

**A SYSTEMS APPROACH TO
ENTERPRISE ORGANIZATION
WITH AN APPLICATION TO TELKOM**

by

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Submitted to the School of Engineering Management in partial fulfillment of the
requirements for the degree of

M.Sc (Engineering Management)

at the

UNIVERSITY OF CAPE TOWN

14 September 1998

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DECLARATION

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and has not previously in its entirety or in part been submitted at any university for a degree.

SIGNED : _____

DATE : _____

ACKNOWLEDGMENTS

I would like to thank the following people :

Johan Strümpfer for accepting the role of being my dissertation supervisor; for facilitating my journey deeper into the world of systems thinking and enterprise organization; and for providing me with the opportunity to be exposed to significant new ideas and approaches to the organizing of complex systems.

Tom Ryan for introducing me to systems thinking and constantly reminding me of the importance of rigorous thinking during my first year on the Operations Management Development Programme.

Pat and Clive Acton, my parents, for their continual support and motivation.

Trevor Christians, my boss, for his support in my endeavor to complete the dissertation in the context of heavy demands being placed on the Project Management division to deliver regional network roll out targets.

Deon Fredericks for initially giving me the opportunity and motivation to perform part time studies.

All my friends for their support and understanding.

SYNOPSIS

INTRODUCTION

The argument of this dissertation is that some of the dilemmas faced by enterprises today are a consequence of the 'authoritarian mode'¹ in which enterprises are organized. The 'authoritarian mode' of organization has the assumptions of the mechanistic world view (paradigm) as its basis. These assumptions are however not relevant in fast changing and complex environments such as that which enterprises must deal with today.

It is argued that an alternative paradigm is required to resolve the dilemmas faced by enterprises organized in the 'authoritarian mode'. The dissertation presents an 'empowerment and alignment'² mode of organization which has the social systems paradigm as its basis. The social systems paradigm has a significantly different set of assumptions about the nature of reality compared to the mechanistic paradigm. It is proposed that this more appropriate set of assumptions will resolve the current dilemmas which mechanistically organized enterprises are experiencing.

A real world organization (namely Telkom Network Build) is used to practically demonstrate the above mentioned ideas. It is argued that Telkom Network Build is operating in the 'authoritarian mode' and that this is the underlying cause of a number of dilemmas of organization. A proposed conceptual design for the organization of Telkom Network Build division in the 'alignment and empowerment' mode is presented. The proposed design has the assumptions of the social systems view of reality as its basis.

SUMMARY OF THE PRINCIPLE ARGUMENTS OF THIS DISSERTATION

The writer articulates the dissertation under the following chapters :

CHAPTER 1 : INTRODUCTION

Strümpfer³ refers to the issue of 'organization' as being one which is concerned with the question of how an enterprise develops the capacity to act as one co-ordinated entity (i.e. one which does not exhibit the unco-ordinated behaviour of multiple individuals/divisions).

Strümpfer⁴ describes the 'mode' in which an enterprise is organized using the concepts of 'control' and 'autonomy'. These concepts are usually viewed as opposites on the same dimension. However, if they are rather viewed as opposite dimensions, a framework with four quadrants is created. Each quadrant represents a different 'mode of organization'. This dissertation is interested in the:

¹ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997.

² Ibid.

³ Ibid.

⁴ Ibid.

1. Low autonomy / high control quadrant : represents an authoritarian mode of organization;
2. High autonomy / high control quadrant : represents an alignment and empowerment mode of organization.

The above mentioned modes of organization have different world views (paradigms) with respect to the nature of reality as their bases. The dissertation will present a theoretical description of the paradigms (world views) and associated 'systemic structures of organization' which underlie the 'authoritarian' and the 'alignment and empowerment' modes of organization. Furthermore, the dissertation will describe how this theory can be used in practice to ensure that enterprises are able to survive in the fast changing and complex environment. The dissertation adopts a 'systems approach' to achieve this.

CHAPTER 2 : THE SYSTEMS APPROACH

The systems approach is a way of tackling complex problematic situations which takes multiple views of a situation. Each view provides a different system conception of the external reality. The rationale for taking multiple views is that a single viewpoint will not have the capacity to comprehend all the variety and emergent issues exhibited by a complex situation.

Multiple views are achieved through adopting different system conceptions of the same situation. Each conception highlights a different aspect of the situation. Three dominant viewpoints (paradigms) are described by Ackoff⁵. Each viewpoint has an associated set of underlying assumptions :

1. The mechanistic view

The world is conceived as a machine. The view implies that there is no interaction with the environment.

2. The organismic view

The world is conceived as a living organism. The view uses biological imagery and implies that the environment cannot be ignored.

3. The social systems view

The world is conceived as a human activity system. The view consciously acknowledges man as part of the situation which neither of the above mentioned viewpoints acknowledge.

Strümpfer⁶ proposes that these viewpoints should not be perceived as mutually exclusive but should rather be seen as complementary to one another. When the

⁵ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

⁶ J. Strümpfer, Personal Communication, University of Cape Town, School of Engineering Management, 1997

enterprise and its organization is conceived as a system from the above mentioned dominant viewpoints, two significantly different models of organization emerge. Each model provides different systemic structures of organization which have their basis in the underlying assumptions of the particular world view.

Hard systems engineering is concerned with the 'means' of achieving predetermined 'ends' around which there can be little debate. It is usually concerned with the design of simple systems which can be defined accurately (e.g. motor cars, bridges). The systems approach is however concerned with the design of 'soft' human activity systems which are of a higher order of complexity than simple systems. In complex systems the 'ends' are not always clearly defined (e.g. how should an education system be conceived). Ulrich⁷ views the systems approach as "*an instrument of practical reason*" which facilitates debate and helps system designers to determine what 'ought' to be done - it is concerned with the nature of the 'ends' rather than the 'means'. For this reason the systems approach is an appropriate approach when tackling the problem of how an enterprise (which is a complex human activity systems) should be organized.

CHAPTER 3 : THE AUTHORITARIAN MODE OF ORGANIZATION

Strümpfer⁸ argues that the authoritarian mode (the high control / low autonomy situation) is a consequence of a mechanistic conception of the enterprise which has the assumptions of the machine world view as its basis. Ackoff⁹ describes the assumption of the machine world view :

1. Reality is completely understandable;
2. Understanding can be achieved through analysis (i.e. breaking a system down into component parts and understanding the whole from aggregating an understanding of the parts);
3. Relationships between parts can be reduced to one simple relationship which is that of linear cause and effect.

Using these assumptions as a basis for a Machine model of organization results in a set of enterprise design principles which provide high levels of control and low levels of autonomy. If these principles are implemented in an enterprise design to provide structures of organization, the emergent behaviour would be authoritarian in nature.

The Machine model principles revolve around issues of span of control, division of work, scalar chain of command, centralization of authority, discipline, subordination of individual interests to general interest and authority and responsibility.

⁷ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983),p.23

⁸ J. Strümpfer, Personal Communication , University of Cape Town, School of Engineering Management, 1997

⁹ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegasus Communications, 1997,p.1

CHAPTER 4 : CHALLENGING THE MECHANISTIC VIEW AS BASIS FOR ORGANIZING

Although the Machine model is simple to implement in an enterprise design, it creates a number of 'dilemmas of organization'. Firstly the model does not take cognisance of the social nature of reality. It does not take cognisance of the need which people have to be creative and exercise choice.

Secondly, the model provides high levels of (organizational) stability and does not take cognisance of the changing external environment.

Thirdly, the assumption that the external reality is completely understandable is not valid. The environment in which enterprises operate today is highly complex and managers cannot be expected to understand or deal with the environment nor the 'system' which they are supposed to control. This has led to managers experiencing control dilemmas where they are conscious of the fact that they are unable to control complex situations.

Fourthly, the assumption that the primary purpose of the enterprise is growth and generation of profits is no longer acceptable. Issues of sustainable development need to be considered.

Lastly, the assumption that system knowledge can be generated by dividing it into components parts and that an understanding of the parts will provide knowledge of the whole is not valid.

A model of enterprise organization is therefore needed which is based on a more relevant set of underlying assumptions. Ackoff¹⁰ suggests a more relevant set of assumptions which he refers to as the assumptions of the social systems view :

1. Reality is not completely understandable;
1. System behaviour is a consequence of interactions between the parts. When a system is taken apart it loses its essential properties. Knowledge can therefore only be obtained by understanding the interactions between the parts;
1. Relationships between parts cannot be reduced to one simple relationship of cause and effect. Causal relationships should be viewed as circular.

¹⁰ Ibid.,p.6

CHAPTER 5 : THE ALIGNMENT AND EMPOWERMENT MODE OF ORGANIZATION

An approach to resolving the previously mentioned dilemmas of organization is to organize the enterprise using a model which has the assumptions of the social systems view as its basis. Strümpfer¹¹ proposes that there are three models of organization which are consistent with the social systems view. Each of the models adopts a different viewpoint on the issue of organization. He suggests that a synthesis of these models would be useful in providing a set of principles for organizing in the alignment and empowerment mode. These models are :

1. The 'Viable Systems' model - proposed by Beer¹².
The model is an 'organismic' model which is concerned with the adaptation and survival mechanisms required to ensure that the enterprise behaves as a whole while at the same time ensures viability (survival) in the long term.
2. 'Internal Market' model - proposed by Halal, Geranmayeh and Pourdehnad¹³.
The model proposes that the enterprise should be conceptualized as a market economy, with market interactions co-ordinating the activity of the enterprise parts.
3. 'Multidimensional Organization' model - proposed by Ackoff¹⁴.
The model proposes that labour should not be divided in one dimension (machine model) but rather should be divided into three dimensions.

[Detailed descriptions of the models are presented in the appendices at the end of the dissertation]

A synthesis of the three models provides a 'holistic' set of principles of organization. These principles of organization have the assumptions of the social systems world view as their basis. Implementation of the set of principles will provide the underlying structures of organization which will allow the enterprise to operate in the alignment and empowerment mode.

The synthesis of the models (referred to as the 'Viable Multidimensional Market' model (VMM) specifies multidimensional division of labour and provides a recursive type structure. Recursive structuring provides a mechanisms to filter the environmental variety (complexity) from the various levels of enterprise management. Each recursive unit is an autonomous profit centre, with interactions between the units being based on market principles.

¹¹ J. Strümpfer, 'Dissertation Review Workshop', University of Cape Town, School of Engineering Management, 17 June 1997.

¹² R. Espejo and R. Harnden, eds. *The VSM : Interpretations and Applications of Stafford Beer's VSM* (Wiley, 1989)

¹³ W. Halal, A. Geranmayeh and J. Pourdehnad , eds. *Internal Markets : Bringing the Power of Free Enterprise Inside Your Organization*, (New York: Wiley and Sons)

¹⁴ R. Ackoff, *The Democratic Corporation*, (New York :Wiley and Sons, 1994)

Two regulatory elements are also specified in the VMM which provide governance structures. The first is a meta-management structure which resembles the management function specified in the Machine model. However, the implementation of the management function is significantly different in the VMM. The VMM rather uses feedback and self-organization mechanisms to provide control. The self-organizing element is implemented by ensuring that interactions between enterprise units are based on market mechanisms. This implementation of 'control' ensure that people working within the enterprise are not viewed as machine parts and gives them the ability to exercise choice and creativity, while at the same time ensuring that the enterprise operates as a whole.

Organizing using the VMM as a basis provides an enterprise which has behavioural characteristics of an enterprise which is empowered, responsive, adaptive to change, aligned with respect to purpose, stable and has high levels of organizational understanding amongst staff.

It is argued that the dilemmas experienced by enterprises operating in the authoritarian mode are resolved by implementing the VMM. The reason for this is it acknowledge that :

1. People require the ability to exercise choice;
2. Management cannot deal with the environmental complexity fully;
3. Environmental changes cannot be ignored and it is necessary to adapt to these changes;
4. Sustainable development is more important than growth to ensure long term survival;
5. Knowledge can only be achieved by understanding the interactions between the parts rather than the parts themselves.

CHAPTER 6 : A SOFT SYSTEMS ENTERPRISE DESIGN METHODOLOGY

The VMM model of organization provides a conceptual perspective of organization but does not provide any guidelines or recipes for implementation. In a complex 'real world' social situation, an element of process is required. A 'soft system' design methodology is presented. A soft system design methodology is significantly different to a 'hard systems engineering' methodology in that it is concerned with achieving consensus regarding the nature of the 'ends'.

An important transformation which the soft systems design methodology attempts to achieve is that of a 'paradigm change' amongst participants. Typically the paradigm in which enterprise decision makers operate is a mechanistic one. The purpose of the process is therefore to transform the existing paradigm to a new one based on the social systems view. Strümpfer¹⁵ believes that one approach to achieving this paradigm transformation (shift) is to create a 'felt need for change'. He proposes that this can be achieved by following a scenario planning methodology. A successful scenario planning exercise will bring about a realization

¹⁵ J. Strümpfer, 'Designing the Design Process Workshop', University of Cape Town, School of Engineering Management, 17-18 April 1997

amongst decision makers that if the enterprise status quo remains, the enterprise will not be in a position to survive in possible future contexts. The social systems paradigm and the associated VMM model of organization should then be presented as a means of ensuring survival. In addition to this, systems based methodologies should be used to develop a shared understanding of the situation. This insight into possible future scenarios, coupled to a shared understanding of the current situation should be adequate to create a paradigm shift in decision makers.

Subsequent to the paradigm shift, a participative design exercise would follow. The design process would begin with defining the enterprise vision and mission. Thereafter a participative design exercise would follow. The design exercise would be structured around a set of enterprise design questions which have the VMM model of organization as the basis.

CHAPTER 7 : A DESIGN METHODOLOGY FOR AN 'INDIVIDUAL EFFORT' CONCEPTUAL ENTERPRISE DESIGN

As a consequence of the complexity and level of participation required to implement the above mentioned 'soft system' design methodology, an 'individual effort' design methodology is used for the purposes of the dissertation.

The scope of this 'individual effort' design application is limited to :

1. Surfacing dilemmas of Telkom Network Build's existing mode of organization (i.e. no scenario planning methodology);
2. Creating a conceptual design for the organization of Network Build.

The purpose of the conceptual design is to reflect the writers understanding of the theory. It is clearly acknowledged that a design created as an individual effort is totally inadequate for real world implementation.

CHAPTER 8 : A CRITICAL REFLECTION OF TELKOM NETWORK BUILD'S ORGANIZATION

The writer established that the mode in which Telkom Network Build division is operating appears to be that of the authoritarian mode. The reason for arriving at this conclusion is that a number of Machine model principles of organization have been implemented to ensure that the division behaves as a whole.

As a consequence of this a number of dilemmas and concerns were also surfaced :

1. No mechanisms are in place which allow the division to adapt to a changing environment. The consequence of this is that there are no mechanisms to interface with customers and stakeholders. Furthermore the basis for dividing labour (which is based on network architecture) is no longer aligned to the new network architecture and trends in the telecommunications environment;
2. The network build parts are not aligned with the purpose of the Network Build division as a whole. The reason for this is that parts were chosen through a

process of analysis. The property of the whole is not however a function of the property of the parts, but rather a function of their interactions;

3. No mechanisms are in place to filter the environmental variety;
4. Management credibility is very low. It is the opinion of the writer that this is a consequence of treating a social system (i.e. a people populated system) as a machine;
5. Other emergent themes include fragmentation of functions and a shortage of resources in general.

CHAPTER 9 : A CONCEPTUAL DESIGN FOR THE ORGANIZATION OF NETWORK BUILD

A conceptual design for the organization of Telkom Network Build is presented. It is the writer's opinion that the design will provide the underlying structures of organization which are necessary for Telkom Network Build to adapt to the fast changing environment and survive in the long term.

The design conceptualizes Telkom Network Build as an operating system. The transformation performed by the system is the conversion of a customer request into a deliverable which satisfies the initial request. The system consists of two parts, namely a planning system and an installation system. The rationale for dividing into these systems is that the nature of the work is similar and it will be useful in limiting the environmental variety to which the management are exposed.

Both the planning and installation system are organized in accordance with the principles of the VMM model of organization. The outcome of the design is a basic conceptual design for the organization of Telkom Network Build. The proposed design differs significantly from the existing mechanistic design.

CHAPTER 10 : A CRITICAL REFLECTION ON THE DISSERTATION

Critical Systems Heuristics is a systems based methodology proposed by Ulrich¹⁶. The purpose of the methodology is to reflect upon proposed social designs and the "*underlying value assumptions that inevitably flow into planning.*"¹⁷

The dissertation is interrogated using Ulrich's 12 critical heuristic questions at three levels. The first level is the general dissertation approach. The second level is the enterprise design process and the third level is the proposed conceptual design.

¹⁶ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.205

¹⁷ W. Ulrich cited by R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.198

CHAPTER 11 : BIBLIOGRAPHY

A comprehensive list of books and articles consulted for the purposes of completing this dissertation are presented.

CHAPTER 12 : APPENDIX A - THE INTERNAL MARKET MODEL OF ORGANIZATION

A comprehensive summary of the Internal Market model is presented.

CHAPTER 13 : APPENDIX B - THE MULTIDIMENSIONAL MODEL OF ORGANIZATION

A comprehensive summary of the Multidimensional model of organization is presented.

CHAPTER 14 : APPENDIX C - THE VIABLE SYSTEMS MODEL OF ORGANIZATION

A comprehensive summary of the Viable Systems model is presented.

CHAPTER 15 : APPENDIX D - DESCRIPTION OF THE TELKOM NETWORK BUILD DIVISION

A brief description of Telkom and the organization of Telkom Network Build is presented.

TABLE OF CONTENTS

	PAGE
1. 1. INTRODUCTION	1
1.1 ENTERPRISE ORGANIZATION	2
1.2 OBJECTIVES OF THE DISSERTATION.....	3
1.3 SCOPE OF DISSERTATION	4
1.3.1 <i>THEORETICAL COMPONENT SCOPE</i>	4
1.3.2 <i>APPLICATION COMPONENT SCOPE</i>	4
1.4 ORGANIZATION OF THE DISSERTATION.....	5
2. THE SYSTEMS APPROACH	6
2.1 THE EPISTEMOLOGICAL POSITION OF THE SYSTEMS APPROACH.....	6
2.2 SYSTEMS THINKING	8
2.3 CONCEIVING REALITY AS A PURPOSEFUL SYSTEM.....	9
2.4 THE NATURE OF COMPLEX SYSTEMS	11
2.4.1 <i>HIERARCHY AND EMERGENCE</i>	12
2.4.2 <i>COMMUNICATION AND CONTROL</i>	12
2.4.3 <i>CYBERNETIC PRINCIPLES</i>	13
2.4.4 <i>SYSTEMIC BEHAVIOUR PATTERNS</i>	15
2.5 MULTIPLE VIEWS OF A COMPLEX REALITY.....	16
2.5.1 <i>MECHANISTIC WORLD VIEW</i>	19
2.5.2 <i>ORGANISMIC WORLD VIEW</i>	19
2.5.3 <i>SOCIAL SYSTEMS WORLD VIEW</i>	19
2.5.4 <i>COMPLEMENTARISM OF THE WORLD VIEWS</i>	19
2.5.5 <i>CONCEIVING THE ENTERPRISE AS A COMPLEX SYSTEM</i>	21
2.6 SYSTEM KNOWLEDGE.....	22
2.7 THE SYSTEMS APPROACH : AN INSTRUMENT OF PRACTICAL REASON	23
2.8 CONCLUSION	25
3. THE AUTHORITARIAN MODE OF ORGANIZATION	26
3.1 THE MECHANISTIC VIEW OF REALITY	26
3.1.1 <i>REALITY IS COMPLETELY UNDERSTANDABLE</i>	27
3.1.2 <i>ANALYSIS AS INQUIRY (REDUCTIONISM)</i>	27
3.1.3 <i>LINEAR CAUSALITY</i>	28
3.2 THE MACHINE MODEL OF ORGANIZATION	28
3.2.1 <i>ENTERPRISE DESIGN PRINCIPLES OF THE MACHINE MODEL</i>	29
3.2.2 <i>CHARACTERISTICS OF THE MACHINE MODEL</i>	31
3.2.3 <i>ADVANTAGES OF THE MACHINE MODEL</i>	32
3.2.4 <i>DESCRIPTION OF THE MACHINE MODEL</i>	32
3.3 REFLECTION : THE AUTHORITARIAN MODE OF ORGANIZATION.....	33
4. CHALLENGING THE MECHANISTIC VIEW AS A BASIS FOR ORGANIZING	35
4.1 DILEMMAS OF THE AUTHORITARIAN MODE OF ORGANIZATION.....	35
4.1.1 <i>THE NATURE OF SOCIAL REALITY</i>	35

