STROKE	0.97	0.83	0.84	0.66	0.32	0.49	0.84	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
H. 1995	693000	755000	884000	873000	226000	753000	682000	618000	669000	648000	635000	532000
H / STROKE 1995	0.72	0.74	0.68	0.81	0.31	0.43	0.79	0.68	0.75	0.76	0.71	0.53



REMARKS: For the year 1996 the following equipment were commenced during last year.

Phosac line
Heming line

REF NO: PM0002
TARGET: 0.893 kWh / Stroke (Horizontal Dotted Line) Ave. for 1995.
FORMATION SOURCE: Alaska Account No. 4006883

0.71 kWh/stroke
Prepared by: H BREED / GROUP PLANT ENGINEERING
Ave for 1996.

STAMPING PLANT BUDGET 1995/6

ACCOUNT	MONTHS												TOTAL	VARIATION	PERCENT		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
EXPENSES																	
PERSONNEL GROUP																	
- SALARIES	192,243	8,818	8,808	12,117	15,882	15,882	7,814	8,114	10,889	12,117	12,117	8,282	12,494	19,848	124,228	124,228	17.4%
- OVERTIME	8,888	838	838	801	871	871	478	832	871	871	871	871	871	871	8,888	8,888	1.2%
- AWARDS	28,008	2,780	2,881	2,907	2,117	2,117	2,141	1,881	2,001	2,001	2,001	2,001	2,001	2,001	28,008	28,008	3.8%
- AW CHARGES	82,784	2,681	2,324	2,688	2,380	2,380	2,428	2,884	2,884	2,884	2,884	2,884	2,884	2,884	82,784	82,784	11.0%
- OTHER	13,841	888	2,008	2,888	2,481	2,481	1,714	1,887	2,708	2,021	2,021	2,389	2,018	2,884	13,841	13,841	1.8%
PAID GROUP	2,774	174	166	109	166	166	174	134	190	174	188	188	174	188	2,774	2,774	0.4%
OUTSIDE SERVICES																	
- RENT	4,084	422	377	482	482	482	400	422	400	422	400	422	400	422	4,084	4,084	0.5%
- UTILITIES	1,880	0	178	119	84	84	0	74	74	72	72	72	72	72	1,880	1,880	0.3%
- TELEPHONE	2,880	887	887	887	887	887	887	887	887	887	887	887	887	887	2,880	2,880	0.4%
OTHER GROUP																	
TOTAL EXPENSES	119,845	19,814	19,818	12,818	11,811	11,810	7,814	8,818	11,818	12,818	12,818	8,818	12,818	19,818	119,845	119,845	16.1%
REVENUE																	
TOTAL MATERIAL	83,003	4,825	4,848	5,882	5,290	5,288	2,774	4,108	5,848	6,212	6,471	6,274	6,274	6,274	83,003	83,003	11.0%
COLLAR (LOCAL MAT DUMAGES)	1,281	704	108	129	112	112	78	88	118	137	98	137	137	137	1,281	1,281	0.2%
WIP OILY/CLEAR	14,281	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	14,281	14,281	1.8%
EXTRA DIRECT COSTS	16,836	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	1,826	16,836	16,836	2.1%
DIRECT LABOUR	1,206	184	187	188	188	188	117	106	142	182	178	182	182	182	1,206	1,206	0.2%
PROD MATERIALS	1,206	118	118	142	142	142	88	88	118	126	88	126	126	126	1,206	1,206	0.2%
UTILITIES	1,874	172	188	207	177	177	128	120	178	201	182	201	201	201	1,874	1,874	0.2%
CARTAGE & BALANCE	81	111	101	137	108	111	78	82	123	138	108	138	138	138	81	81	0.0%
PROPERTY TAX																	
TOTAL OTHER DIRECT COST	18,772	2,487	2,208	2,902	2,440	2,524	1,802	1,886	2,808	2,882	2,884	2,882	2,882	2,882	18,772	18,772	2.4%
CONTRIBUTION	28,188	2,081	2,388	4,022	3,841	3,482	2,422	2,840	3,872	3,886	3,886	3,886	3,886	3,886	28,188	28,188	3.6%
LABOURS & WAGES	18,802	1,840	1,477	1,888	1,810	1,630	1,328	1,817	1,827	1,708	1,848	1,708	1,848	1,848	18,802	18,802	2.4%
CONSUMABLES	884	80	41	88	82	86	34	87	112	42	81	42	81	81	884	884	0.1%
UTILITIES	18	1	1	1	2	1	1	1	1	1	2	1	2	2	18	18	0.0%
MAINTENANCE	8,880	884	822	833	887	838	882	838	834	844	842	844	842	842	8,880	8,880	1.1%
PROPERTY TAX	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	0.0%
DEPR DEPRECIATION	4,080	288	288	288	288	288	288	288	288	288	288	288	288	288	4,080	4,080	0.5%
DEPR DEPRECIATION - DEPR	2,888	288	288	288	288	288	288	288	288	288	288	288	288	288	2,888	2,888	0.4%
DEPR DEPRECIATION - DEPR	1,474	71	88	72	88	70	88	80	80	88	85	88	88	88	1,474	1,474	0.2%
DEPR DEPRECIATION - DEPR	1,804	288	288	288	288	288	288	288	288	288	288	288	288	288	1,804	1,804	0.2%
TOTAL OTHER REVENUE	24,818	2,188	2,848	2,180	2,284	2,118	2,118	2,118	2,118	2,118	2,118	2,118	2,118	2,118	24,818	24,818	3.2%
PAID SERVICE OTHER INCOME	1,480	841	318	842	327	322	322	322	322	322	322	322	322	322	1,480	1,480	0.2%
OTHER INCOME	1,812	108	108	108	108	108	108	108	108	108	108	108	108	108	1,812	1,812	0.2%
PROPERTY TAX	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	0.0%
DEPR DEPRECIATION	4,832	44	44	44	44	44	44	44	44	44	44	44	44	44	4,832	4,832	0.6%
TOTAL REVENUE	28,818	2,818	3,818	2,818	2,818	2,818	2,818	2,818	2,818	2,818	2,818	2,818	2,818	2,818	28,818	28,818	3.7%
NET PROFIT	10,818	1,818	2,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	10,818	10,818	1.4%
NET LOSS	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	8,818	11.4%