4.1.2	<i>THE NATURE OF THE ENVIRONMENT</i>	37
4.1.3	<i>THE NATURE OF COMPLEX SYSTEMS</i>	37
4.1.4	<i>THE NATURE OF GROWTH</i>	38
4.1.5	<i>THE NATURE OF UNDERSTANDING</i>	39
4.2	AN ALTERNATIVE : THE SOCIAL SYSTEMS VIEW OF REALITY	40
4.3	REFLECTION	42
5.	THE ALIGNMENT AND EMPOWERMENT MODE OF ORGANIZATION	44
5.1	A SOCIAL SYSTEMS VIEW OF ORGANIZATION	44
5.2	MOTIVATION FOR SELECTING BASE MODELS OF ORGANIZATION	47
5.2.1	<i>INTERNAL MARKET MODEL</i>	47
5.2.2	<i>VIABLE SYSTEMS MODEL</i>	47
5.2.3	<i>MULTIDIMENSIONAL MODEL</i>	48
5.3	A 'VIABLE MULTIDIMENSIONAL MARKET' MODEL OF ORGANIZATION ..	48
5.3.1	<i>THE VMM : Structural perspective</i>	51
5.3.2	<i>THE VMM : Process perspective</i>	53
5.3.3	<i>THE VMM : Function perspective</i>	53
5.3.4	<i>REGULATION PERSPECTIVE</i>	54
5.4	BEHAVIOURAL CHARACTERISTICS OF THE SOCIAL SYSTEMS MODEL ..	60
5.5	REFLECTION : RESOLUTION OF THE MACHINE MODEL DILEMMAS	61
5.5.1	<i>THE NATURE OF SOCIAL REALITY</i>	61
5.5.2	<i>THE NATURE OF CONTROL</i>	62
5.5.3	<i>THE NATURE OF THE ENVIRONMENT</i>	62
5.5.4	<i>THE NATURE OF DEVELOPMENT</i>	62
5.5.5	<i>THE NATURE OF UNDERSTANDING</i>	63
5.6	CONCLUSION	63
6.	A SOFT SYSTEMS ENTERPRISE DESIGN METHODOLOGY	66
6.1	'SOFT' VERSUS 'HARD' SYSTEM DESIGN METHODOLOGY	66
6.2	METHODOLOGICAL PRINCIPLES FOR A SOFT SYSTEM DESIGN PROCESS	68
6.2.1	<i>MULTIPLE DESCRIPTIONS OF A PROBLEMATIC SITUATION</i>	68
6.2.2	<i>HUMAN BELIEF SYSTEMS</i>	69
6.2.3	<i>LEARNING AND CHANGE</i>	69
6.2.4	<i>COMPLETE REDESIGN OF THE WHOLE</i>	71
6.2.5	<i>CHANGING THE STATE OF A COMPLEX SYSTEM</i>	71
6.3	DESCRIPTION OF THE SOFT SYSTEM ENTERPRISE DESIGN PROCESS	73
6.3.1	<i>ESTABLISH NEED FOR CHANGE IN DECISION MAKERS</i>	73
6.3.2	<i>PRESENT SOCIAL SYSTEM THEORY AND ASSOCIATED MODELS</i> ...	75
6.3.3	<i>DEVELOP SHARED UNDERSTANDING OF SITUATION</i>	75
6.3.4	<i>DEFINE IDEALIZED ENTERPRISE VISION AND MISSION</i>	76
6.3.5	<i>CREATE IDEALIZED ENTERPRISE DESIGN</i>	76
6.3.6	<i>DEVELOP TRANSITION PLAN</i>	78
6.3.7	<i>IMPLEMENT DESIGN</i>	78
6.4	CONCLUSION	79
7.	A DESIGN METHODOLOGY FOR AN 'INDIVIDUAL EFFORT' CONCEPTUAL	
	ENTERPRISE DESIGN	80
7.1	ACTUAL DESIGN METHODOLOGY USED.....	80
7.1.1	<i>DESCRIPTION OF CURRENT DILEMMAS OF ORGANIZATION</i>	81

7.1.2	<i>CREATION OF THE CONCEPTUAL DESIGN</i>	81
8.	TELKOM NETWORK BUILD AND ITS MODE OF ORGANIZATION	83
8.1	BACKGROUND TO TELKOM	83
8.1.1	<i>RE-ORGANIZATION INITIATIVE</i>	85
8.1.2	<i>NETWORK BUILD INITIATIVE</i>	85
8.2	TELKOM'S NETWORK BUILD DIVISION	86
8.3	NETWORK BUILD : EVIDENCE OF THE AUTHORITARIAN MODE OF ORGANIZATION	86
8.4	NETWORK BUILD : DILEMMAS AND CONCERNS OF ORGANIZATION.....	89
8.4.1	<i>ACKNOWLEDGMENT OF THE ENVIRONMENT</i>	89
8.4.2	<i>ALIGNMENT OF NETWORK BUILD PARTS</i>	94
8.4.3	<i>DEALING WITH ENVIRONMENTAL COMPLEXITY</i>	95
8.4.4	<i>TREATING A SOCIAL SYSTEM AS A MACHINE</i>	96
8.5	OTHER EMERGENT THEMES.....	98
8.5.1	<i>FRAGMENTATION OF FUNCTIONS</i>	98
8.5.2	<i>SHORTAGE OF RESOURCES</i>	99
8.6	A REFLECTION ON THE DILEMMAS OF NETWORK BUILD	99
9.	A CONCEPTUAL DESIGN FOR THE ORGANIZATION OF NETWORK BUILD ...	101
9.1	INTERNAL MARKET MODE OF ORGANIZATION	101
9.2	BOUNDARY ASSUMPTIONS FOR THE SYSTEM IN FOCUS	102
9.2.1	<i>ENTERPRISE UNITS INCLUDED IN DESIGN</i>	102
9.2.2	<i>INTERNAL SERVICE UNITS FOR NETWORK BUILD</i>	103
9.3	PURPOSE STATEMENT FOR NETWORK BUILD.....	103
9.4	DESCRIPTION OF NETWORK BUILD STAKEHOLDERS	103
9.5	CONCEPTUAL DESIGN : RECURSION LEVEL 1 (NETWORK BUILD)	104
9.5.1	<i>PROCESS DESIGN</i>	104
9.5.2	<i>FUNCTION DESIGN</i>	105
9.5.3	<i>REGULATION DESIGN</i>	106
9.5.4	<i>STRUCTURAL DESIGN</i>	108
9.6	RESOLUTION OF NETWORK BUILD CONCERNS AND DILEMMAS	108
9.6.1	<i>ACKNOWLEDGMENT OF THE ENVIRONMENT</i>	108
9.6.2	<i>ALIGNMENT OF NETWORK BUILD PARTS</i>	109
9.6.3	<i>DEALING WITH ENVIRONMENTAL COMPLEXITY</i>	109
9.6.4	<i>TREATING A SOCIAL SYSTEM AS A MACHINE</i>	109
9.6.5	<i>FRAGMENTATION OF FUNCTIONS</i>	109
9.6.6	<i>SHORTAGE OF RESOURCES</i>	110
9.7	CONCLUSION	110
10.	A CRITICAL REFLECTION UPON THE OUTCOMES OF THE DISSERTATION	111
10.1	CRITICAL SYSTEM HEURISTICS	112
10.1.1	<i>CRITICAL SYSTEM HEURISTICS DEFINED</i>	112
10.1.2	<i>CRITICAL SYSTEMS HEURISTICS PRINCIPLES</i>	113
10.1.3	<i>CRITICAL SYSTEMS HEURISTICS METHODOLOGY</i>	114
10.2	A CRITICAL HEURISTIC REFLECTION OF THE DISSERTATION.....	116
10.2.1	<i>A REFLECTION ON THE GENERAL APPROACH OF THE DISSERTATION</i>	117
10.2.2	<i>A REFLECTION ON THE ENTERPRISE DESIGN METHODOLOGY</i>	119
10.2.3	<i>A REFLECTION ON THE OUTCOMES OF THE PROPOSED DESIGN</i> ...	121

10.3 CONCLUSION	123
11. BIBLIOGRAPHY	125
11.1 PRIMARY SOURCES	125
11.1.1 Books	125
11.1.2 Articles	125
11.2 SECONDARY SOURCES	126
11.2.1 Books	126
11.2.2 Articles	127
12. APPENDIX A - THE INTERNAL MARKET MODEL OF ORGANIZATION	128
12.1 PHILOSOPHY OF THE IMM	128
12.2 PRINCIPLES OF THE IMM	129
12.2.1 MARKET FORCES	129
12.2.2 ENTREPRENEURSHIP	129
12.2.3 MANAGEMENT'S ROLE	129
12.2.4 AVAILABILITY OF INFORMATION	130
12.3 DESCRIPTION OF THE IMM	131
12.3.1 PROFIT CENTRES	131
12.3.2 PERFORMANCE MANAGEMENT	132
12.3.3 CORPORATE EXECUTIVES	132
12.4 CHARACTERISTICS	133
12.5 ASSUMPTIONS OF THE IMM	136
12.6 ADVANTAGES OF THE IMM	136
12.7 LIMITATION OF THE IMM	137
12.8 IMPLICATIONS OF THE IMM	137
13. APPENDIX B - THE MULTIDIMENSIONAL MODEL OF ORGANIZATION	140
13.1 PHILOSOPHY OF THE MDO	140
13.2 PRINCIPLES OF THE MDO	140
13.3 DESCRIPTION OF THE MDO	141
13.3.1 PRODUCT OR SERVICE DEFINED (OUTPUT) UNITS	141
13.3.2 FUNCTIONAL (INPUT) UNITS	142
13.4 CHARACTERISTICS OF THE MDO	142
13.5 ASSUMPTIONS OF THE MDO	142
13.6 ADVANTAGES OF THE MDO	143
13.7 LIMITATIONS OF THE MDO	144
13.8 IMPLICATIONS OF THE MDO	144
14. APPENDIX C - THE VIABLE SYSTEM MODEL OF ORGANIZATION	146
14.1 PHILOSOPHY OF THE VSM	146
14.2 PRINCIPLES OF THE VSM	148
14.2.1 CYBERNETIC LAWS	148
14.2.2 STRUCTURE AND ENTERPRISE PURPOSE	149
14.2.3 ORGANIZATIONAL RECURSION	150
14.2.4 AUTONOMOUS OPERATING UNITS	151
14.2.5 SYSTEMIC CONTROL	152
14.2.6 ADAPTATION	153
14.3 DESCRIPTION OF THE VIABLE SYSTEM MODEL	153

14.3.1	<i>VSM FUNCTIONS FOR VIABILITY</i>	155
14.3.2	<i>SUMMARY OF INFORMATION FLOWS</i>	162
14.4	IDENTIFICATION OF OPERATIONAL UNITS (F1'S)	163
14.5	VIABLE SYSTEM DIAGNOSIS	164
14.6	CHARACTERISTICS OF THE VSM	165
14.7	ASSUMPTIONS OF THE VSM	165
14.8	ADVANTAGES OF THE VSM	165
14.9	LIMITATIONS OF THE VSM.....	167
14.10	IMPLICATIONS OF THE VSM	167
15.	APPENDIX D : DESCRIPTION OF THE TELKOM REGIONAL NETWORK BUILD	
	DIVISION	168
15.1	INTRODUCTION	169
15.1.1	<i>TELKOM SA LTD</i>	169
15.1.2	<i>A GENERIC TELECOMMUNICATIONS NETWORK</i>	170
15.1.3	<i>TELKOM BUSINESS UNITS</i>	173
15.2	DESCRIPTION OF THE TNBU PARTS	174
15.2.1	<i>TECHNOLOGY STRATEGY</i>	175
15.2.2	<i>PLANNING</i>	175
15.2.3	<i>NETWORK ACQUISITION</i>	175
15.2.4	<i>SERVICE DELIVERY</i>	176
15.2.5	<i>REGIONAL OPERATIONS</i>	176
15.3	DESCRIPTION OF THE 'SYSTEM IN FOCUS' - THE REGIONAL NETWORK	
	BUILD DIVISION	176
15.3.1	<i>ACCESS PLANNING</i>	178
15.3.2	<i>CONSTRUCTION SERVICES</i>	178
15.3.3	<i>TRANSMISSION BUILD</i>	179
15.3.4	<i>SWITCHING BUILD</i>	181
15.3.5	<i>PROJECT MANAGEMENT</i>	182

LIST OF FIGURES

FIGURE 1 : MODES OF ORGANIZATION.....	2
FIGURE 2 : ORGANIZATION OF THE DISSERTATION.	5
FIGURE 3 : A SYSTEM.....	8
FIGURE 4 : SYSTEM CLASSES.....	11
FIGURE 5 : FEEDBACK MECHANISM INFLUENCING SYSTEM OUTPUT.....	14
FIGURE 6 : UNDERLYING SYSTEMIC STRUCTURES.	16
FIGURE 7 : LADDER OF INFERENCE.	17
FIGURE 8 : MULTIPLE VIEWS OF A COMPLEX SITUATION.	18
FIGURE 9 : COMPLEMENTARISM OF MECHANISMS, ORGANISMS AND SOCIAL SYSTEMS.....	20
FIGURE 10 : MULTIPLE VIEWS OF THE ENTERPRISE.	21
FIGURE 11: SYSTEM VIEWPOINTS.	22
FIGURE 12 : OBSERVER CAPACITY TO UNDERSTAND REALITY.	27
FIGURE 13 : LINEAR 'CAUSE - EFFECT' THINKING.	28
FIGURE 14: MECHANISTIC CONCEPTION OF ENTERPRISE HIERARCHY AND AUTHORITY.....	31
FIGURE 15 : THE ENTERPRISE AS MECHANICALLY ORGANIZED PARTS.	33
FIGURE 16 : THE CONTROL DILEMMA.	38
FIGURE 17 : OBSERVER CAPACITY TO UNDERSTAND REALITY.	41
FIGURE 18 : CIRCULAR CAUSALITY.	42
FIGURE 19 : COMPLEMENTARISM OF MODELS FROM STRUCTURE PROCESS VIEW POINTS.	46
FIGURE 20: SYSTEM DYNAMICS MODEL : UNDERLYING STRUCTURES OF ORGANIZATION.....	50
FIGURE 22: COMPLEXITY UNFOLDING - LEVELS OF RECURSION.	52
FIGURE 22 : BALANCE BETWEEN EMPOWERMENT AND ALIGNMENT.....	54
FIGURE 24 : REGULATORY SYSTEMS : SELF-ORGANIZING AND FEEDBACK ELEMENTS.	55
FIGURE 24: THE INTERDEPENDENCE OF CONTENT, CONTEXT AND PROCESS.	67
FIGURE 25 : HARD SYSTEM ENGINEERING METHODOLOGY.	67
FIGURE 26 : SINGLE AND DOUBLE LOOP LEARNING.....	70
FIGURE 27 : HANDY'S 'CYCLE' OF LEARNING.	71
FIGURE 28 : REVOLUTIONARY APPROACH - STEP CHANGES TO A SYSTEM STATE.....	72
FIGURE 29 : EVOLUTIONARY APPROACH - GRADUAL CHANGE TO A SYSTEM STATE.....	72
FIGURE 30 : SOFT SYSTEMS ENTERPRISE DESIGN PROCESS.	74
FIGURE 31: NEW LINE ROLL OUT TARGETS	84
FIGURE 32: TELKOM BUSINESS UNITS.....	85
FIGURE 33 : TECHNOLOGY AND NETWORK BUSINESS UNIT - REGIONAL OPERATIONS.	86
FIGURE 34 : DECISION-MAKING AND AUTHORITY : PERCEPTIONS OF MANAGEMENT.	87
FIGURE 35 : THE TELECOMMUNICATIONS EXPLOSION	92
FIGURE 36 : INTEGRATED TECHNOLOGIES REPLACING THE TRADITIONAL NETWORK ARCHITECTURE.	93
FIGURE 37 : COMPLEXITY FACED BY LINE MANAGEMENT.....	96
FIGURE 38 : MANAGEMENT CREDIBILITY AND FAIRNESS OF DECISION MAKING.....	96
FIGURE 39 : TELKOM'S ACCELERATED LINE ROLL OUT	97
FIGURE 40 : TELKOM OPERATING WITHIN AN INTERNAL MARKET CONTEXT.....	102
FIGURE 41 : AN OPERATING SYSTEM AND ITS PROJECT TRANSFORMATION PROCESS.	104
FIGURE 42 : STRUCTURAL VIEWPOINT.....	108
FIGURE 43: DIFFERENT LEVELS OF FOCUS FOR REFLECTION.	116
FIGURE 44 : THE MDO.	141
FIGURE 45 : ENVIRONMENTAL COMPLEXITY FACED BY MANAGEMENT.....	147

FIGURE 46 : COMPLEXITY UNFOLDING.....	151
FIGURE 47: BALANCING THE VARIETY OF THE ENVIRONMENT, MANAGEMENT AND THE OPERATIONAL UNITS.....	155
FIGURE 48 : RECURSION AND THE META-MANAGEMENT SYSTEM.....	156
FIGURE 49 : STRUCTURAL FILTERS : THE INTELLIGENCE AND CONTROL FUNCTIONS.....	157
FIGURE 50 : THE CONTROL FUNCTION.....	159
FIGURE 51 : POLICY MAKING : THE MECHANISM FOR ADAPTATION.	160
FIGURE 52: CO-ORDINATION FUNCTION.....	161
FIGURE 53 : THE VIABLE SYSTEM MODEL.....	162
FIGURE 54 : TELKOM VALUE CHAIN AND THE TELKOM BUSINESS UNITS.....	170
FIGURE 55 : TELECOMMUNICATIONS NETWORK HIERARCHY.....	171
FIGURE 56 : THE DIVIDING LINE IN THE NETWORK BETWEEN CFBU'S AND TNBU.....	172
FIGURE 57 : TRANSMISSION TRANSPORT NETWORK.....	172
FIGURE 58 : FUNCTIONAL DIVISIONS OF THE TNBU.....	174
FIGURE 59 : REGIONAL NETWORK BUILD DIVISION.....	177
FIGURE 60 : ACCESS PLANNING DIVISION.....	178
FIGURE 61 : TRANSMISSION BUILD DIVISION.....	179
FIGURE 62 : SWITCHING BUILD DIVISION.....	181
FIGURE 63 : PROJECT MANAGEMENT DIVISION.....	182
FIGURE 64 :CAPITAL BUDGETING SYSTEM.....	183

LIST OF TABLES

TABLE 1 : UNDERLYING ASSUMPTIONS OF THE TRADITIONAL EPISTEMOLOGICAL POSITIONS.	7
TABLE 2: CHURCHMAN’S NINE APPRECIATIVE CONDITIONS.	10
TABLE 3 : MACHINE MODEL PRINCIPLES OF ORGANIZATION.	30
TABLE 4 : A REFLECTION ON THE MACHINE MODEL USING CHURCHMAN’S APPRECIATIVE CONDITIONS.....	34
TABLE 5 : SUMMARY OF BASE MODELS OF ORGANIZATION	45
TABLE 6 : FUNDAMENTAL ORGANIZATION DESIGN QUESTIONS TO BE ANSWERED.	49
TABLE 7 : VMM PRINCIPLES OF ORGANIZATION - STRUCTURAL VIEWPOINT.	51
TABLE 8 : VMM PRINCIPLES OF ORGANIZATION - PROCESS VIEWPOINT.....	53
TABLE 9 : VMM PRINCIPLES OF ORGANIZATION - FUNCTION VIEWPOINT.	54
TABLE 10 : VMM PRINCIPLES OF ORGANIZATION - REGULATION VIEWPOINT (SELF- ORGANIZATION).	56
TABLE 11 : VMM PRINCIPLES OF ORGANIZATION - REGULATION VIEWPOINT (META- MANAGEMENT)	57
TABLE 12 : BEHAVIOURAL CHARACTERISTICS OF THE VMM.	60
TABLE 13 : MECHANISTIC VERSUS SOCIAL SYSTEMIC CONCEPTIONS OF THE ENTERPRISE.....	64
TABLE 14 : ENTERPRISE DESIGN QUESTIONS.	81
TABLE 15 : EVIDENCE OF MECHANISTIC UNDERLYING STRUCTURES OF ORGANIZATION IN THE NETWORK BUILD DIVISON.	88
TABLE 16 : EXAMPLES OF THE IMPACT OF FRAGMENTED FUNCTIONS.....	98
TABLE 17 : DELIVERABLES OF THE NETWORK BUILD DIVISION.....	103
TABLE 18 : ULRICH’S 12 CSH BOUNDARY QUESTIONS IN THE ‘IS’ MODE.....	115
TABLE 19 : CSH BOUNDARY QUESTIONS INTERROGATING S1	118
TABLE 20 : CSH BOUNDARY QUESTIONS INTERROGATING S2.....	120
TABLE 21: CSH BOUNDARY QUESTIONS INTERROGATING S3.....	122
TABLE 22 : ENTERPRISE CHARACTERISTICS : MACHINE MODEL VERSUS IMM (1).....	133
TABLE 23 : ENTERPRISE CHARACTERISTICS : MACHINE MODEL VERSUS IMM (2).....	134
TABLE 24 : ENTERPRISE CHARACTERISTICS : MACHINE MODEL VERSUS IMM (3).....	135
TABLE 25 : ADVANTAGES OF THE MDO.....	143
TABLE 26 : TNBU INTERNAL AND EXTERNAL CUSTOMERS.....	174

1. 1. INTRODUCTION

*"The purpose of **organization** is ensure the basic self preservation of the individual, group and species" - Strümpfer¹⁸*

*"The difference between the molecules in a mouse and those in a test tube full of chemicals is **organization**. The molecules in a mouse are organized in a precise and complex way, while those in the test tube are just sloshed together" - Kauffman¹⁹*

The environment in which an enterprise must survive today is highly complex and fast changing. To ensure survival, the enterprise must have the ability to adapt with the changing environment. This will ensure that the deliverables of the enterprise remain relevant to the requirements of the stakeholders in the external environment. A relevant example of enterprises not adapting to the external environment are the traditional telephone companies who have ignored the development of the Internet. However, the Internet is considered to be major threat to traditional facsimile, voice and data services which generate most of the revenues of the traditional telephone companies.

The argument of this dissertation is that enterprises need to review the manner in which they are organized. Traditionally, enterprises have been organized to ensure high levels of stability and low levels of change which results in a state of stagnation²⁰. Strümpfer²¹ argues that an alternative paradigm is required where stability and change are not perceived as opposites. A new paradigm will enable enterprises to continuously adapt to the external environment, but at the same time retain stability (i.e. continuously remain organized). The paradigm in which we think about and conceive the enterprise and its organization has major implications for the design of an enterprises structures of organization.

The question is - how is it possible for *"multiple control elements, human or mechanical, each one possessing only limited powers of perception, computation and action, to achieve the enormous task of regulation needed to achieve complex purposes, or even any kind of identifiable continuity - that is to say stability - in turbulent, noisy and sometimes aggressively competitive environment. The general answer is by making them subject to appropriately organized systems of constraints ... to organize is therefore arrange for complex regulation. If the organization is to be viable then this system of constraints must continue to provide effective regulation even though its environment may change."*²²

¹⁸ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997

¹⁹ D. Kauffman, Jr., *An introduction to Systems Thinking*, (Innovative learning series), p.1

²⁰ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997

²¹ Ibid.

²² R. Espejo and R. Harnden, eds. *The VSM : Interpretations and Applications of Stafford Beer's VSM* (Wiley, 1989), p.43

The theory of organization attempts to determine what is appropriate for this.

1.1 ENTERPRISE ORGANIZATION

Strümpfer²³ believes that the issue of organization is how an enterprise develops the capacity to act as one co-ordinated entity which does not exhibit the unco-ordinated behaviour of multiple individuals / divisions. Strümpfer²⁴ describes the 'mode' in which enterprises are organized in terms of 'control' and 'autonomy', which are often perceived as opposites (i.e. where there is no control of divisions and individuals it is assumed that high levels of autonomy exist).

Strümpfer²⁵ presents the idea that autonomy (ability of the individuals/divisions to act on their own initiative) and control (ability of the whole to act as one) should not be seen as two opposites of the same dimension (which is how it is normally perceived), but rather as two different dimensions. This is illustrated in Figure 1. Viewing autonomy and control as opposite dimensions provides a framework which describes four 'modes of organization'. Each mode of organization has associated emergent behavioural patterns which are a consequence of the 'underlying systemic structures of organization'. (The concept of underlying systemic structures of organization is described in detail in section 2.4.4).

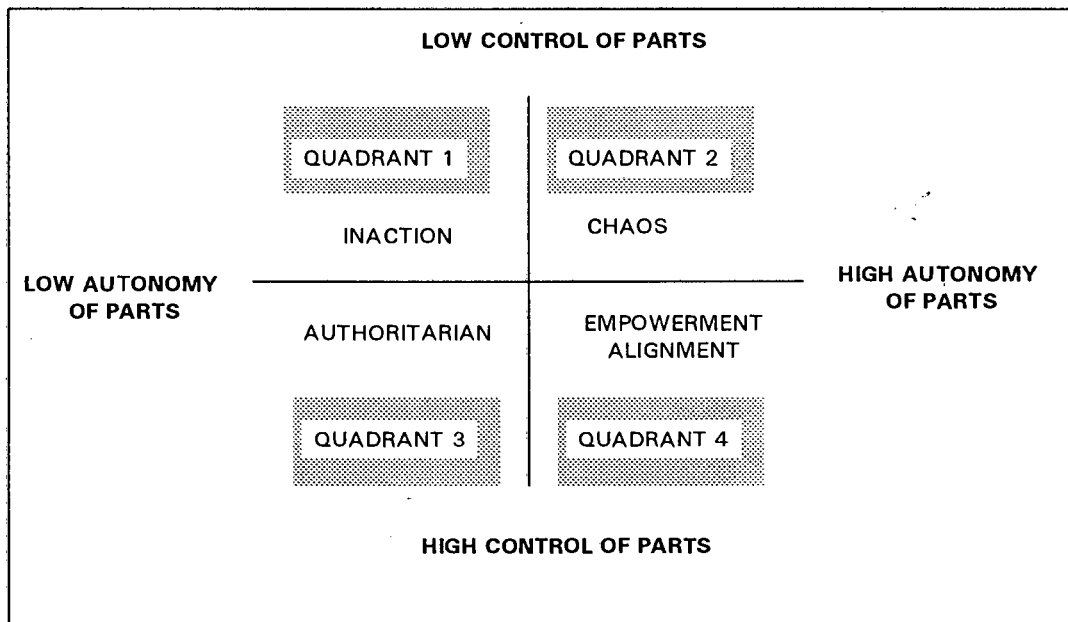


Figure 1 : Modes of organization²⁶.

²³ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997

²⁴ Ibid.

²⁵ Ibid.

²⁶ Ibid.

Strümpfer²⁷ argues that the modes of organization described by quadrants 1 and 2 are never considered desirable by managers and owners of enterprises - " *When one moves to the high autonomy, low control state (top right quadrant), there is much action by the parts but little co-ordinated behaviour between them. Managers intuitively and rightly fear this situation with passion. (The low control, low autonomy situation does occur , e.g. in some government departments, but most commercial organizations would go out of business if they were in that quadrant for any period of time).*"

According to Strümpfer²⁸ quadrant 3 (low autonomy, high control) is the traditional hierarchical control structure which provides characteristics of authoritarianism, stability and discipline. Strümpfer²⁹ argues that these structures " *give the capability to act as a whole in the sense that the sum total of the range of individual actions is coherent , that is has meaning within a larger picture.*"

Strümpfer³⁰ argues that the alignment and empowerment mode is were the enterprise can act as one entity by providing high levels of autonomy and high levels of control simultaneously. This mode of organization is based on an entirely different paradigm (world view) to the authoritarian mode. This alternative paradigm enables control to be implemented through alignment of the parts rather than an authoritarian command system. This significant difference in the implementation of control have important implications with respect to the management style within an enterprise³¹. These implications will be described in the main body of this dissertation.

1.2 OBJECTIVES OF THE DISSERTATION

This dissertation has two main objectives. The first objective is to present a theoretical description of the paradigms (world views) and associated systemic structures of organization which underlie the 'authoritarian' and the 'alignment and empowerment' modes of organization. The descriptions will present the assumptions of each paradigm with respect to the nature of reality. Specific models of organization which are born from these different paradigms are also presented. These models can be used as a rational basis for organizing an enterprise in either the authoritarian or empowerment and alignment mode.

The second objective of the dissertation is to describe how the above mentioned theory can be applied in practice to reflect upon and implement improvements in a real world enterprise. The context for the description is the Telkom Network Build division³². Telkom is the South African telecommunications operator and has been granted exclusive rights to provide public telephony and data service in South Africa. These exclusive rights to provide these services will terminate in

²⁷ Ibid.

²⁸ Ibid.

²⁹ Ibid.

³⁰ Ibid.

³¹ Ibid.

³² An introduction to Telkom and the Network Build division is presented in chapter 14.

approximately three years when Telkom will be expected to compete with other Telecommunications operators - *"Telkom's ability to hold onto its monopoly will be determined by events beyond its control - the battle between old and new taking place in global telecommunications. Leading an assault against the entrenched telephone companies are startups armed with Internet technologies. Their aim is to unseat entrenched fixed-line telephone monopolies - operators need to drag themselves out of the dark ages of the public switched telephone networks and into the Internet age."*³³

1.3 SCOPE OF DISSERTATION

1.3.1 THEORETICAL COMPONENT SCOPE

The theoretical component of the dissertation is limited to reflection upon four models of organization. In the context of Strümpfer's 'mode of organization' framework, the Machine model is used to describe the authoritarian mode of organization. A synthesis of the Viable Systems model (proposed by Beer), the Internal Market model (proposed by Halal, Geranmayeh and Pourdehnad) and the Multidimensional Model (proposed by Ackoff) are used to describe the alignment and empowerment mode. The rationale for selecting these specific models is presented in detail in section 5.2.

The theory is limited to mechanistic, organismic and social systems metaphorical viewpoints (paradigms) which Ackoff³⁴ suggests are the most general of the theories of reality which people hold.

1.3.2 APPLICATION COMPONENT SCOPE

The purpose of the application component is to demonstrate the writer's understanding of the theory and how it can be used in practice. The application component focuses on the evaluation of the organization of the Telkom Network Build division. The rationale for using the Network Build division in the application is that the writer has a concern that the enterprise unit is not organized adequately to assist Telkom in surviving in the highly competitive, global, complex and fast changing telecommunications environment.

The diagnosis of the existing organization of Network Build and the conceptual design presented are not intended for real world application - the application component is significantly limited when viewed from a 'systems approach' perspective (This is elaborated upon in chapter 7).

³³ 'Beating a Retreat', *Financial Mail*, 29 May 1998

³⁴ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', *Pegasus Communications*, 1997, p.1

1.4 ORGANIZATION OF THE DISSERTATION

The dissertation can be viewed at the macro-level level as consisting of two component parts, namely theory and application (refer to Figure 2).

The theory component presents a synthesis of the theory underlying the modes of organization framework. The application component demonstrates how the concepts and ideas developed in the theory component can be utilized to develop a conceptual design for the organization of the Telkom Network Build division.

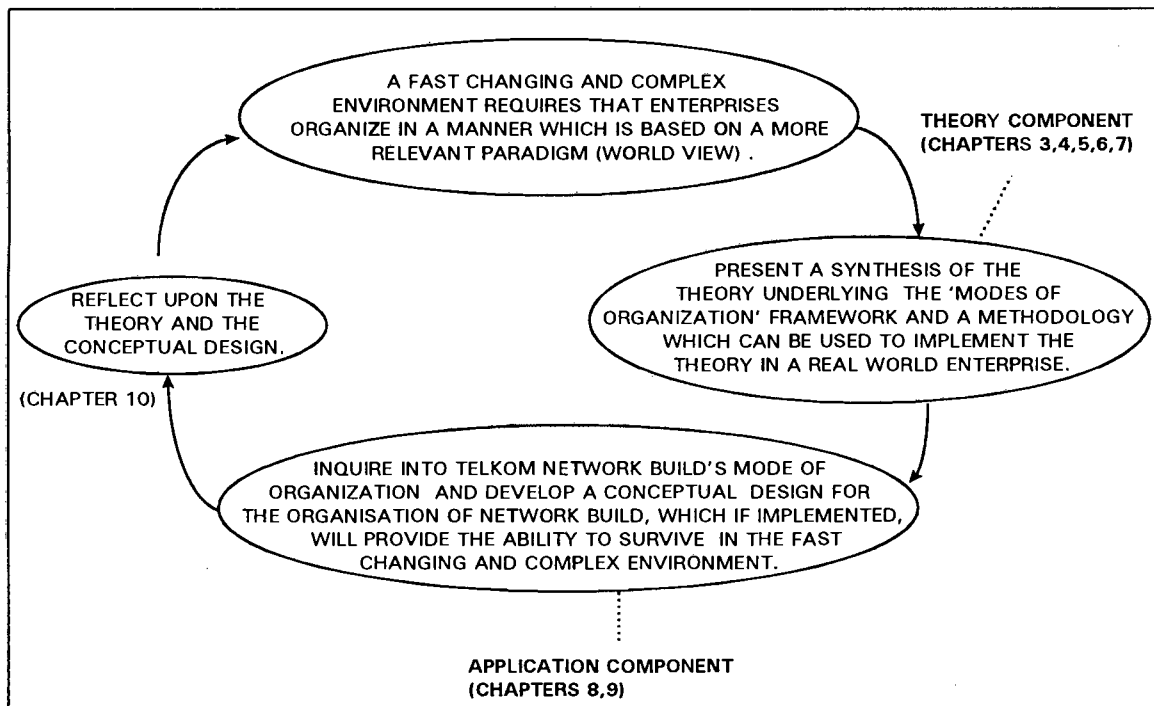


Figure 2 : Organization of the dissertation.

The approach adopted in tackling the dissertation is the 'systems approach'. The systems approach is an approach which is useful in thinking about and taking action in complex problematic situations. For this reason, it is viewed as an appropriate means of approaching the issue of enterprise organization. A synthesis of the systems approach is presented in the next chapter.

2. THE SYSTEMS APPROACH

"Approach : way about tackling a problem."- Checkland³⁵

"The systems approach (1) : An interdisciplinary and comprehensive approach to the analysis and unfolding of complex problem situations."- Ulrich³⁶

"The systems approach (2) : An approach which tries to take all aspects into account, which focuses on the interactions between the different parts of the problem." - Checkland³⁷

"It has been recognized throughout history that the human mind is capable of two kinds of knowledge .. which have often been termed the rational and the intuitive. Rational knowledge is derived from the experience we have with objects and events in our everyday environments. It belongs to the realm of the intellect whose function it is to discriminate, divide, compare, measure and categorize ... Rational knowledge is a system of abstract concepts and symbols which become an intellectual map of reality. However the natural world has infinite variety and complexity which results in the intellectual maps being necessarily limited."-Capra³⁸

This chapter provides a synthesis of the 'systems approach'. The purpose of the chapter is to provide an explanation of the major systems concepts which are used throughout the dissertation. The chapter describes the nature of complex systems and how the external reality (of which the enterprise is a part) can be conceived as a complex system. Ackoff's³⁹ 'mechanistic', 'organismic' and 'social systemic' metaphorical conceptions (world views / paradigms) of the external reality are presented. It is argued that each metaphorical conception highlights different aspects of the external reality. The metaphorical conceptions are complementary to one another in assisting the observer to make sense of the situation. The idea of the fallibility of system conceptions of the external reality is also discussed.

2.1 THE EPISTEMOLOGICAL POSITION OF THE SYSTEMS APPROACH

"Epistemology: Theory of the method or grounds of knowledge."-The Concise Oxford dictionary⁴⁰

Two opposing philosophical positions with respect to the grounds of knowledge have been debated amongst philosophers.⁴¹ The two positions are the positivist and

³⁵ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.316

³⁶ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983),p.24

³⁷ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.316

³⁸ F. Capra, *The Tao of Physics*, (Glasgow: Flamingo Publishers, 1991),p.34

³⁹ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

⁴⁰ J. Sykes, ed. *The Concise Oxford Dictionary*, (Oxford: University Press, 1989)

the opposing social constructionist (phenomenology). The two positions have different assumptions regarding the nature of reality as their bases (see Table 1).

*"The key idea of positivism is that the social world exists externally and that its properties should be measured through objective methods, rather than being inferred subjectively through sensation, reflection or intuition."*⁴² The view subscribes to the idea that there *"can be no real knowledge but that what is based on observed fact."*⁴³ The scientific method, which is described as *"the most powerful way of thinking that mankind has yet evolved"*⁴⁴, is strongly associated with the positivist position. The scientific method provides a rigorous methodology for thinking which disentangles itself from emotion and ambition.⁴⁵

The social constructionist position *"stems from the view that the world and reality are not objective and exterior, but that they are socially constructed and given meaning by people."*⁴⁶ The social constructionist position is opposed to the positivism position in that its fundamental assumption is that it is not possible to disentangle oneself from emotion and ambition.

Table 1 : Underlying assumptions of the traditional epistemological positions.

Epistemological position.	Assumptions regarding the nature of reality.
Positivism	Reality is external and objective. Knowledge is only of significance if it is based on observations of this external reality.
Phenomenology	Reality is socially constructed . Similar experiences are given different constructions and meanings by different people.

The systems approach is a pragmatic view which combines elements of both positivism and social constructionism. The systems approach attempts to follow the rigour of the scientific method, but at the same time, takes cognisance of the idea that it is not possible to ignore the human element in a complex social context.

The systems approach conceptualizes the external reality in terms of systems (i.e. a positivist base), but at the same time acknowledges that different observers will

⁴¹ M. Smith, R. Thorpe and A Lowe, *Management Research : An introduction*, (London:Sage, 1993),p.22

⁴² Ibid.p.22

⁴³ Ibid.p.22

⁴⁴ C. Peirce cited in 'On Fixing Belief',Course Material, School of Engineering Management, UCT, 1995,p.30 (exact reference unknown)

⁴⁵ C. Peirce cited in 'On Fixing Belief',Course Material, School of Engineering Management, UCT, 1995,p.30 (exact reference unknown)

⁴⁶ M. Smith, R. Thorpe and A Lowe, *Management Research : An introduction*, (London:Sage, 1993),p.24

create different system conceptions of the same external reality (social constructionist base).

2.2 SYSTEMS THINKING

A system is a recognizable whole which consists of a set of inter-dependent parts. It is an assembly of components connected together in an organized way (see Figure 3). The components are effected by being in the system and the behaviour of the system is changed if they leave it⁴⁷. Systems boundaries mark the difference between the whole entity and the environment in which the system exists.⁴⁸

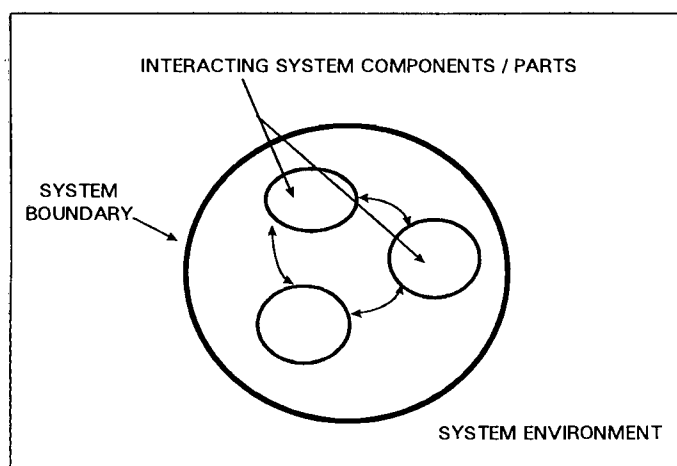


Figure 3 : A system.

According to Checkland⁴⁹, a 'systems thinker' assumes that there is a reality outside ourselves which does actually exist and that as individuals we are able to observe this reality outside ourselves. Checkland⁵⁰ also argues that if the observer is a 'system thinker', the observer will "*seek an account of the structure of reality and the processes going on within it in terms of whole entities ('systems') which he will define.*" These system definitions of the external reality form the individuals mental models. Senge⁵¹ describes mental models as peoples internal pictures of how the world works.

Checkland⁵² describes 'systems thinking' as a "*particular set of ideas which try to understand the world's complexities.*" It is an approach to thinking about and developing an understanding of complex, problematic situations by developing

⁴⁷ W. Topp, 'Practical Description of Human Populated Systems', Course Material, University of Cape Town, School of Engineering Management, 1995

⁴⁸ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.312

⁴⁹ Ibid.,p.100

⁵⁰ Ibid.,p.100

⁵¹ P. Senge, *The Fifth Discipline*, (New York: Doubleday Publishers,1990) p.174

⁵² P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.3

mental pictures of the situation which define the messy situation in terms of a 'system conception'.

The concept of a system 'boundary' has significant implications for a particular system conception / definition. The system boundary makes explicit which parts and interactions of the external reality are included in a system definition and which parts and relationships are ignored. As a consequence of the complexity of the external reality, a system definition will always have a boundary which ignores much of the richness of the real external situation. In this context, Ulrich⁵³ argues that the systems concept should "*remind us precisely of the unavoidable incomprehensiveness and selectivity of every definition of a system.*"

Systems thinking acknowledges that a problematic situation is typically highly complex and a single system conception of the situation will be fallible (i.e. the system conception will not accurately reflect the complexities and realities of a real situation). This fallibility of the system conceptions is accommodated by making multiple systems definitions of the same situation. For each definition it is then necessary to understand the assumptions about the situation which lead to the specific system conception with its associated boundary definition. Furthermore, for each system definition, the limitations and advantages of the definition should be understood.

2.3 CONCEIVING REALITY AS A PURPOSEFUL SYSTEM

The doctrine of teleology implies that the structures and behaviour of a system are determined by the purpose which the system fulfills⁵⁴. Churchman⁵⁵ has provided a set of appreciative conditions which can be used by systems thinkers to conceive the external reality in terms of 'purposeful systems'. These appreciative conditions which must be fulfilled before 'something' can be conceived as purposeful system (S) (see Table 2 on page 10).

Checkland⁵⁶ complements Churchman's appreciative conditions by providing a framework of systems classes which classifies purposeful systems (see Figure 4). The system classes can also be viewed as forming a hierarchy of complexity with natural systems being the least complex and transcendental systems being the most complex. The five classes of purposeful systems which can be conceived by an observer are natural systems, designed physical systems, designed abstract systems, human activity systems and transcendental systems. Natural systems and human activity systems fall within a sub class called social systems. According to

⁵³ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983)p.21

⁵⁴ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.75

⁵⁵ OMDP Course Material, University of Cape Town, 1995

⁵⁶ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.75

Checkland⁵⁷ a social system can be thought of as groupings of people who are aware of and acknowledge their membership of a group.

Table 2: Churchman's nine appreciative conditions.

1.	The system must be teleological (purposeful).
2.	The system must have measures of performance.
3.	There must be a 'client' whose interests(values) are served by the system in such a manner that the higher the measure of performance, the better the interests are served, and more generally the client is the standard measure of performance.
4.	The system must have teleological components (parts) which co-produce the measures of performance of the system.
5.	The system must have an environment (defined either teleologically or ateleologically), which also co-produce the measure of performance of the system.
6.	A decision maker must exist who via his resources can produce changes in the measures of performance of the system.
7.	A designer must exist, who conceptualizes the nature of the system in such a manner that the designers concepts potentially produce actions in the decision maker, and hence changes in the measures of performance of the systems components, and hence changes in the measures of performance of the system.
8.	The designers intention is to change the system so as to maximise the systems value to the client.
9.	The system should be "stable" with respect to the designer in the sense that there is a built in guarantee that the designer's intention is ultimately realisable.

The systems approach is primarily concerned with human activity systems. The rationale for the systems approach being mainly concerned with human activity systems is a consequence of the nature of human activity systems where humans have choice in how purpose is achieved.

Checkland⁵⁸ describes the five system classes (in order of increasing system complexity) as follows :

1. Natural systems

Natural systems are orderly systems which appear to behave according to natural laws. The concern of science has been to gain understanding of these laws which provide a 'natural pattern' to the behaviour of the universe (e.g. molecules, weather systems etc.).

⁵⁷ Ibid.,p.119

⁵⁸ Ibid.,p.112

2. Designed physical systems

Systems which are designed by man to serve a purpose (e.g. railway systems which serves a purpose of transport).