REVENUE - PHOTOGRAPHY

STAMPING DIVISION
INCOME STATEMENT June-1996
(R 000's)

	MONTH				YEAR TO DATE			
	ACTUAL	BUDGET	VARIANCE	PREVIOUS MONTH	ACTUAL	BUDGET	VARIANCE	COMP FIG 1994
TURNOVER	7,755	11,770	(4,015)	12,132	120,722	134,825	(14,103)	119,944
MATERIALS ISSUED	3,715	5,591	1,876	6,090	56,671	64,639	7,968	63,282
W.I.P. MOVEMENT	(351)	0	351	(133)	1,914	0	(1,914)	(4,257)
*GROSS CONTRIBUTION	4,391	6,179	(1,788)	6,175	62,137	70,186	(8,049)	60,919
MANUFACTURING COSTS	1,573	2,286	713	2,394	25,073	27,592	2,519	23,417
* GROSS PROFIT	2,818	3,893	(1,075)	3,781	37,064	42,594	(5,530)	37,502
% OF TURNOVER	36%	33%		31%	31%	32%		31%
FIXED COSTS	3,017	3,263	246	3,385	37,565	37,995	430	34,089
OVERHEADS	2,886	2,942	56	3,109	34,809	34,436	(373)	31,236
DEPRECIATION	131	321	190	276	2,756	3,559	803	2,853
* CONTRIBUTION	(199)	630	(829)	396	(501)	4,599	(5,100)	3,413
OTHER INCOME	(15)	108	(123)	78	1,485	1,303	182	1,284
*PROFIT/(LOSS) BEFORE TAX	(214)	738	(952)	474	984	5,902	(4,918)	4,697
TAXATION	79	(286)	365	(175)	(367)	(2,227)	1,860	(1,843)
* PROFIT/(LOSS) BEFORE DIVIDEND	(135)	452	(587)	299	617	3,675	(3,058)	3,054
DIVIDEND	(34)	113	147	75	154	920	766	
RETAINED PROFIT/(LOSS)	(101)	339	(440)	224	463	2,755	(2,292)	3,054

164
282

Fixed
prime