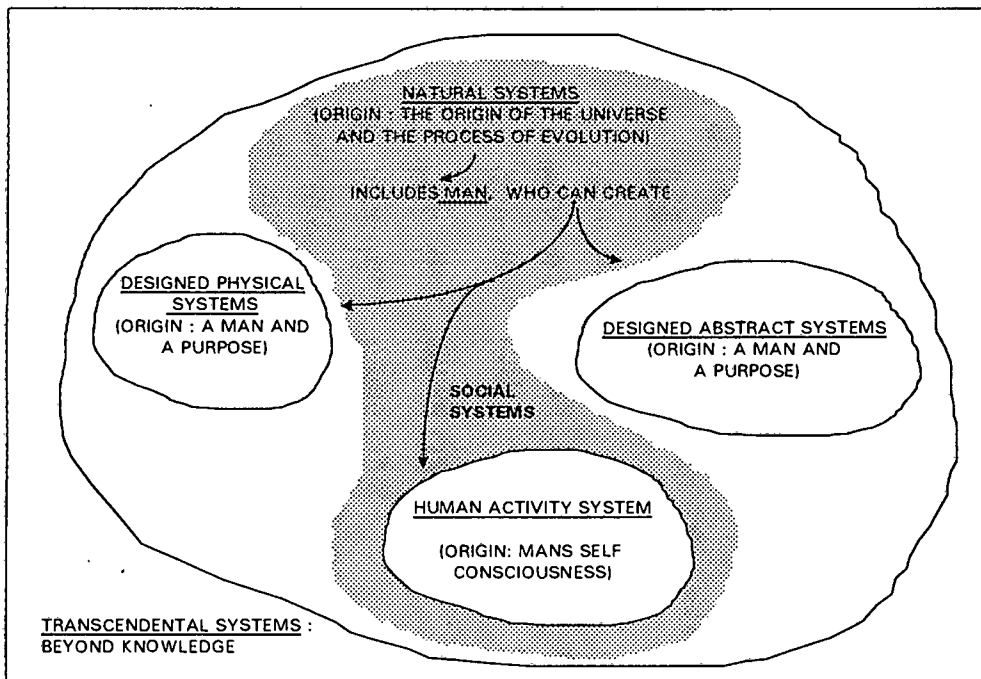


Figure 4 : System classes.⁵⁹

3. Designed abstract systems

Systems which are 'structured sets of thoughts' designed by man to serve a purpose (e.g. political system).

4. Human activity systems

Systems where sets of human activities are related to one another and can be viewed as a whole. The existence of such a set of human activities is to serve some purpose (e.g. enterprises).

5. Transcendental systems

Systems which are beyond understanding (e.g. religious systems).

2.4 THE NATURE OF COMPLEX SYSTEMS

A complex system is defined by Clemson⁶⁰ as one where "there is more relevant detail than the observer can possibly cope with". It is useful to understand the nature of complex systems as this can assist in describing the patterns and behaviour exhibited by these systems. The systems theory principles of 'communication and control', 'hierarchy and emergence' and cybernetics are an effective framework for describing complex systems.

⁵⁹ Ibid.,p.112

⁶⁰ B. Clemson, *Cybernetics: A New Management Tool*, (Kent: Abacus Press, 1984),p.19

2.4.1 HIERARCHY AND EMERGENCE

The concept of hierarchy and emergence provide a conceptual framework for attempting to understand the behaviour of complex purposeful systems.

Checkland⁶¹ argues that a general model for understanding complex organized systems is that there exists a hierarchy of levels of organization with each level being more complex than the level below. Each level in this hierarchy is characterized by emergent properties which do not exist at the lower level. As a result of the emergent properties not existing at a lower level, emergent properties are meaningless in the language of the lower level - *"emergent properties associated with a set of elements at one level in a hierarchy are associated with what we may look upon as constraints upon the degree of freedom of the elements. The emergent properties resulting from the application of the constraints will entail a descriptive language at a meta-level to that describing the elements themselves ... This imposition of constraints upon activity at one level which harnesses the laws at that level to yield activity meaningful at a higher level, is an example of regulatory or control action. Hierarchies are characterized by processes of control operating at the interface between the levels."*⁶²

2.4.2 COMMUNICATION AND CONTROL

For the hierarchy to be maintained, Checkland⁶³ states that there must be a set of processes in which there is communication of information for the purposes of regulation and control. Checkland⁶⁴ continues to say that in the case of an open system (i.e. a system in which there is a flow of matter energy and information between the system and its environment), the processes of communication and control allow the system to regulate itself so that it may survive the knocks administered by the environment.

According to Checkland⁶⁵, the systems theory which provides insights into how control mechanisms can be implemented in man made systems (including human activity systems) is provided by the part of systems theory called 'cybernetics'.

⁶¹ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994), p.78

⁶² *Ibid.*, p.81

⁶³ *Ibid.*, p.83

⁶⁴ *Ibid.*, p.83

⁶⁵ *Ibid.*, p.84

2.4.3 CYBERNETIC PRINCIPLES

Wiener⁶⁶ defines cybernetic as *"the science of effective communication and control in man and the machine"*. Clemson⁶⁷ argues that cybernetics is concerned with the general patterns, laws and principles of behaviour that characterizes complex systems. Furthermore, Clemson⁶⁸ claims that the cybernetic laws and principles *"seem to be important when we deal with social systems and institutions."*

Clemson⁶⁹ suggests that the concept of 'circular causality' is perhaps the key notion in cybernetics, and that it has gradually become clear that the relationships between the elements is more important than the nature of the elements themselves in determining overall system behaviour.

2.4.3.1 SELF-ORGANIZATION

Self-organization (1): *"Complex systems organize themselves; The characteristic structural and behavioural patterns in a complex system are primarily the result of the interactions amongst the system parts."*⁷⁰

Self-organization (2): *"The system is the way it is because of the mutual adjustments the parts have made in the process of interacting with each other."*⁷¹

Corollary to (1) and (2) above: *"Complex systems have basins of stability separated by thresholds of instability."*⁷²

Clemson⁷³ suggests that the self-organizing systems law implies that when a systems thinker is observing a complex system, a human regulator is not solely or even mainly responsible for the system state observed. The system state is almost solely a result of the circular causal process of parts interacting with one another - *"the imperative suggested by the laws of self-organization systems is that the reformers and designers of organizations need to understand which catchment basins they are setting the systems into."*⁷⁴

This implies that it is first necessary to understand the catchment basin and then to design the interactions (which are circular - causal interaction) between the parts which ensures that the system rests in the required catchment basin. Clemson⁷⁵ refers to the circular causal processes as 'feedback'.

⁶⁶ N. Wiener, cited by, B. Clemson, *Cybernetics: A New Management Tool*, (Kent: Abacus Press, 1984),p.19.

⁶⁷ B. Clemson, *Cybernetics: A New Management Tool*, (Kent: Abacus Press, 1984),p.19

⁶⁸ *Ibid.*,p.26

⁶⁹ *Ibid.*,p.22

⁷⁰ *Ibid.*,p.26

⁷¹ *Ibid.*,p.26

⁷² *Ibid.*,p.27

⁷³ *Ibid.*,p.27

⁷⁴ *Ibid.*,p.28

⁷⁵ *Ibid.*,p.22

2.4.3.2 FEEDBACK

Feedback: *"The output of a complex system is dominated by the feedback and, within wide limits, the input is irrelevant."*⁷⁶

Corollary: *"All outputs which are important to the system will have associated feedback loops."*⁷⁷

In terms of basins of system stability, each basin can be perceived as a different system output. A mechanistic conception of control implies that the input to a system can be adjusted to achieve a desired output (i.e. the system is in a specific basin of stability).

The principle of feedback is a systemic conception of control (see Figure 5). Feedback implies that a system cannot be brought into a required basin by making adjustments to the input alone. It is the feedback elements (circular causal process within the system) which can be used by system designers to control the interactions between the parts and ensure that the output lies in the required basin of stability. According to Clemson⁷⁸, *"feedback loops are one of the major elements that make self-organizing systems work the way they do."*

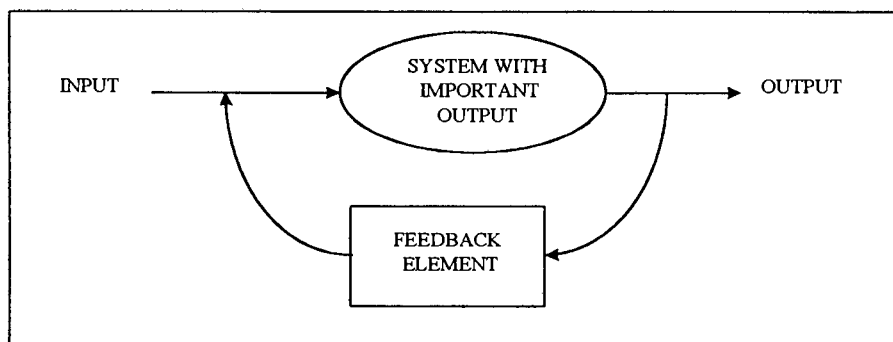


Figure 5 : Feedback mechanism influencing system output.

2.4.3.3 REQUISITE VARIETY

Requisite variety (1): *"Given a system and some regulator of that system, the amount of regulation attainable is absolutely limited by the variety of the regulator."*⁷⁹

Requisite variety (2): *"The relative complexity of the regulator and the system to be regulated is crucially important."*⁸⁰

⁷⁶ Ibid.,p.28

⁷⁷ Ibid.,p.30

⁷⁸ Ibid.,p.31

⁷⁹ Ibid.,p.36

⁸⁰ Ibid.,p.39

The principle of requisite variety refers to the ability of a regulator to control a complex system. The complexity of the system cannot be comprehended by the observer who is (in this context) attempting to control (manage) the external reality in bringing about specific required behaviours.

Clemson⁸¹ summarizes the situation clearly in terms of managers attempting to control a complex organized human activity system - *"In all management situations, the management is always faced with the task of regulating a complex people-plus-thing that is always more complex than the management team. Thus management is always faced with less than total regulation. The question then becomes , given that you cannot regulate everything, how should these limited regulatory capabilities be deployed? This is a crucial question because, if regulatory efforts are inappropriate to the situation, it is entirely possible for the regulatory attempts to be counter productive, i.e. the system will be more out of control than it would have been in the absence of any regulation by the 'bosses'. "*

Clemson⁸² argues that this dilemma can be resolved by a different conception of the traditional management function. This different conception is grounded in the corollary to the principle of requisite variety which states - *"Most of the regulation of very complex systems is achieved through the interactions of the parts (i.e. one part acts to regulate some other part) ... regulation achieved by the ostensible bosses is merely imposed on top of the systems own regulation of itself. In a real sense this is a reinstatement of the law of self-organizing systems, but it should take on new depth now that feedback and requisite variety have been introduced."*⁸³

2.4.4 SYSTEMIC BEHAVIOUR PATTERNS

*"A basic tenet of systems thinking is that the dynamic behaviour exhibited by a system is produced by the 'structure' of the system."*⁸⁴

The emergence of systems thinking challenges the paradigm that behaviour of a whole system can be understood from the properties of its parts. In complex systems *"the properties of the parts are not intrinsic properties, but can only be understood in the context of the larger whole. Thus the relationship between the parts and the whole is reversed ... the properties of the parts can only be understood from the organization of the whole (i.e. how the parts are interconnected into self-organizing systems)."*⁸⁵ (Additions in brackets).

System dynamic modeling is a method which has been developed to attempt to simulate the behaviour of complex systems. This is achieved by identifying the

⁸¹ Ibid.,p.38

⁸² Ibid.,p.39

⁸³ Ibid.,p.39

⁸⁴ Stella Software User Manuals, 'An Introduction to Systems Thinking', High Performance Systems, 1994,p.35

⁸⁵ F. Capra, *The Web of Life*, (London : Flamingo Publisgers, 1997),p.29

flows and feedback interactions between parts, and monitoring what patterns of behaviour this creates for the whole - "System dynamic modeling considers behaviour as being principally caused by structure, it is a theory of the structures of systems and dynamic behaviour."⁸⁶

The behaviour properties and structure of complex systems should therefore be understood in terms of the relationships between the parts (primary concern) and not the properties of the parts (secondary concern). The form of the specific structures should be understood in terms of the specific paradigm in which the structures were conceived (see Figure 6). The next section will describe 'multiple views' of reality and how these views can effect the design of the underlying structures and the associated emergent behaviour patterns.

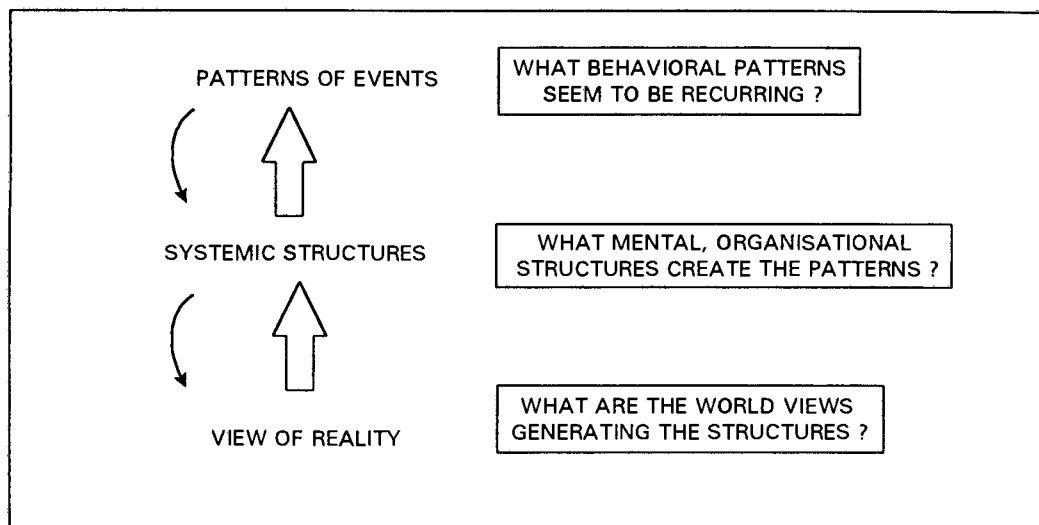


Figure 6 : Underlying systemic structures.⁸⁷

2.5 MULTIPLE VIEWS OF A COMPLEX REALITY

Jackson⁸⁸ states that it has become an acceptable approach to use metaphor to describe complex systems. The rationale for this is that an observer cannot comprehend all relevant detail of a complex situation and using metaphorical viewpoints can highlight certain important aspects of the complex situation. If complementary metaphorical viewpoints are used, the synthesis of the highlighted aspects will provide the observer with a richer understanding of the situation.

Senge⁸⁹, Mitroff and Linstone⁹⁰, Argyris⁹¹ and Ackoff⁹² refer to this as 'multiple mental models', 'multiple realities', 'ladder of inference' and 'world views'

⁸⁶ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.62

⁸⁷ Adapted from : Notes from 'Telkom Indaba', Gordons Bay, 1996

⁸⁸ M. Jackson, Personal Communication, International System Thinking Conference, University of Cape Town, November 1997

⁸⁹ P. Senge, 'The Fifth Discipline', (New York: Doubleday Publishers, 1990)

respectively. It is the opinion of the writer that these authors ideas are consistent with one another and refer to an observer having the ability to make several different system conceptions of the same complex external reality.

Senge⁹³ states that two people with different mental models (system conceptions) of a situation can observe the same event and describe it differently. Senge⁹⁴ argues that this is because each model looks at different details in the situation. The external reality is complex and a single conception of a system will not provide a complete description or understanding of the external reality. This highlights the concept of fallibility described in the introduction to the systems approach.

Mitroff and Linstone⁹⁵ presents the idea that 'multiple realities' occur as a result of the data, facts, or observations one collects about a situation being highly dependent on the model a person has of the situation. Where people hold two different models, the same data, facts are interpreted and have meaning added to them in different ways. Argyris⁹⁶ described the process Mitroff is referring to in terms of a 'ladder of inference'. The 'ladder of inference' describes how people infer meaning from observed data (see Figure 7).

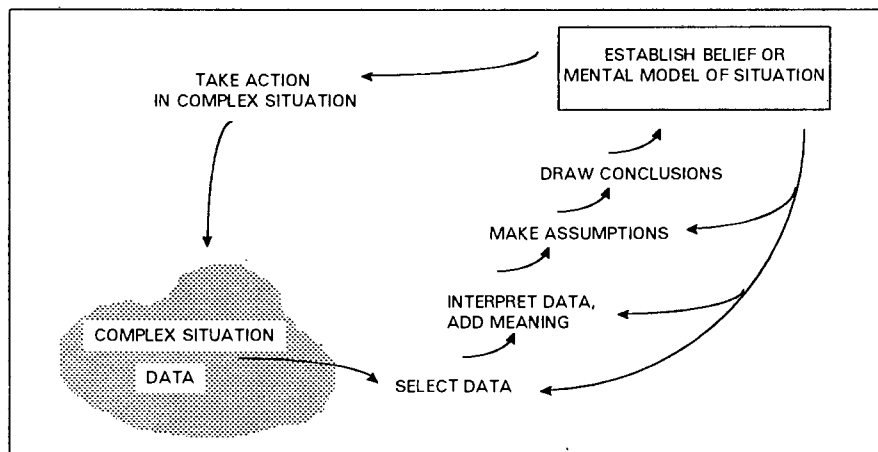


Figure 7 : Ladder of inference.⁹⁷

The existence of different sets of what Ackoff⁹⁸ refers to as 'world views' influence the above mentioned ladder of influence further. A world view can be described as

⁹⁰ I. Mitroff and H. Linstone, *The Unbounded Mind*, (New York : Oxford Press, 1995)

⁹¹ C. Argyris cited by T. Ryan, 'A Note on Learning from Readings', OMDP Course Material, University of Cape Town, 1995

⁹² R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegasus Communications, 1997

⁹³ P. Senge, *The Fifth Discipline*, (New York: Doubleday Publishers, 1990),p.175

⁹⁴ Ibid.,p.175

⁹⁵ I. Mitroff and H. Linstone, *The Unbounded Mind*, (New York : Oxford Press, 1995),p.61

⁹⁶ C. Argyris cited by T. Ryan, 'A Note on Learning from Readings', OMDP Course Material, University of Cape Town, 1995

⁹⁷ C. Argyris cited by T. Ryan, 'A Note on Learning from Readings', OMDP Course Material, University of Cape Town, 1995

a filter through which we view the world. Each world view is based on different assumptions about how the world works. These assumptions are a result of a persons education, culture, life experiences and value systems - "All the explanations of the world rest on certain assumptions that we hold. These assumptions are deductions from theories, and every theory rests on a more general theory. The most general theory that each of us holds is a theory of reality, of the nature of the world - our world view." - Ackoff⁹⁹

Where two different people hold the same world view, the data and facts which are gathered will be similar. However, should two people hold different views of the world, significantly different data and facts will be gathered which will result in significantly different models (beliefs) of the same external reality (see Figure 8).

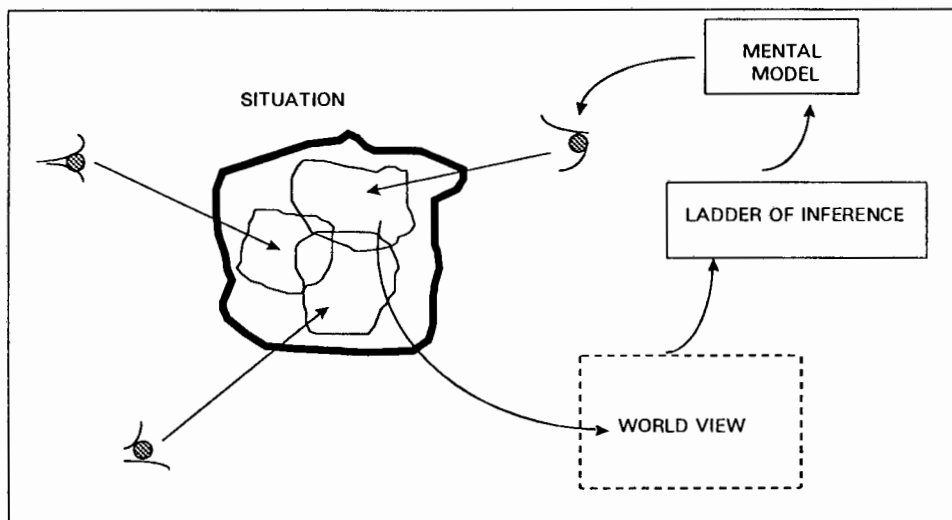


Figure 8 : Multiple views of a complex situation.¹⁰⁰

Ackoff¹⁰¹ describes three dominant world views which exist and each of the world views are based on a different set of assumptions about how the word works. These world views are referred to as the mechanistic, organismic and social systemic world views.

⁹⁸ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegasus Communications, 1997, p. 1

⁹⁹ Ibid., p. 1

¹⁰⁰ OMDP Course Material, University of Cape Town, 1995

¹⁰¹ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

2.5.1 MECHANISTIC WORLD VIEW

An observer viewing a complex situation with a mechanistic world view will conceive the reality in terms of a designed physical system (i.e. a machine). Mental models will use mechanistic imagery in describing the external reality. Mechanistic imagery results in definition of well defined relationships between the system parts.

The mechanistic world view implies that there is no interaction between the entity conceived as a system and its environment (i.e. it is a closed system).

2.5.2 ORGANISMIC WORLD VIEW

An organismic view makes conscious acknowledgment of the interactions between the entity conceived as a system and its environment. The organismic view has its origins in the field of biology. Biological concepts and imagery of survival and growth are associated with the organismic world view .

"Because changes in the environment are considered to be inevitable and relevant, organismically conceptualized social systems seek a dynamic rather than a static equilibrium. They operate homeostatically, adjusting the behaviour of the parts to maintain the properties of the whole within acceptable limits." - Ackoff¹⁰²

2.5.3 SOCIAL SYSTEMS WORLD VIEW

The social systems view contains elements of both the mechanistic and organismic views, however it also consciously acknowledges people as being parts of the system conception. Neither the mechanistic nor the organismic views acknowledge people.

2.5.4 COMPLEMENTARISM OF THE WORLD VIEWS

"A model can only capture one possible perception of a social situation. Objectivity, therefore, can only rest upon open debate among many different perspectives." - Flood and Jackson¹⁰³

Three views of reality have been described, namely the mechanistic, the organismic and the social systems view of reality. The underlying assumptions of the mechanistic and social systems world views are described in more detail in chapters 3 and 5 respectively.

It has also been argued that the world view in which the particular system is conceived will have a significant impact on the system definition of the external reality (e.g. where a social situation is conceived as a machine system). The definition will revolve around mechanical imagery and the mental models developed

¹⁰² Ibid.,p.5

¹⁰³ Ibid.,p.122

will neither take cognisance of the qualities of people within the system nor the dependence of the situation on its environment.

This illustrates the fallibility of a mechanistic system conception of a social situation. Notwithstanding this fallibility, many of the images used will however be useful in understanding certain parts of the social situation.

Strümpfer¹⁰⁴ mentions that it is a common misconception that these ideas contained within each view are mutually exclusive. Strümpfer argues that different world views should rather be seen as complementary to one another, in the sense that one contains the other (see Figure 9).

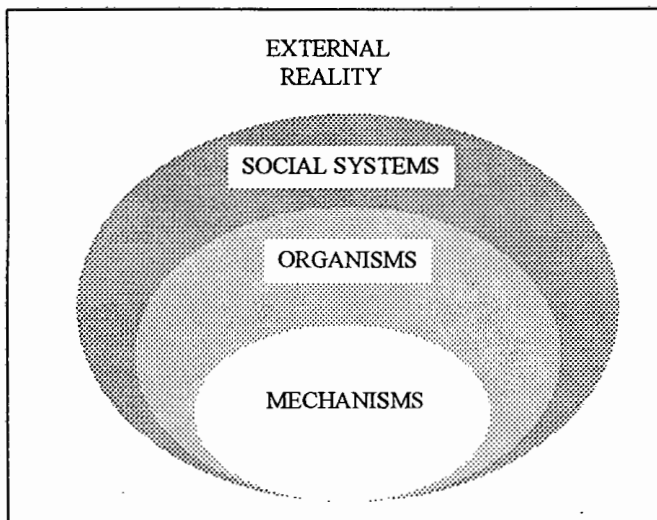


Figure 9 : Complementarity of mechanisms, organisms and social systems.¹⁰⁵

Flood and Jackson¹⁰⁶ describe complementarity as a position which respects alternative views of a situation. The position respects that each view has its own theoretical rationality which is applicable to certain aspects of a situation and not applicable to other aspects. They promote an approach which uses each view as a partnership. Operating as a partnership will ensure that strengths of a specific view are retained. Furthermore a partnership will allow the views weaknesses to be supported by strengths of alternative views. Adopting an approach which takes multiple views of the external reality is a key idea of the systems approach.

¹⁰⁴ J. Strümpfer, Personal communication, University of Cape Town, School of Engineering Management, 1997

¹⁰⁵ Ibid.

¹⁰⁶ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.47

2.5.5 CONCEIVING THE ENTERPRISE AS A COMPLEX SYSTEM

The enterprise represents a part of the complex external reality. It is therefore common to see the use of metaphorical conceptions of the enterprise as an approach to dealing with the various challenges enterprises are presented with. However, adopting different metaphorical views can result in significantly different conceptions of the enterprise as a system. Two world views which result in significantly different conceptions of the enterprise and its organization are the mechanistic and the social systems world views.

The mechanistic world view results in the enterprise being conceived as a 'designed physical system' (machine) and the social system world view results in the enterprise being conceived as a social system. These different views of the enterprise have resulted in different sets of organizational design principles which are used by enterprise designers to implement underlying systemic structures of organization to ensure that the enterprise behaves as a whole entity (see Figure 10).

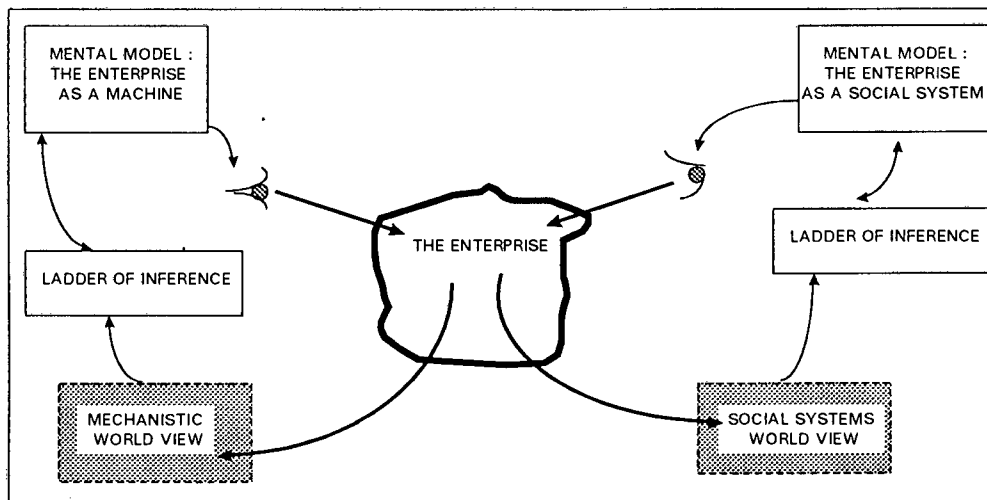


Figure 10 : Multiple views of the enterprise.

Strümpfer¹⁰⁷ states that adopting the mechanistic world view will result in underlying structures of organization being designed using the Machine model of organization as a basis. This model provides a set of principles which can be used to design the underlying systemic structures of organization, which results in an authoritarian mode of organization. The authoritarian mode of organization was introduced in chapter 1 and is explored in chapter 3.

Similarly, the social systems world view can complement the mechanistic world view and provide underlying systemic structures of organization which will enable

¹⁰⁷ J. Strümpfer, Personal communication, University of Cape Town, School of Engineering Management, 1997

the enterprise to operate in the alignment and empowerment mode of organization.¹⁰⁸

2.6 SYSTEM KNOWLEDGE

"Viewing a system from the structure, process, function and regulation perspectives will provide knowledge of the system which can be used as a rational basis for action." - Strümpfer¹⁰⁹

As a consequence of the complexity of the external reality, it is important that a clear framework for thinking about a system conception is held. Strümpfer's¹¹⁰ framework is useful in assisting an observer to develop rigorous system conceptions which will be used as a rational basis for action. The section then proceeds to discuss the nature of changing system states and argues that changing complex system states should be viewed as a learning process.

For an inquirer (observer) to gain both knowledge and an understanding of a system Strümpfer¹¹¹ states that it is necessary to view the system from a structural, functional, process and regulatory viewpoints (see Figure 11).

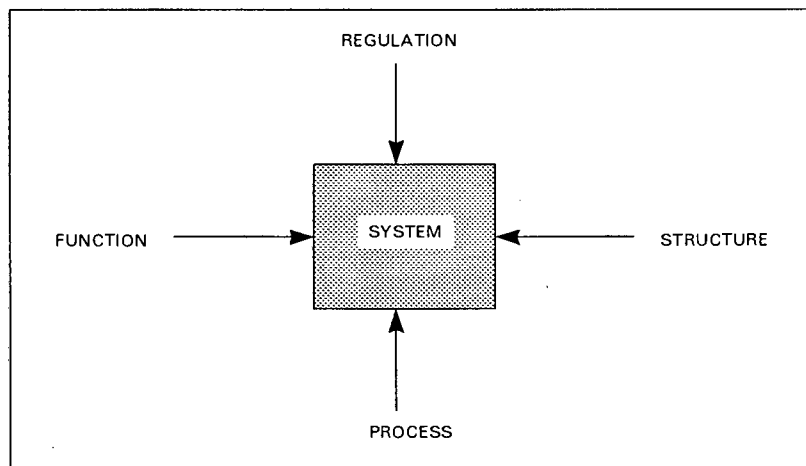


Figure 11: System viewpoints.¹¹²

¹⁰⁸ Ibid.

¹⁰⁹ Ibid.

¹¹⁰ J. Strümpfer, 'Modes of Inquiry', Programme for Systems Management, University of Cape Town, 1992-1994

¹¹¹ Ibid.

¹¹² Ibid.

Structure, function, process and regulation are described by Strümpfer¹¹³ as :

1. Structure

Refers to the relationships that remain relatively unchanged for the period of inquiry (observation). Understanding the structure (analysis) does not however explain the dynamics of the system.

2. Process

Refers to the system relationships. It refers to the altering or changing of relationships over the time period of the inquiry (i.e. the matter, information or energy flows, their transformations which take place within the entity and between the entity and its environment). Process therefore describes the logical linking of inputs to outputs.

3. Function

Refers to the utility or value derived from the entity when placed in a wider context (i.e. the role of the entity in a particular context). Function is a result of relationships / interactions which arise from the stable relationships between the parts.

4. Regulation

Refers to the interactions which take place which keeps the relationships 'standing together' through time. Regulation explains the stability of the system.

2.7 THE SYSTEMS APPROACH : AN INSTRUMENT OF PRACTICAL REASON

"Our mental models determine not only how we make sense of the world, but how we take action." - Senge¹¹⁴

The previous sections of this chapter have described the nature of complex systems and it has been proposed that any system conception of a complex situation will be fallible (particularly in social system contexts). This is a consequence of the systems conceptions not having the ability to acknowledge all the variety of the complex reality. This fallibility of system conception becomes significant when attempting to design new complex systems (particular complex systems such as abstract systems and human activity systems - refer to section 2.3).

Designing abstract or human activity systems requires a 'soft system design methodology' which is significantly different from a 'hard systems engineering methodology'. A 'hard systems engineering methodology' would be used to design physical systems (e.g. buildings, bridges etc.) for which accurate systems designs (conceptions) can be created. The underlying difference in methodology is the mode of reasoning employed. Ulrich¹¹⁵ distinguishes between three modes of reasoning :

¹¹³ Ibid.

¹¹⁴ P. Senge, *The Fifth Discipline*, (New York: Doubleday Publishers, 1990),p.175

¹¹⁵ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983),p.24

1. Theoretical reason

Reason is theoretical when it produces understanding of 'what is' or 'what happens'. The scientific method is an exercise in theoretical reason. Its primary concern is to produce knowledge of the laws of nature by producing testable and repeatable results in a rigorous manner - "*Rigour is a precise formulation of method: something clear and definite, testable and repeatable.*"¹¹⁶ The scientific method is particularly suitable in gaining knowledge in simple systems (natural systems) where clear system boundaries may be defined for purposes of achieving testable and repeatable results.

2. Instrumental reason

Instrumental reason is "*an application of theoretical reason.*"¹¹⁷ It helps us to decide 'how to do things'. Knowledge gained using theoretical reason is used to achieve some predetermined ends. The discipline of 'hard systems engineering' can be viewed as an exercise in instrumental reason. Checkland¹¹⁸ summarizes a systems engineering methodology as the "*total task of conceiving, designing, evaluating, and implementing a system to meet some defined need.*"

3. Practical reason

Ulrich¹¹⁹ describes reason as practical when it helps us determine what 'ought' to be or what 'ought' to be done. Practical reason is primarily concerned with the nature of the ends. This is significantly different to instrumental reason which is primarily concerned with the nature of the means to achieve predefined ends (i.e. ends are typically fixed and focus is on the means). Ulrich¹²⁰ states that "*theoretical reason can give us insights into the causal laws and the evolutionary process of natural systems, but only practical reason can tell us how to use our freedom of choice so as to realize better human (social) systems ... the challenge to practical reason consists of using this freedom reasonably, that is, determining the ends and means of one's actions 'with reason'.*"

Ulrich¹²¹ argues that that the challenge of practical reason is to ensure adequate debate regarding the nature of the ends, and that this debate is not restricted to those who are responsible for the design, but should include "*representatives of those effected but not involved.*" The systems approach is a powerful tool of practical reason. A number of systems methodologies¹²² have been developed

¹¹⁶ 'On Fixing Belief', p.29 (reference unknown)

¹¹⁷ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983), p.25

¹¹⁸ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994), p.130

¹¹⁹ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983), p.23

¹²⁰ Ibid., p.23

¹²¹ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991), p.202

¹²² Interested readers can find a summary of these methodologies in : R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991)

which use the concepts described in this chapter to determine the 'ends' in a rigorous manner.

2.8 CONCLUSION

This purpose of this chapter was to provide a synthesis and broad overview of the systems approach. The chapter has provided an explanation of the major 'systems' concepts referred to in this dissertation.

Details of a 'soft systems enterprise design methodology' which can be used to create designs for the organization of complex human activity systems (specifically enterprises) is described in chapter 6. The 'soft system design methodology' is an exercise in practical reason and has the systems approach as a basis.

The next chapter presents a theoretical description of the authoritarian mode of organization and its associated underlying systemic structures of organization.

3. THE AUTHORITARIAN MODE OF ORGANIZATION

"The prevalence of the hierarchic, more or less autocratic, power driven, traditional organizational structures requires explanation." - Strümpfer¹²³

The previous chapter described how an observer can use different metaphorical viewpoints to conceive the external reality. The purpose of this chapter is to provide the reader with insights into the mechanistic conception of the enterprise and the associated Machine model of organization. Use of the Machine model by enterprise designers provides the underlying structures of organization for operation in the authoritarian mode¹²⁴. Strümpfer¹²⁵ says that the using the Machine model is popular as a basis for an organizational design *"because it provides a mode of organizing which provides one way of ensuring that the whole acts as one coordinated entity."*

The chapter provides a description of the underlying assumptions of the mechanistic world view and illustrates how these assumptions are embedded in a set of Machine model enterprise design principles.

3.1 THE MECHANISTIC VIEW OF REALITY

[Source : Ackoff¹²⁶]

An age is defined as a period of time in which a single shared view of the nature of reality (world view / paradigm) exists amongst a culture. During the medieval age, it was assumed that the purpose of life was to serve god and prepare the soul for realities found in the next world. During this period it was not unusual for people to move further than a few kilometers from their birth place throughout their lives. However, during the Crusades people started traveling and experiencing different cultures. This meeting of cultures resulted in questioning the assumptions of the nature of reality during the medieval period.

As people emerged from the medieval age into the modern age a new set of assumptions as to how the world works began emerging. Throughout this period of questioning (termed the renaissance or rebirth) an entirely new view of the world was developed based on three fundamental assumptions of the nature of reality. This new world view was the mechanistic view of reality. The mechanistic view of reality conceives the world as a machine. Similarly the enterprise can also be conceived as a machine with its structure, process, function and regulation described in terms of mechanical imagery.

¹²³ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997

¹²⁴ Ibid.

¹²⁵ Ibid.

¹²⁶ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegasus Communications, 1997, p.1

Ackoff¹²⁷ describes three assumptions upon which the mechanistic view is based. The writer's interpretation of the corollary of the assumptions in the context of enterprise organization are also presented.

3.1.1 REALITY IS COMPLETELY UNDERSTANDABLE

The human mind is fully capable of grasping the nature of reality and therefore reality can be modeled precisely (i.e. reality can be completely understood - see Figure 12).

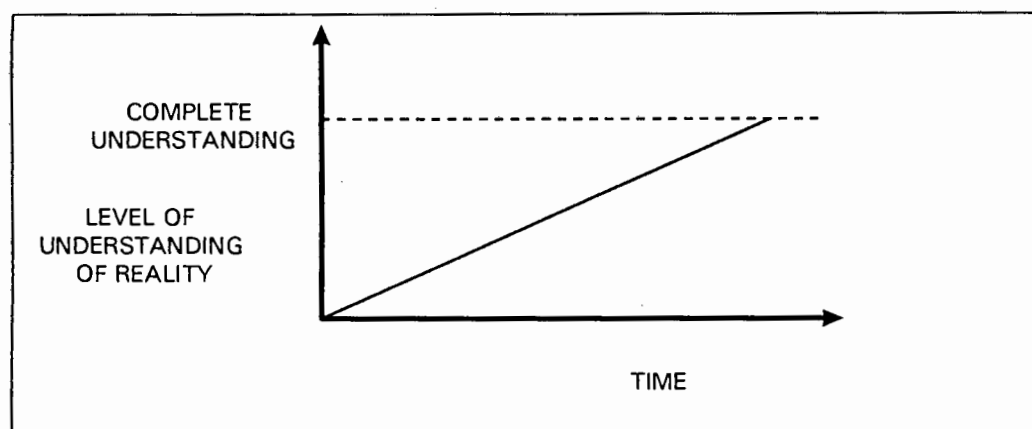


Figure 12 : Observer capacity to understand reality.¹²⁸

Corollary :

The enterprise can be completely understood and its organization can be accurately modeled to predict its behaviour.

3.1.2 ANALYSIS AS INQUIRY (REDUCTIONISM)

To understand the universe fully it is necessary to first take it apart to its smallest element. Understanding of a system can therefore be developed by breaking the system down into parts. The process of inquiry to develop an understanding of a system is to break the whole (system) down into component parts, understand the purpose of each part and then finally aggregate an understanding of the parts into an understanding of the whole.

Corollary :

The best approach to understand the purpose and organization of the enterprise as a whole is to break it down into its component divisions (enterprise units / parts). The purpose and organization of each division should then be understood. Finally, the understanding of the divisions should be aggregated to form an understanding

¹²⁷ Ibid.,p.1

¹²⁸ T. Ryan, School of Engineering Management, University of Cape Town, 1995

of the purpose and organization of the whole. This implies that the enterprise can be perceived as the sum of its divisions.

3.1.3 LINEAR CAUSALITY

Understanding can be achieved by dividing a system into its smallest part. Therefore relationships between parts can be reduced to one simple relationship of cause and effect. As a consequence of this, the environment can be ignored when observing the interaction between the parts of a system.

Cause and effect relationships can therefore only be conceived as linear process where A effects B and B effect C (see Figure 13).

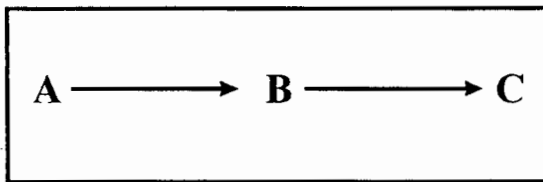


Figure 13 : Linear 'cause - effect' thinking.

Corollary :

Interactions between enterprise divisions can be reduced to single cause-effect relationships between the enterprise divisions.

3.2 THE MACHINE MODEL OF ORGANIZATION

"The use of machines has radically transformed the nature of productive activity and has left its mark on the imagination, thoughts and feelings of humans throughout the ages. Scientists have produced mechanistic interpretations of the natural world, and philosophers and psychologists have articulated mechanistic theories of human mind and behaviour. Increasingly we have learnt to use the machine as a metaphor for ourselves and our society, and to mold our world in accordance with mechanical principles. This is nowhere more evident than in the modern organization." - Morgan¹²⁹

The introduction to this chapter mentioned that the Machine model is a consequence of the mechanistic conception of the enterprise and that the Machine model of organization provides a basis for organizing an enterprise in the 'authoritarian mode'.

In terms of the mechanistic view of the enterprise, enterprises are machines whose goal it is to seek maximum profit. According to Rice and Bishoprick¹³⁰, the means of maximising profit is the choice of an individual, typically the owner of the

¹²⁹ G. Morgan, *Images of Organization*, (London: Sage Publishers, 1986),p.20

¹³⁰ G. Rice and D. Bishoprick, *Conceptual Models of Organization*, (Prentice Hall, 1971),p.34

enterprise. An enterprise exists in a clearly defined and static environment. People working in the enterprise are parts of the machine and are viewed as variables which should be optimised to increase levels of productivity which is assumed to increase profits. According to Morgan¹³¹, it is believed that these goals can best be achieved by designing an enterprise as a machine to reach these goals in a routine (disciplined), efficient, reliable and predictable (stable) way.

The Machine model of organization is complemented with the economic theory of the enterprise and the economic theory of man.

Rice and Bishoprick¹³² summarize the economic theory of the firm by stating that the enterprises main purpose is changing inputs into outputs (i.e. production). They argue that the enterprises incentive to do so is profits, and through rational (machine like) behaviour will attempt to maximize profits. Underlying this economic theory of the enterprise is the basic assumption that the entrepreneur (owner) can do what he wants to with the firm. That is, someone in the firm has the right, ability, power and capability, to direct the activity of the enterprise in the way that someone feels it should go (i.e. one person has the ability to understand the enterprise completely - reflecting the mechanistic assumption of complete understanding of reality).

The concept of economic man is described by Rice and Bishoprick¹³³ as a generalization which treats man in the aggregate rather than individually. It is generalized that in the market place people will consume that which will be of the most utility to him/her (man the consumer) and on the job people will seek to maximize their financial return (man the producer).

3.2.1 ENTERPRISE DESIGN PRINCIPLES OF THE MACHINE MODEL

As a result of the enterprise being conceived as a machine, several principles were developed which would enable enterprise designers to organize the enterprise such that it would behave as a coherent whole in attempting to achieve the enterprise goals (i.e. maximizing profit). Each one of the design principles has a mechanistic assumption as its rational basis (See Table 3).

[Note : The source of the listed items in the table is Morgan¹³⁴. The reference to the mechanistic assumptions and the division into Strümpfer's 'modes of inquiry' framework is the work of the writer].

¹³¹ G. Morgan, *Images of Organization*, (London: Sage Publishers, 1986),p.22

¹³² G. Rice and D. Bishoprick, *Conceptual Models of Organization*, (Prentice Hall, 1971),p.33

¹³³ Ibid.,p.34

¹³⁴ G. Morgan, *Images of Organization*, (London: Sage Publishers, 1986),p.26

Table 3 : Machine model principles of organization.

System Viewpoint : Structure	Mechanistic Assumption
<p><u>Span of control</u> The number of people reporting to one superior must not be so large that it creates problems of communication and co-ordination.</p>	Reality is completely understandable.
System Viewpoint : Function	
<p><u>Division of work</u> Management should aim to achieve a degree of specialisation designed to achieve the goal of the organization in an efficient manner.</p>	Reality is completely understandable.
System Viewpoint : Process	
<p><u>Unity of command</u> An employee should receive orders from only one superior.</p>	Cause - effect.
System Viewpoint : Regulation	
<p><u>Scalar chain of command</u> The line of authority from superior to subordinate, which runs from the top to the bottom of the organization. This chain results from the unity of command principle and should be used as a channel for communication and decision making.</p>	Cause - effect.
<p><u>Centralisation (of authority)</u> Should always be present to some degree. This may vary to optimize the use of faculties of personnel.</p>	Economic theory of the firm.
<p><u>Discipline</u> Obedience, application energy, behaviour and outward marks of respect in accordance with agreed rules and customs.</p>	Economic theory of the firm.
<p><u>Subordination of individual interests to general interest</u> Through firmness, example , fair agreement and constant supervision.</p>	Economic man
<p><u>Equity</u> Based on kindness and justice, to encourage personnel in their duties; and fair remuneration which encourages morale yet does not lead to over payment.</p>	Economic man.

Table 3 : Machine model principles of organization...

<p><u>Authority and responsibility</u></p> <p>Attention should be paid to the right to give orders and to exact obedience; an appropriate balance between authority and responsibility should be achieved. It is meaningless to make someone responsible for work if they are not given appropriate authority to execute that responsibility (see Figure 14).</p>	<p>Cause-effect.</p>
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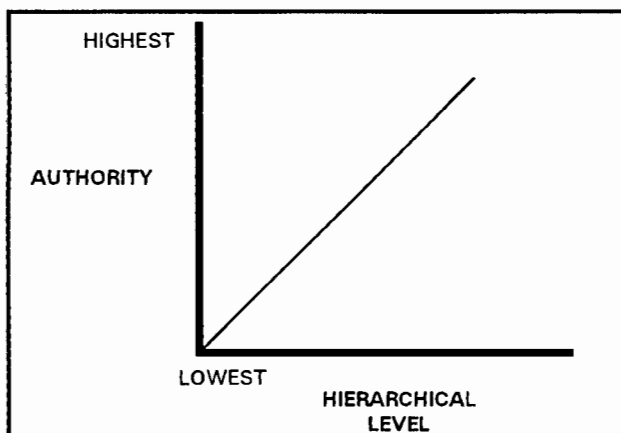


Figure 14: Mechanistic conception of enterprise hierarchy and authority

3.2.2 CHARACTERISTICS OF THE MACHINE MODEL

Designing an enterprise using these principles to implement systemic structures of organization results in emergent behavioural characteristics of the authoritarian mode of organization :

1. Discipline

People must obey authority and do not have freedom of choice in how they perform their work.

2. Stability

As a consequence of the discipline, people are unable to react to changes in the environment. This creates a high level of stability in the sense that there is no change to the organization of the enterprise. Strümpfer¹³⁵ argues that in a mechanistically organized enterprise *"change and stability are perceived as two opposites on the same dimension. The more (organizational) stability, i.e. order, you*

¹³⁵ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997

have, the less (organizational) change there is. Conversely, the more change there is in the enterprise, the less stability there is." Slow decision making as a result of decisions only being taken by those with the relevant hierarchical authority adds to the stability in that decisions to change take much time to be made.

3.2.3 ADVANTAGES OF THE MACHINE MODEL

Implementing the above mentioned principles when organizing an enterprise is relatively simple and allows the enterprise to operate as a whole. The principles are clear and are aligned to the view of the world as a machine.

The stability and discipline of organization as a machine is favoured where clear and stable goals are required to be achieved and the environment is relatively static.

3.2.4 DESCRIPTION OF THE MACHINE MODEL

If the above mentioned principles are implemented in an enterprise design, a structure is developed which results in the organizational chart. Morgan¹³⁶ describes an organizational chart as a pattern of precisely defined jobs organized in a hierarchical manner through precisely defined lines of command or communication.

The enterprise is a network of parts (units) which are divided according to the principle of the division of labour. Within each part, work is further divided up according to the principle of span of control. Through this a hierarchy is formed. At each level of the hierarchy, people only report to a single person above them in accordance with the principle of unity of command. Furthermore these people have the authority and responsibility of performing any tasks requested from a single person in the hierarchy directly above them (see Figure 15 on page 33).

For the structure to achieve the objectives of the owner, the network of parts must be controlled in some manner. Commands are therefore issued from the top of the organization and are passed down the hierarchy through the scalar chain of command. The orders from above are interpreted at each level and people with the authority relay the message downward.

¹³⁶ G. Morgan, *Images of Organization*, (London: Sage Publishers, 1986),p.27

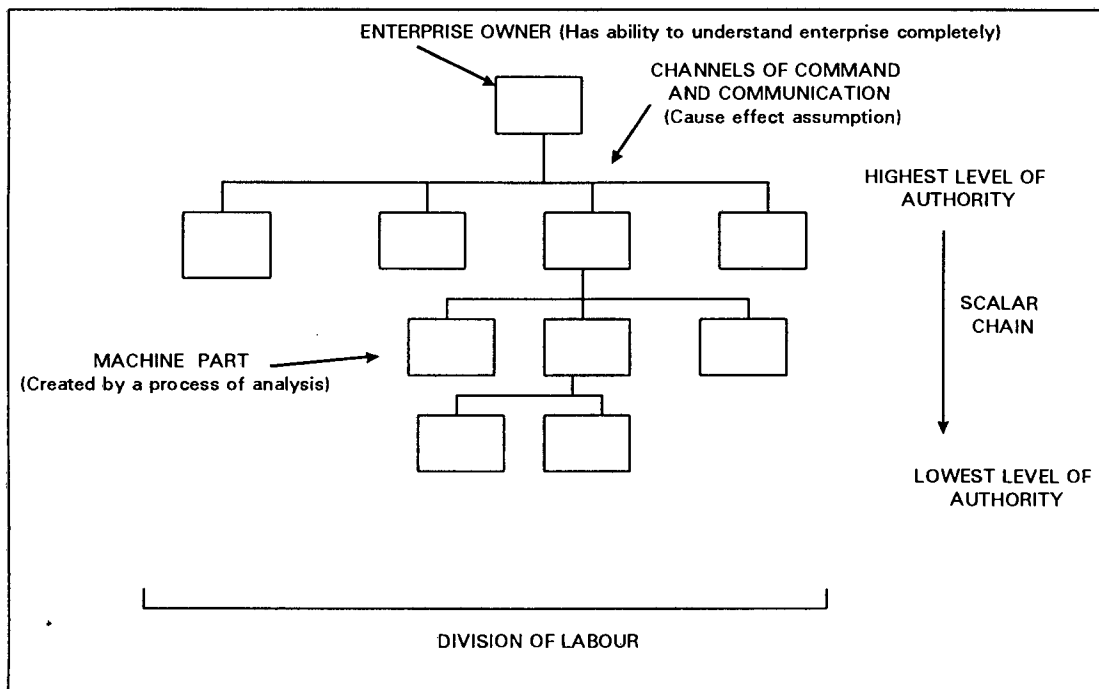


Figure 15 : The enterprise as mechanically organized parts.

3.3 REFLECTION : THE AUTHORITARIAN MODE OF ORGANIZATION

The purpose of this section is to reflect on the Machine model and the authoritarian mode of organization. The reflective framework used is Churchman's appreciative conditions posed as a set of questions (see Table 4 on page 34).

The Machine model of organization is a very simple approach to describing a complex social phenomenon. It is based on assumptions which have shaped people's views of the world for approximately the last 300 years. However, new knowledge about the nature of man and the environment is now available which is not consistent with this mechanistic world view.

According to Ackoff¹³⁷, these inconsistencies are resulting in dilemmas in government and organizations - *"in a world of accelerating change, increasing uncertainty, and growing complexity it is becoming apparent that these (mechanistic views) are inadequate as guides to decision and action. Alienation, hopelessness, frustration, insecurity, corruption, tyranny and social unrest are only a few of the symptoms of deeply rooted malfunctioning of societies and their institutions."*

¹³⁷ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

The purpose of the next chapter is to describe the dilemmas of organization experienced by enterprises operating in the authoritarian mode.

Table 4 : A reflection on the Machine model using Churchman's appreciative conditions.

Appreciative Question	Machine Model
What is the purpose ?	To serve the requirements of the owners.
What are the measures of performance ?	Overall enterprise profits received by owners.
Who are the owners ?	Centralized ownership of the enterprise (Shareholders).
What are the purposeful parts ?	Function, product or market divisions.
What is the environment ?	Slow changing and is assumed to have a limited effect on the enterprise.
Who is the decision maker ?	Managers who have decision making powers delegated to them by the owners.
Who is the designer ?	Shareholders (owners).
What is designers intention ?	Growth in terms of profit and enterprise size.
How is system stability maintained ?	Scalar chain of command and the authority and accountability of managers in the hierarchy.

4. CHALLENGING THE MECHANISTIC VIEW AS A BASIS FOR ORGANIZING

"The industrial revolution was the technological manifestation of machine age thinking. But as happens with any age, certain problems cropped up during the industrial revolution that challenged the validity of the current world view." - Ackoff¹³⁸

"As the world rushes into an information age of complex technologies, global markets, intense competition and turbulent constant change, the institutions which worked in the past are failing everywhere." - Halal, Geranmayeh and Pourdehnad¹³⁹

It was argued in the previous chapter that the mechanistic conception of the enterprise and the associated authoritarian mode of organization is a manifestation of machine age thinking. It was also mentioned that new knowledge about the nature of man and the environment presents problems which challenge the validity of the mechanistic world view. Ackoff¹⁴⁰ refers to the problems which challenge the current world view as dilemmas. This chapter will present a synthesis of the dilemmas being experienced by mechanistically organized enterprises operating in the context of today's fast changing and complex environment. The basis of the argument is that the dilemmas are a consequence of the assumptions of the mechanistic view no longer being valid (if they ever were).

An alternative world view (the 'social systems' world view) is presented which has a more appropriate set of assumptions in terms of today's high rate of change and levels of complexity. It is suggested that using this alternative set of assumptions as a basis for organizing the enterprise will resolve the dilemmas of organization associated with the authoritarian mode of organization.

4.1 DILEMMAS OF THE AUTHORITARIAN MODE OF ORGANIZATION

4.1.1 THE NATURE OF SOCIAL REALITY

"The activities associated with a social system, and the connections between them are certainly amenable to rational design; but any actual manifestation of such a system involving a group of real people will exhibit properties due to the natural characteristic of man the social animal." - Checkland¹⁴¹

"In understanding organization as a rational, technical process, mechanical imagery tends to underplay the human aspects of organization, and to overlook the fact that

¹³⁸ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegasus Communications, 1997, p.6

¹³⁹ Halal, Geranmayeh and Pourdehnad, 'The Single Most Important Change in Management Today', in *Internal Markets*, eds. Halal, Geranmayeh and Pourdehnad, p.1

¹⁴⁰ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegasus Communications, 1997, p.6

¹⁴¹ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994), p.120

tasks facing the organization are often much more complex, uncertain, and difficult than those which can be performed by most machines " - Morgan¹⁴²

The way in which work is organized under the mechanistic world view is a direct consequence of analytic thinking. Ackoff¹⁴³ explains this as follows - *" They begin by reducing work to elementary tasks, tasks so simple that they can be performed by one person alone. The simplicity of the task's facilitates their mechanization. Only those tasks that are too expensive or complex to be mechanized are assigned to people. Work is reduced to machine like behaviour and workers are treated like replaceable machine parts. Adherence to rules and regulations is made an end-in-itself either by rewarding compliance or punishing non-compliance. By this means humans responses to stimuli are made to approximate mindless physical reactions."*

Checkland's¹⁴⁴ view is that the assumptions of the mechanistic world view have been entrenched as a result of their success as a basis to the scientific method. Checkland¹⁴⁵ argues that *"we have a picture of science as a method of inquiring or learning, which offers us at any moment of time a picture of our understanding of the reality which consists of certain conjectures, established in reductionist repeatable experiments, which are as yet not been demolished"*. However Checkland¹⁴⁶ continues to argue that social sciences have, as yet not been able to point to significant body of empirically-derived, publicly repeatable results; and that there are no substantive accounts of laws governing social interaction. Checkland¹⁴⁷ continues to say that the reason these laws have not been developed is that people are self conscious, and as a consequence of this are irreducibly free - people have genuine freedom of choice in selecting their actions. It is peoples self consciousness which differentiates people from the natural world.

As a result of people being self-conscious, there is a requirement for their emotions and desires to be accommodated. It should therefore be clear that treating people as component parts of a machine (where it is implied that the parts in the machine have no choice) is not a rational approach.

Attitudes of managers in mechanistic organizations that *staff "are not supposed to think because other people are paid to think for them"*¹⁴⁸ will result in de-motivation and a feeling of helplessness. Morgan¹⁴⁹ argues that treating man as a machine will erode the human spirit and capacity for spontaneous action.

¹⁴² G. Morgan, *Images of Organization*, (London: Sage Publishers, 1986),p.34

¹⁴³ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

¹⁴⁴ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.265

¹⁴⁵ *Ibid.*,p.265

¹⁴⁶ *Ibid.*,p.265

¹⁴⁷ *Ibid.*,p.116

¹⁴⁸ G. Morgan, *Images of Organization*, (London: Sage Publishers, 1986),p.32

¹⁴⁹ *Ibid.*,p.25

4.1.2 THE NATURE OF THE ENVIRONMENT

"A mechanistically conceived social system is inflexible. Therefore it can operate effectively only if its environment is static or has little effect on it; that is where it can operate as a closed system." - Ackoff¹⁵⁰

One of the assumptions on which the Machine model of organization is based is that of cause and effect. Ackoff¹⁵¹ says that this infers that the environment may be ignored (i.e. the enterprise is viewed as a closed system). However, ignoring the environment is only acceptable when there is no change and it can be assumed to be a constant.

The assumption of a static environment is no longer valid (if it ever was). The environment in which enterprises operate is one which is fast changing and increasingly complex. This complexity and rate of change is a result of increasing population levels, competition for scarce resources, technological advances in communication / information technology and global transport infrastructures.

"The larger social system of which every organization is apart ... no longer permit an organization to ignore its effects on and the effects on it of its environment. Recognition of this interaction poses a severe dilemma to mechanistically conceptualized organizations." - Ackoff¹⁵²

4.1.3 THE NATURE OF COMPLEX SYSTEMS

An assumption of the mechanistic view of reality is that the external reality is completely understandable. This has resulted in the belief that management can understand and be aware of everything which happens within their span of control. Managers are allocated the responsibility and authority for controlling and directing everything 'under' their span of control in accordance with this assumption. Decision making is centralised to these managers as it is assumed they are the only people who have a complete understanding of the 'system' under their control (i.e. the cybernetic principles of requisite variety and self-organization are ignored - see section 2.4.3).

The assumption that a complex situation (particularly a social one) can be completely understood is no longer valid. Managers can no longer perceive the complexity of the operations below them (if they ever could). Managers are becoming more dependent on information being provided to them from lower level supervisors (who are contained within the boundaries of the system which the manager is attempting to control) before they can make informed decisions.

¹⁵⁰ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

¹⁵¹ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegasus Communications, 1997, p.4

¹⁵² R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

The information given to high level management is not always a clear reflection of what is actually happening at lower levels. Espejo¹⁵³ explains that this causes "interpersonal games, where on the one hand the senior managers control the allocation of resources, and on the other hand junior managers control the information. It is inherent to management that managers operate within an information gap. If junior managers, for whatever reasons, withhold the relevant information, the likelihood is that corporate managers will loose control." Espejo¹⁵⁴ refers to this situation as a 'control dilemma' (see Figure 16).

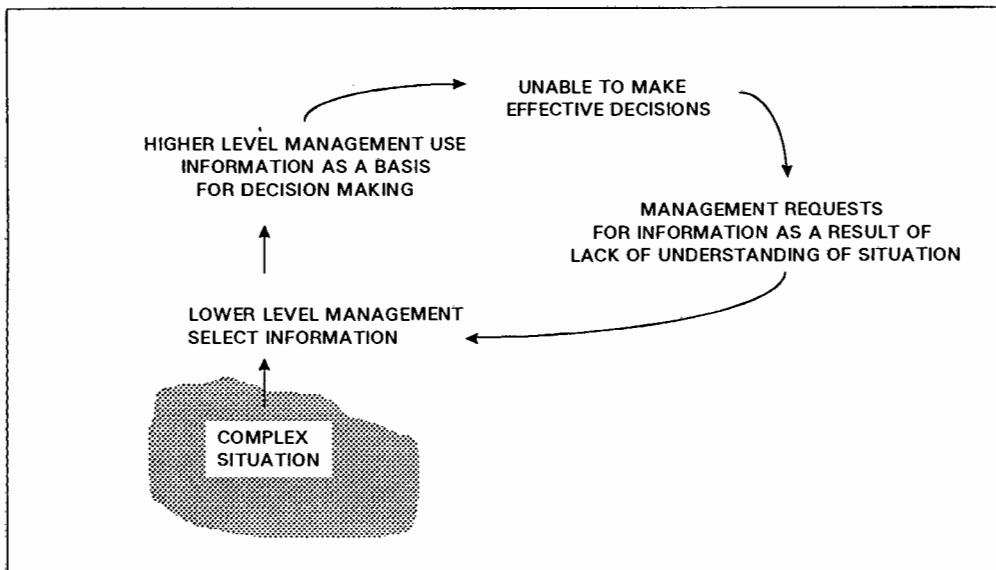


Figure 16 : The control dilemma.

Espejo¹⁵⁵ explains that corporate management respond with demands for more information when they are aware that lower level managers are selecting information being sent upwards to them. The reason they respond with these demands is that they feel they are unable to make decisions based on the information provided. The consequence of this is that managers/supervisors can spend less time performing their jobs and more time selecting information to provide to corporate management.

4.1.4 THE NATURE OF GROWTH

The economic theory of the firm, which is one of the foundation theories of the Machine model of organization (see section 3.2), states that the primary goal of the enterprise is to maximize the enterprise profits. It is argued that this profit can be re-invested into the enterprise to stimulate further profits. It is assumed this will

¹⁵³ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.93

¹⁵⁴ *Ibid.*, p.93

¹⁵⁵ *Ibid.*, p.93

ensure growth. In terms of the assumption of linear cause-effect, it is assumed that this growth will ensure survival of the enterprise.

An increase in size (i.e. to grow) will require an increase in the consumption of resources to sustain the growth. However, the increases in population and competition levels has had an impact of making resources a limited entity whose consumption should be reduced. This results in a dilemma for the mechanistic enterprise which depends upon large amounts of resources to support growth.

This dilemmas can be resolved by understanding the difference between growth and development. Ackoff¹⁵⁶ describes the difference:- *"Growth and development are not the same thing and are not even necessarily associated. Either can take place with or without the other. A cemetery can grow without developing; a person may continue to develop long after he or she has stopped growing ... What is not so obvious is that many of the problems associated with development derive from the assumption that economic growth is necessary if not sufficient for development and that limits to growth limit development."*

Most authoritarian organizations unquestioningly pursue growth and do not consider development. This places them at odds with their people and the environment¹⁵⁷. To extend this idea further, is the concept of 'sustainable' development. Sustainable development is development which *"satisfies its (e.g. the enterprises) needs without diminishing the prospects of future generations."*¹⁵⁸

4.1.5 THE NATURE OF UNDERSTANDING

When people in an enterprise are required to make decisions, they are required to have an understanding of the implications of the decision. This is very difficult when the enterprise is described in terms of its parts which creates knowledge and not systemic understanding.

Ackoff¹⁵⁹ argues that breaking up a system into its component parts (i.e. analysis) only provides knowledge of a system. According to Ackoff¹⁶⁰ *"knowledge is instructive. Knowledge can be used to describe how enterprises are designed but does not answer why the enterprise is designed like it is."* Ackoff¹⁶¹ continues to say that knowledge of a system (e.g. an enterprise) *"does not explain its properties and behaviour, and to reveal why it is what it is and why it behaves the way it does."* Breaking up a system into component parts through analysis cannot provide

¹⁵⁶ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

¹⁵⁷ J. Strümpfer, Personal Communication, University of Cape Town, 1997

¹⁵⁸ L. Brown cited by F. Capra, *The Web of Life*, (Glasgow: Flamingo Publishers, 1997),p.4

¹⁵⁹ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

¹⁶⁰ *Ibid.*,p.1

¹⁶¹ *Ibid.*,p.1

understanding of how the system operates. Ackoff¹⁶² argues that *“without understanding one cannot control causes; only treat effects, suppress symptoms.”*

Most management interventions are based on this assumption and serve only to deal with the symptoms. The organization is changed but the mindset causing the problems is not changed.¹⁶³

4.2 AN ALTERNATIVE : THE SOCIAL SYSTEMS VIEW OF REALITY

“A prevailing world view should be confronted by another world view based on an entirely different set of assumptions in order to bring about a richer appreciation of the situation expressing elements of both positions while going beyond them as well” - Flood and Jackson¹⁶⁴

A number of dilemmas of the authoritarian mode of organization have been described. It has been argued that the dilemmas are predominantly a consequence of the assumptions of the mechanistic view of reality.

Ackoff¹⁶⁵ believes that dilemmas created by the assumptions of a specific world view cannot be solved within the paradigm of that world view. He proposes the social systems view as a more appropriate metaphorical view of reality. The social systems view, implies that the external reality should be conceived as a social system rather than a machine. The underlying assumptions of the social system's view should not be seen as a mutually exclusive to the mechanistic view's assumptions. The social systems assumptions are rather a complementary set of assumptions which resolve dilemmas of the mechanistic view (see section 2.5.4). A fundamental difference in the nature of the two world views is that the social systems view consciously acknowledges people as being part of the system and does not ignore the effects of the environment.

Ackoff¹⁶⁶ presents three alternative assumptions of the 'social systems' view of reality:

1. Reality is not completely understandable

Reality is highly complex and cannot be understood completely. This is particularly true when people are included in the external reality. An inquirer can attempt to increase his/her capacity to understand but will never reach complete understanding of a complex people plus 'things' external reality (see Figure 17). The social systems view assumes that we can never know everything needed to 'control' a situation (i.e. the social systems view is consistent with the cybernetic principles).

¹⁶² Ibid.,p.1

¹⁶³ J. Strümpfer, Personal Communication, University of Cape Town, 1997

¹⁶⁴ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.121

¹⁶⁵ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegusus Communications, 1997,p.6

¹⁶⁶ Ibid.,p.8

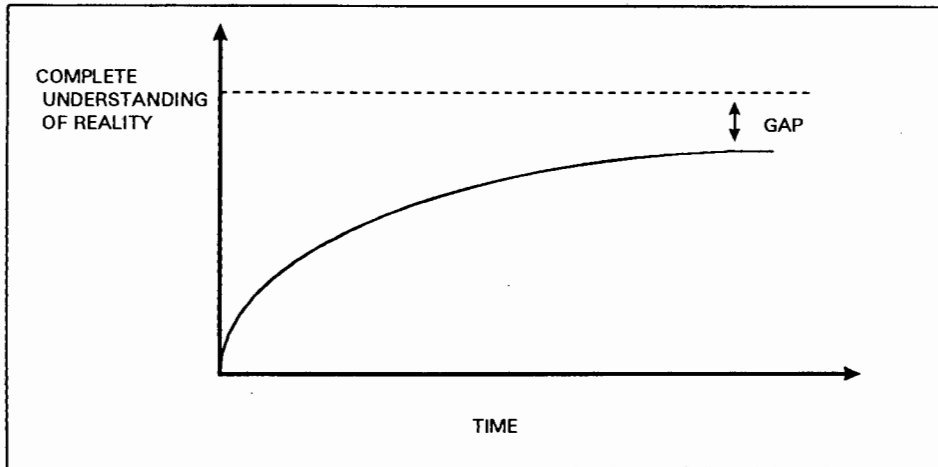


Figure 17 : Observer capacity to understand reality¹⁶⁷.

2. Understanding requires synthesis (expansionism)

"A system is a whole that cannot be divided into independent parts; the behaviour of the parts and their effects on the whole depends on the behaviour of the other parts. Therefore the essential properties of a system are lost when it is taken apart."-Ackoff¹⁶⁸

A systems behaviour is a consequence of the interactions between the parts and the properties of the parts themselves. When a system is taken apart (i.e. reduced) it loses its essential properties.¹⁶⁹

The social system view assumes that you cannot understand a system by trying to aggregate an understanding of the parts into an understanding of the whole. Rather, the system should be understood in terms of its holistic emergent properties which are a consequence of the interaction between the parts and not the parts themselves.

3. Circular causality

The properties of a system are a result of the interactions between the parts. Relationships between parts cannot therefore be reduced to one simple relationship of cause and effect. Systems are a network of relationships between the parts with one part having an effect on another and that same part effecting the other part. Cause and effect relationships should therefore be conceived as a circular process where A effects B and B effect A (see Figure 18).

¹⁶⁷ T. Ryan, School of Engineering Management, University of Cape Town, 1995

¹⁶⁸ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

¹⁶⁹ R. Ackoff cited by L. Johnson, 'From Mechanistic to Social Systemic Thinking', Pegasus Communications, 1997, p.7

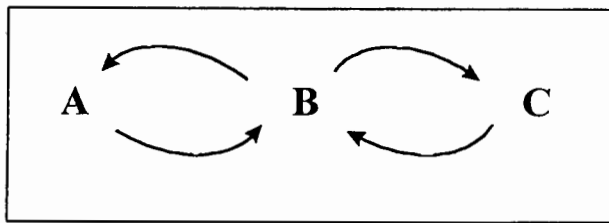


Figure 18 : Circular causality.

The social system view assumes that the environment cannot be ignored as a consequence of these circular casual relationships. The system effects the environment and is effected by the environment itself.

4.3 REFLECTION

The high levels of complexity in the external and internal environment have resulted in enterprises having to cope with a variety of challenges. This complexity is a result of increasing population levels and rapid changes and advances in communication and information technology. This in turn has contributed to the increase in global competition and the number of environmental disturbances which an organization must deal with. These challenges have resulted in a number of dilemmas of organization which are a consequence of enterprises not being organized appropriately to deal with these challenges (i.e. the underlying assumptions of the systemic structures of organization are inappropriate).

Historically, reactive responses to the above mentioned challenges (dilemmas) have been used by management. Examples of this are retrenchment programmes and elimination of layers of management¹⁷⁰. The reactive responses are disruptive and do not have a systemic basis. Although short term improvements may be achieved, they are generally ineffective for long term survival of enterprises. The reason for this is that these reactive approaches do not alter the underlying systemic structures of organization responsible for the dilemmas. Furthermore, they do not change the paradigms of the managers.

An alternative approach to responding to these challenges is to fundamentally and deliberately change the underlying systemic structures of organization using an alternative world view as a basis. It has been proposed that this new world view is the social systems view which has a set of assumptions as its basis which take cognisance of the complexity, people and the external environment.

The alternative world view should provide a mode of organization which :

- Consciously acknowledges the human qualities of people who are purposeful parts of the enterprise;
- Allows the enterprise to adapt to the continuously changing environment;
- Focuses on development rather than growth;

¹⁷⁰ Halal, Geranmayeh and Pourdehnad , 'The Single Most Important Change in Management Today", in *Internal Markets*, eds. Halal, Geranmayeh and Pourdehnad, p.2

- Takes cognisance of the enterprises inherent complexity.

The next chapter will present a model of organization which has the social system world view as a basis. The model will provide the underlying systemic structures of organization which will allow an enterprise to operate in the 'alignment and empowerment' mode. It is argued that this would resolve the dilemmas of organization described in section 4.1.

5. THE ALIGNMENT AND EMPOWERMENT MODE OF ORGANIZATION

The previous chapter presented the social systems view as an alternative view to the mechanistic view. It was proposed that the dilemmas of organization experienced by enterprises which are organized using the Machine model as a basis (i.e. operating in the authoritarian mode) would be resolved by rather adopting a social systems view of the enterprise.

Conceiving the concept of 'control' from the social systems view can provide insights into how the enterprise can be organized to operate in the alignment and empowerment mode. The social systems view proposes that it is possible to have both high levels of control and high levels of autonomy simultaneously (see section 1.1).

The purpose of this chapter is to present a model of organization which has the social systems view as its basis. The model provides a set of inter related design principles which, if implemented, provides the underlying systemic structures of organization which allow for simultaneous high levels of control and autonomy. The model is a synthesis of three existing models of organization (The rationale for selecting the three specific model of organization is described in section 5.2). The models are :

1. The 'Internal Market' model (IMM) - proposed by Halal, Geranmayeh and Pourdehnad¹⁷¹;
2. The 'Viable System' model (VSM) - proposed by Beer¹⁷²; and
3. The 'Multidimensional Organization' model (MDO) - proposed by Ackoff¹⁷³.

Strümpfer¹⁷⁴ feels that there is a requirement for developing a single integrated model of organization. The integrated model would provide a complementary synthesis which will be richer than using each model separately. Using one model at a time would be mechanistic in approach in that it would focus on the models (parts) rather than understand how the models work together (i.e. the interactions). Furthermore, by creating a synthesis, disadvantages of one model are complemented by advantages of another.

5.1 A SOCIAL SYSTEMS VIEW OF ORGANIZATION

Table 5 on page 45 presents a brief summary of the three base models of organization mentioned above. Detailed descriptions of the models are included as appendices to the dissertation which can be referred to by readers who are not familiar with them.

¹⁷¹ W. Halal, A. Geranmayeh and J. Pourdehnad, eds. *Internal Markets : Bringing the Power of Free Enterprise Inside Your Organization*, (New York: Wiley and Sons)

¹⁷² R. Espejo and R. Harnden, eds. *The VSM : Interpretations and Applications of Stafford Beer's VSM* (Wiley, 1989)

¹⁷³ R. Ackoff, *The Democratic Corporation*, (New York: Wiley and Sons, 1994)

¹⁷⁴ J. Strümpfer, 'Dissertation Review Workshop', University of Cape Town, School of Engineering Management, 17 June 1997

Table 5 : Summary of base models of organization .

<p><u>'Internal Market' model (IMM)</u> (A detailed description of the IMM can be found in chapter 12)</p> <p>Halal, Geranmayeh and Pourdehnad's IMM proposes that enterprises are currently operated as centrally controlled micro-economies similarly to that of the communist macro-economy. It is argued that the enterprise should rather be conceived as a micro-market economy. The advantages of the IMM is that it provides a framework in which human aspirations and desires can be accommodated in a self-organizing manner which ensure the outputs of the enterprise which are required by the enterprises stakeholders are continuously achieved. Implementing market principles also ensures that the requirements of the environment are continuously acknowledged.</p>
<p><u>'Multidimensional Organization' model (MDO)</u> (A detailed description of the MDO can be found in chapter 13)</p> <p>Ackoff's MDO proposes that the enterprise should be organized with market, functional and product units all existing at the same time and at the same hierarchical level of the enterprise. Ackoff's rationale for this proposal is that most re-organizations involved a change in the relative importance of either the market, function or product enterprise units. Ackoff argues that this change is disruptive and that the level of disruption can be reduced significantly by allowing the three dimensions to exist simultaneously. Change only requires a movement of people within the multidimensional structure which reduces many of the undesirable effects of change.</p>
<p><u>Viable System' model (VSM)</u> (A detailed description of the VSM can be found in chapter 14)</p> <p>According to Ryan¹⁷⁵, the <i>'Viable Systems' model (VSM) offers a useful way of understanding how effective organizations work from the point of view of adaptation, control and communication. It offers an approach for studying these processes from the perspective of the management of complexity. This approach argues that if an organization is to be viable in a given environment, it must be able to adapt to changes in the environment and this requires efficient control of the parts. The adaptation and control is achieved through efficient communication and regulation. Viability requires the presence of certain viable parts or functions in the organization.'</i></p> <p>Beer's Viable System model (VSM) is described as an 'organismic model' in that it is concerned with the adaptation and survival mechanisms of the enterprise as a whole in a complex and rapidly changing environment. The model uses the concepts and principles of cybernetics (see 2.4.3) to implement control mechanisms which regulate the actions of the parts.</p>

¹⁷⁵ T. Ryan, 'The Viable Systems Model', Course Material, University of Cape Town, School of Engineering Management

Strümpfer¹⁷⁶ explains that the underlying principles of the three base models are not mutually exclusive but are complementary when viewed from the structure, functional, process and regulatory viewpoints (see Figure 19).

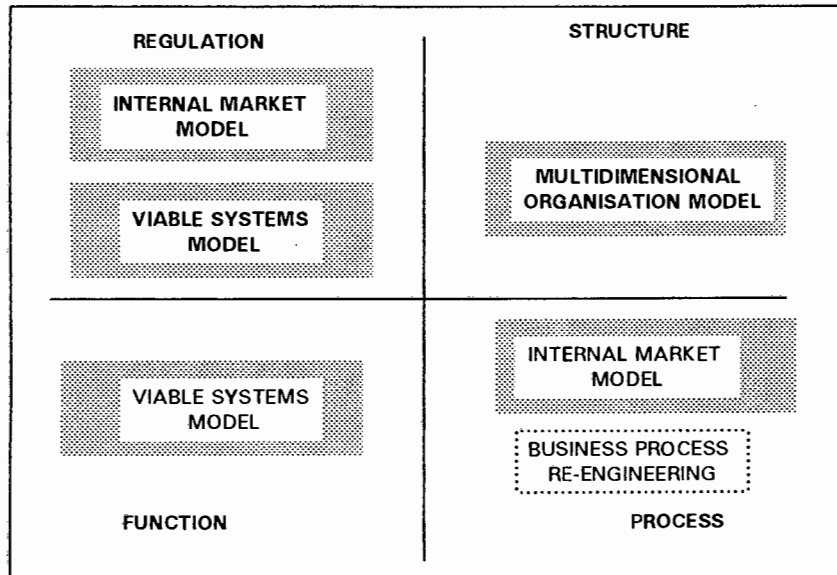


Figure 19 : Complementarism of models from structure process view points.¹⁷⁷

Viewed from the different system viewpoints :

- The Multidimensional Organization model provides emphasis on the parts which an enterprise should consist of (i.e. its structure);
- The Internal Market model provides emphasis on the regulation of the relationships between enterprise units and the role of management (i.e. regulation and process with emphasis on the regulation viewpoint);and
- The Viable System model provides emphasis on the functions of enterprise units and how the functions should regulated the enterprise to ensure long term survival (i.e. function and regulation with emphasis on the regulation viewpoint);

The reader will notice that Business Process Re-engineering is also included in the system viewpoint framework. The rationale for this is that it is a useful methodology for designing the processes which deliver what the enterprise stakeholders require. Business Process Re-engineering is not within the scope of this dissertation.

¹⁷⁶ J. Strümpfer, 'Dissertation Review Workshop', University of Cape Town, School of Engineering Management, 17 June 1997.

¹⁷⁷ J. Strümpfer, Personal communication, University of Cape Town, School of Engineering Management, 1997

5.2 MOTIVATION FOR SELECTING BASE MODELS OF ORGANIZATION

Strümpfer¹⁷⁸ notes that the selection of the three specific models of organization as a basis (rather than other models of organization) for the synthesis is a contentious one. The purpose of the next section is to motivate the use of these models, particularly the VSM which has received much criticism from social system adherents¹⁷⁹.

5.2.1 INTERNAL MARKET MODEL

The IMM focuses on the interactions between the parts of the enterprise. This is consistent with the 'expansionist' social systems assumption of reality and the nature of complex systems. The market relationships between units should be viewed as a powerful mechanism for implementing the principle of self-organization to regulate a complex system. The implementation of market principles allows people within enterprises to be entrepreneurs. The IMM thus consciously acknowledges the requirement for people to have the opportunity to be creative and exercise choice in the means through which the enterprise purpose is achieved.

5.2.2 VIABLE SYSTEMS MODEL

According to Strümpfer¹⁸⁰, the VSM has been criticised for not taking cognisance of the nature of social reality (i.e. that enterprises are 'people populated systems'). The rationale for this criticism is that the model uses mechanistic and organismic conceptions of the enterprise as a basis.

Although the VSM does not consciously acknowledge people, it does have a number of advantages when considering the nature of complex systems, the complementary nature of the mechanistic, organismic and social systemic world views and the complementarism of the three base models selected (see section 5.1) :

1. The nature of complex systems

The VSM embodies the concepts of cybernetics, 'hierarchy and emergence' and 'communication and control'. These are useful concepts when attempting to make sense of the complex reality (see section 2.4). It thereby allows managers and designers to conceptualize the enterprise in terms of a complex system interacting with a complex environment.

¹⁷⁸ J. Strümpfer, 'Enterprise Design Workshop', University of Cape Town, School of Engineering Management (24-28 February 1997)

¹⁷⁹ J. Strümpfer, Personal Communication, University of Cape Town, School of Engineering Management, 1997

¹⁸⁰ Ibid.

2. The complementarism of the three world views

The mechanistic, organismic and social systems world views are complementary to one another and are therefore useful in understanding different aspects of the same external reality (i.e. the non people parts).

3. The complementarism of the IMM and VSM

The VSM specifies 5 functions (mechanisms) which are required to ensure viability. These functions are described in terms of the Machine model (i.e. mechanistic control, co-ordination, policy etc.) and therefore receive much criticism.

However, it is not necessary that these functions are implemented using mechanistic mechanisms. Strümpfer¹⁸¹ proposes that these functions can rather be implemented using mechanisms proposed by the IMM. The IMM is not mechanistic in nature and consciously acknowledge the social nature of the enterprise (this idea is described in detail in section 5.3.4).

5.2.3 MULTIDIMENSIONAL MODEL

The MDO is mechanistic by nature in that it resembles the traditional organizational chart. However the model also introduces the idea that market units are necessary at every level of the 'chart'. This is consistent with the social systems view that the environment cannot be ignored. Furthermore, the model appears to be mostly concerned with issues of change (i.e. the idea that change is disruptive and that it is necessary to attempt to retain (organizational) stability in times of change. The mechanistic paradigm sees change and stability as opposites - see section 1).

5.3 A 'VIABLE MULTIDIMENSIONAL MARKET' MODEL OF ORGANIZATION¹⁸²

It has been repeatedly mentioned that a social systems view / paradigm of organization will provide the underlying systemic structures of organization for the empowerment and alignment mode. This section will present a synthesis of enterprise design principles which are derived from the 3 base models of organization (VSM, IMM and MDO). For the purposes of the dissertation, the synthesis will be referred to as the 'Viable Multidimensional Market' model of organization (VMM).

Figure 20 on page 50 represents a system dynamics model which attempts to illustrate how the VMM design principles interact to create high levels of autonomy and high levels of control simultaneously. A dynamic balance exists between the principles of organization and depending upon the strength of each principles

¹⁸¹ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997

¹⁸² The synthesis of the IMM, VSM and MDO was first done by J. Strümpfer, who describes it as the Modular Enterprise Design (MED). This has been in use in a number of companies for several years now. The synthesis presented here follows that of the original MED by J. Strümpfer.

implementation in an organizational design, an enterprise with characteristics in either of the quadrants of Strümpfer's modes of organization framework could be developed. For example, if the principles of 'profit centres' is implemented without the associated principles of 'entrepreneurship' the balance changes from high autonomy to lower autonomy while retaining high levels of control - a definite shift towards the authoritarian mode.

Similarly, removing the principles of 'web of communication and information flows' and the principles of 'market interactions' reduces the self-organizing ability of the enterprise, which in turn reduces the levels of control greatly but only affects the high levels of autonomy slightly - a definite shift towards the high autonomy, low control quadrant (representing chaos) (see Figure 1 on page 2).

It is therefore important to understand that the set of principles must be viewed as a system and that it is the complementarism and interactions between the principles which provide operation in the empowerment and alignment mode. Where certain principles are either fully or partially sacrificed, the dynamic balance is upset and the emergent characteristics of the organization will shift into a new quadrant. The new quadrant will depend on which principles are sacrificed.

The principles of the VMM will be described in terms of Strümpfer's fundamental enterprise design questions, which are structured around his systems viewpoint framework (see Table 6).

Table 6 : Fundamental organization design questions to be answered.

Fundamental organization design question ¹⁸³	System viewpoint	Cross reference to section
What are the parts ?	Structure	5.3.1
How do the parts interrelate ?	Process	5.3.2
What is the purpose of the whole ?	Function	5.3.3
How should the whole be put together ?	Regulation	5.3.4

¹⁸³ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997

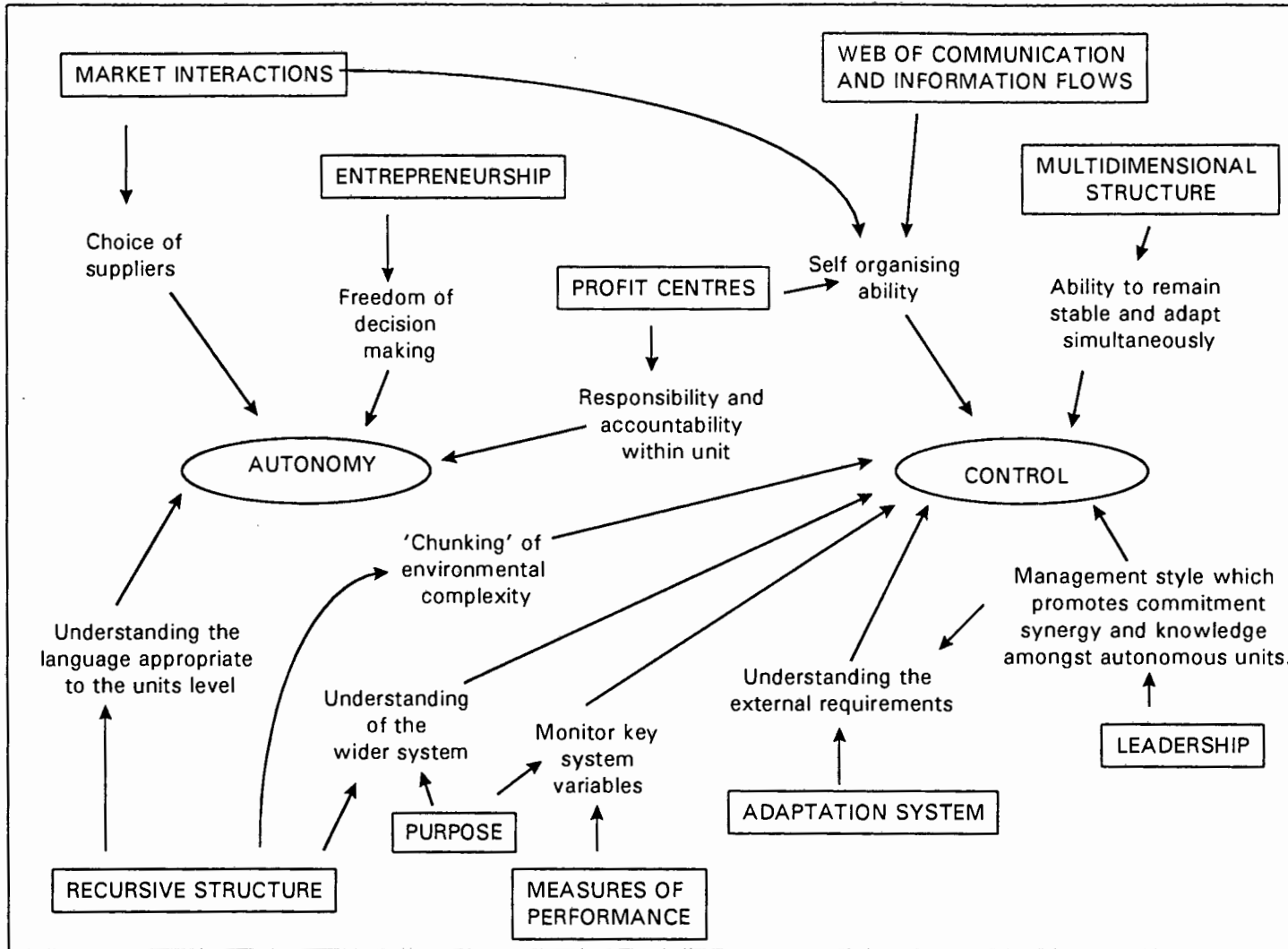


Figure 20: System dynamics model : Underlying structures of organization.

5.3.1 THE VMM : STRUCTURAL PERSPECTIVE

Table 7 presents the VMM's structurally related principles of organization.

Table 7 : VMM Principles of organization - Structural viewpoint.

<p><u>Multidimensional Division of Labour (MDO)</u></p> <p>According to Ackoff¹⁸⁴, the need to organize derives for the need to divide labour. There are three criteria for dividing labour namely functional (input), product or service (output) and market defined units. According to Ackoff most re-organization involve the changing of the relative importance of these criteria used for dividing labour.</p> <p>Enterprises should therefore contain all three dimensions at the same time. Re – organization then only requires a change in the relative importance of the functional, product or market units.</p>
<p><u>Recursion (VSM)</u></p> <p>Managers of enterprises are required to deal with complexity from both the external and internal environment. Enterprises should be designed such that the <i>“managerial operational and environmental varieties diffusing through an institutional system tend to equate”</i>.¹⁸⁵</p> <p>To attenuate the complexity / variety from the external environment, the unit may be split into several smaller units, each with its own management to deal with the specific chunk of both the internal and external environment. Splitting a unit into several smaller units creates a hierarchy of activities, with different levels responsible for a specific chunk of the environment (see Figure 21 on page 52). [The terminology hierarchy can have connotations of power and control. A higher level unit will therefore rather be referred to as a containing system].</p> <p>The management of each level effectively acts as an environmental filter to the containing unit.</p> <p>At each level of the hierarchy, the enterprise units should be regulated in the same way as the unit above. This means that the enterprise effectively looks the same at every level.</p>

¹⁸⁴ R. Ackoff, *The Democratic Corporation*, (New York : Wiley and Sons, 1994),p.169

¹⁸⁵ R. Espejo and R. Harnden, eds. *The VSM : Interpretations and Applications of Stafford Beer's VSM* (Wiley, 1989),p.33

The enterprise is divided into a recursive structure. This division into a recursive structure takes cognisance the nature of complex systems, particularly the principles of 'hierarchy and emergence' and 'requisite variety'.

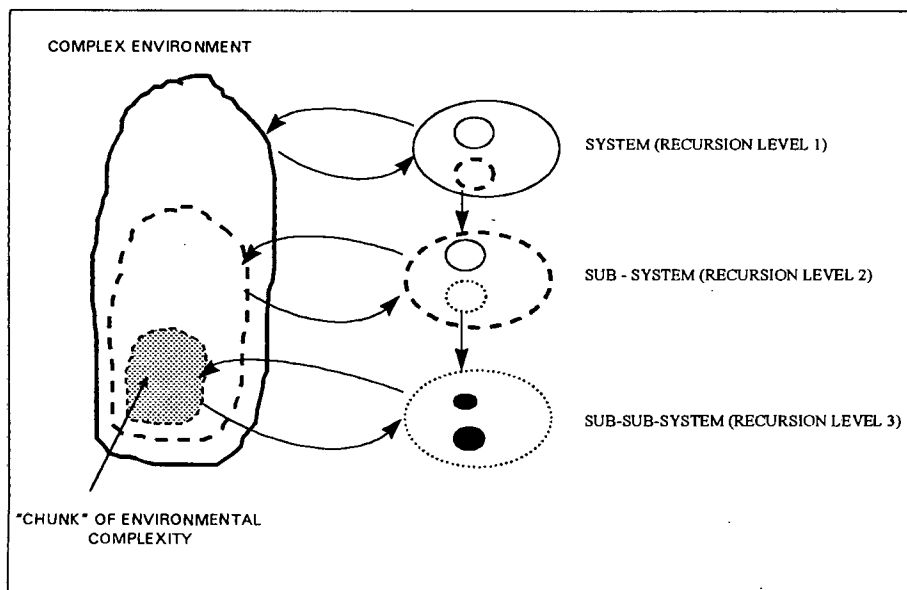


Figure 21: Complexity unfolding - levels of recursion.¹⁸⁶

Recursive structuring provides an effective mechanisms for reducing the environmental variety from both the internal and external environment which must be dealt with by management (i.e. it embodies the law of requisite variety). Recursion also improves management's understanding of how the enterprise is organized because the enterprise is organized the same way at all 'levels' of the enterprise.

The basis for dividing the enterprise into several units at each level of recursion is based on the principle of multidimensional organization where market, input and output units all exist at the same recursive/hierarchical level. This contributes to the stability of the organization in that adapting the enterprise to focus on a specific division of labour only requires the movement of people and not a complete re-organization (e.g. change from functional based to geographic based only requires the moving of people between units and not restructuring the entire enterprise.)

¹⁸⁶ Source : R. Espejo and R. Harnden, eds. *The VSM : Interpretations and Applications of Stafford Beer's VSM* (Wiley, 1989),p.90

5.3.2 THE VMM : PROCESS PERSPECTIVE

Table 8 presents the process related principles of organization.

Table 8 : VMM Principles of organization - Process viewpoint.

<p><u>Market interactions (IMM)</u></p> <p>Each enterprise unit should be treated as a profit centre with the interactions between the units being based on voluntary market interactions.</p>
<p><u>Information Flows (IMM)</u></p> <p>Information technology should be used as a means to disseminate information quickly and securely within an enterprise.</p>
<p><u>Business Process Re-engineering</u></p> <p>Outside the scope of the dissertation.</p>

The availability of information technology to co-ordinate processes within the enterprise, and management's improved understanding of the structure of the enterprise (see 5.3.1 above) provides an enterprise where information on the status of work (matter, information) within processes is available in real time.

5.3.3 THE VMM : FUNCTION PERSPECTIVE

Table 9 on page 54 presents the function related principle of organization.

In addition to the principle of enterprise purpose, the VSM specifies five functions which need to be fulfilled by any enterprise which is to remain viable (that is to ensure long term survival). The four functions are the policy, intelligence, control, and co-ordination functions (see section 14.3.1 for a detailed description of these functions).

The rationale for implementing these functions in a design is that they regulate the enterprise to ensure that the enterprise remains 'aligned with respect to purpose' and that the purpose of the enterprise remains relevant within the context of the stakeholders (environments) requirements. The regulation perspective, will expand upon this idea.

Table 9 : VMM Principles of organization - Function viewpoint.

<p><u>Purpose (VSM)</u></p> <p>An enterprise can be considered to be a system which is deliberately designed to fulfill a purpose. Within the context of a recursive structure, each recursive unit within the enterprise system is an autonomous purposeful part of the enterprise system. The purpose of the part should be aligned to the purpose of the containing system. This alignment is provided by regulatory mechanisms.</p> <p>According to Flood¹⁸⁷, Ulrich insists that, <i>"social systems are designed to be purposeful systems - otherwise they are likely to serve people and purposes other than those intended. Ulrich argues that the ability to determine purpose must be spread throughout the system; the system should produce knowledge relevant to purposes and encourage debate about purposes."</i></p> <p>The spreading of purpose throughout the system can be implemented using the principle of recursion mentioned above.</p>
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5.3.4 REGULATION PERSPECTIVE

The regulation mechanisms provide the underlying systemic structures which ensure that the multiple purposeful parts behave as a whole entity. This is one of the most significant challenges for an enterprise design. The implementation of regulatory mechanisms has a significant impact on the manner in which the enterprise will behave.

The VMM proposes two regulatory elements. These elements are complementary to one another and create a dynamic balance between 'empowerment' and 'alignment' (see Figure 23 on page 55) :

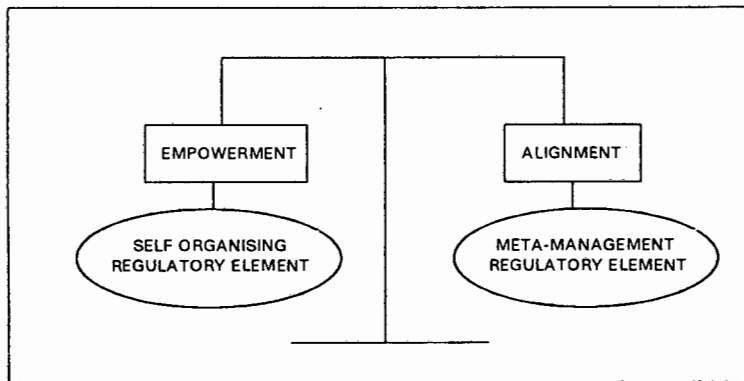


Figure 22 : Balance between empowerment and alignment.

¹⁸⁷ W. Ulrich cited by : R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.203

1. Self-organizing element

The element is based on the cybernetic principle of self-organization. This element provides an 'empowerment operating framework' for human activity within the boundaries of each enterprise unit. The framework provides control but acknowledges the 'human' requirements of people within the system under control.

2. Meta-management element

The element is based on the cybernetic principle of feedback. This element represents the traditional (mechanistic) management function of control and co-ordination which ensures alignment of the parts. However, it should be noted that the manner in which the feedback elements are implemented is significantly different to the traditional authoritarian implementation of control. This idea was introduced in section 5.2.2 where it was proposed that IMM principles could be implemented as feedback mechanisms.

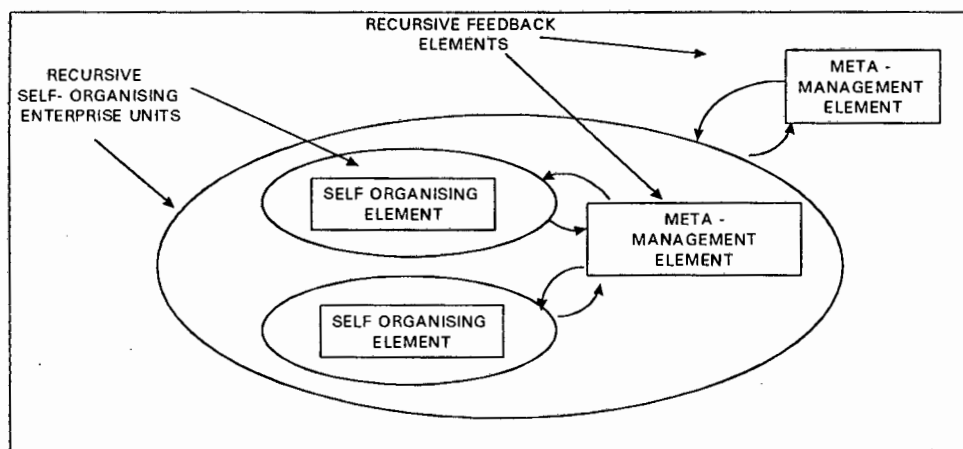


Figure 23 : Regulatory systems : Self-organizing and Feedback elements.

5.3.4.1 SELF-ORGANIZING REGULATORY ELEMENT

Table 10 presents the self-organization related principles of organization.

The internal operating framework provides regulation of the enterprise unit from within the unit itself (self-organization). It is the self-organizing mechanisms which allow the enterprise unit to absorb much of the environmental complexity without it reaching the meta-management regulatory element operating from outside the boundaries of the enterprise unit (from the next level of recursion).

This is aligned with the cybernetic principles of complex systems :

- Requisite variety : implies that management can only deal with low levels of variety if they are to regulate a system competently; and

- Self-organization : implies that a human regulator (i.e. manager performing meta-management functions) is not solely or even mainly responsible for the state of a complex system.

Each enterprise unit should operate as a profit centre and be given full autonomy to make any decisions which effect its operation. Operation as a profit centre requires that each units be responsible and accountable for their own financial health.

Table 10 : VMM Principles of organization - Regulation viewpoint (Self-organization).

<p><u>Autonomous Operating Units (VSM)</u></p> <p>Each recursive enterprise unit should be treated as an autonomous black box. The local management of autonomous units (at each level of the 'hierarchy') should be allowed the freedom to achieve the outputs required by the containing unit in any way the local manager thinks is best. This is effective in filtering the environmental variety of the containing unit.</p> <p>The containing unit (at the next level of recursion) then only deals with issues which cannot be resolved at the level of the autonomous operating units contained by it - the issue has an effect on the operation of wider system of which the autonomous unit is only one part.</p>
<p><u>Profit Centres (IMM)</u></p> <p>Each autonomous black box should operate as a profit centre responsible for its own financial heath.</p>
<p><u>Market forces (regulation) (IMM)</u></p> <p>The implementation of market interactions between enterprise units provides a powerful means of self-organization. If enterprise units are not satisfied with levels of service obtained from units within the organization then they are free to use the services of units outside the organization. This effectively regulates service levels and ensures that enterprise unit outputs are relevant to the requirements of users of the goods and services offered.</p>
<p><u>Entrepreneurship (IMM)</u></p> <p>Enterprise units should have decision making decentralised to the lowest level of recursion, with subordinates having freedom to make operational decisions and take advantage of opportunities which present themselves in the 'market' by using their own judgment. At the same time subordinates are accountable for the results achieved. This entrepreneurship provides an element of risk, which enables the organization to move forward.</p>

The market forces, profit centre concept, and the communication web (see 5.3.1) provide a self-organizing operating framework in which each unit has entrepreneurial freedom to exploit opportunities to increase the profitability of the unit.

5.3.4.2 META-MANAGEMENT REGULATORY ELEMENT

Table 11 presents the meta-management related principles of organization.

Table 11 : VMM Principles of organization - Regulation viewpoint (Meta-management)

<p><u>Leadership (IMM)</u></p> <p>Managers (at each level of recursion) should be seen as responsible for developing commitment, looking towards the future of the enterprise, building knowledge and designing and guiding the process (e.g. establishing common systems for accounting, communications and policies) rather than planning, organizing and controlling the enterprise units day to day activities (these activities should be taken care of by the unit itself in a self-organizing manner).</p>
<p><u>Measures Of Performance - Systemic Control (VSM)</u></p> <p>Traditional mechanistic control systems are open loop control systems which control the output by making changes to the input. The commands issued by management can be conceived as input signals attempting to regulate the output. Designers of 'physical systems' have demonstrated that 'open loop' control is not efficient when controlling complex systems.</p> <p>An alternative conception of control is that of closed loop control using the cybernetic principle of feedback. The state of a system is measured by a set of certain essential variables held by the system at any given time which reflect the performance of the system. The essential variables which are monitored by the containing system of each unit are the units 'measure of performance'.</p> <p>Measures of performance should therefore be designed as feedback elements ensuring that the outputs of the autonomous units are aligned to the requirements of the containing system.</p> <p>In cases where units operate as profit centres, a specific measure of performance can be objectively based on the profit of the unit. However, additional measures should also be implemented to prevent enterprise units focusing on short term profits at the expense of the long term.</p>

Table 11 : VMM Principles of organization - Regulation viewpoint (Meta-management)

<p><u>Communication channels for purposes of systemic control (VSM)</u></p> <p>It is important that the status of the system variables (see 'measures of performance') are communicated to the containing system and that the containing system is able to communicate to lower systems where a change in the state of the variables is required. A set of processes for communication of this information for purposes of regulation are therefore required between the operational units.</p> <p>By using information technology to co-ordinate activities of operational units, a different type of enterprise is established where communication channels exist which cut across enterprise boundaries.</p>
<p><u>Adaptation System (VSM)</u></p> <p>It is important for the organization to have the capacity to adapt to new situations or changes in its external environment.</p> <p>Processes are required which will compare the outputs of the enterprise with the outputs required by the environment which the enterprise is serving. This includes identifying trends in the environment and preparing the organization for the outcomes of the trends.</p> <p>Where changes are required to match the enterprises outputs with the outputs required by its environment, the changes should be communicated via the communication and control processes.</p> <p><i>"Indeed it seems intuitively obvious that a hierarchy of systems which are open must entail processes of communication and control if the systems are to survive the knocks administered by the systems environment." - Checkland¹⁸⁸</i></p>

Forester¹⁸⁹ defines a fundamental principle in the behaviour of a system - "*policies favouring the short run always degrade the long run*". To prevent the autonomous, entrepreneurial and self-organizing operational units from focusing on short term profits, the enterprise units require a certain degree of external regulation. The implementation of an external meta-management regulatory elements to prevent focus on the short term and to provide alignment of the parts with respect to purpose is specified by the VSM in the form of the functions 2 to 5.

¹⁸⁸ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.83

¹⁸⁹ J. Forrester, 'Reconsidering a New Corporate Design', in *Internal Markets*, eds. Halal, Geranmayeh and Pourdehnad,p.63.

The meta-management element's policies and interventions regulate the interactions between the units in certain circumstances where the actions of a single unit may not be desirable for the operation of the enterprise as a whole. It was mentioned in section 5.2.2 that the VSM has been criticised for proposing the implementation of these functions in a mechanistic manner. However Strümpfer¹⁹⁰ believes that principles of organization from the IMM can be used to implement some of the meta-management functions in a strictly 'non-mechanistic' manner. Strümpfer¹⁹¹ states that these functions can be implemented "*using market mechanisms such as taxes on consumption, revenue sources and income or profit*". For example, if the meta-management system detects that an enterprise unit has moved out of agreed performance areas, it could be possible for the unit to be taxed at a higher rate until such a time that it moves within agreed limits.

The meta-management system (at each level of recursion), treats each autonomous unit as a black box. The meta-management system does not get involved with the day to day operation of the units and only regulates the outputs of the recursive units. Outputs of the units are measured by the containing meta-management system against agreed 'measures of performance'. As a result of the autonomous units having accountability for their own financial status, each recursive unit is free to achieve the measures of performance however it thinks is best. The measures of performance monitor key system variables. Where variables move out of a specific range, feedback mechanism implemented in the meta-management system should prompt the units to move the variables back into the correct range (e.g. taxes or fines could be levied).

A meta-management system exists at each level of recursion. Regulation is therefore distributed throughout each level of the organization rather than being centralised at the highest level. This is useful in filtering variety and in association with high levels of autonomy provides quick responses to changes in the internal and external environment.

The meta-management system is also responsible for understanding the external environment in which the system is operating, and ensuring that the outputs of the units are aligned to the requirements of the environment. Where a mismatch is experienced, it is necessary to adapt the operating policy of the enterprise. This ensures that the enterprise is constantly adapting to the external environment, at all levels of recursion.

As a result of units being given operating autonomy, the meta-management system cannot become involved in the day to day operation of the units as the traditional management function would. Management's role rather becomes one of :

- dealing with issues which cannot be resolved at lower levels,
- developing synergy between the units;

¹⁹⁰ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997.

¹⁹¹ Ibid.

- generating a better understanding of the operation of the whole, such that when issues cannot be resolved at lower level, the manager is in a better position to make an informed decision;
- adapting the enterprise to the requirements of the environment.

5.4 BEHAVIOURAL CHARACTERISTICS OF THE SOCIAL SYSTEMS MODEL

Table 12 presents the behavioural characteristics which would be exhibited by an enterprise organized using the VMM as a basis.

Table 12 : Behavioural characteristics of the VMM.

Behavioural Characteristic	Underlying Principle of Organization
<p><u>Empowerment</u></p> <ul style="list-style-type: none"> • Entrepreneurial management culture where staff working within the profit centres are provided with opportunities to be paid for their efforts; • People are empowered at the lowest level of the organization. This satisfies the human needs of people working within the enterprise. 	<ul style="list-style-type: none"> • Market interactions • Entrepreneurship • Profit centres
<p><u>Responsive</u></p> <ul style="list-style-type: none"> • The enabling of initiative and creative freedom at the lowest level of the organization allows for responsiveness to a changing environment (decisions can be taken without escalation to higher levels); • Only issues which cannot be resolved at that level are communicated to higher levels; • Voluntary interactions between units are clearly specified with simple structured contracts in which a win-win outcome is attempted. 	<ul style="list-style-type: none"> • Entrepreneurship • Web of communication and information flows • Recursive structure
<p><u>Adaptive</u></p> <ul style="list-style-type: none"> • Continuously changing structure in which enterprise units attempt to serve the requirements of the stakeholders; • Information flows are not only up and down but are spread throughout the organization; • Structure can change without re-organization by merely moving people between existing units. 	<ul style="list-style-type: none"> • Web of communication and information flows • Multidimensional organization • Adaptation system
<p><u>Efficient utilization of resources</u></p> <ul style="list-style-type: none"> • Overall enterprise costs should decrease as a result of units operating as profit centres with market related prices for goods and services. 	<ul style="list-style-type: none"> • Entrepreneurship • Profit centres

Table 12 : Behavioural characteristics of the VMM...

<p><u>Alignment</u></p> <ul style="list-style-type: none"> • The entire structure is linked and integrated by the outputs of the black boxes regulated by strong feedback elements. 	<ul style="list-style-type: none"> • Measures of performance • Purpose • Recursive structure
<p><u>Stability</u></p> <ul style="list-style-type: none"> • Units can be added or subtracted without re-organization; • Complexity is continuously being filtered by lower level units. 	<ul style="list-style-type: none"> • Multidimensional division of labour • Recursive structure
<p><u>High level of organization understanding</u></p> <ul style="list-style-type: none"> • The model gives an indication of how the enterprise works (i.e. it takes cognisance of the parts and how they interact); • As a result of the recursive nature of the enterprise, the way in which it is organized is the same at every recursive level. This provides a useful framework for understanding the organization and how it works. 	<ul style="list-style-type: none"> • Recursive structuring • Web of communication and information flows • Purpose

5.5 REFLECTION : RESOLUTION OF THE MACHINE MODEL DILEMMAS

The previous chapter described a number of dilemmas of organization faced by enterprises operating in the authoritarian mode. The purpose of this section is to reflect upon how implementation of the VMM will resolve these dilemmas.

5.5.1 THE NATURE OF SOCIAL REALITY

According to Ackoff¹⁹², the accommodation of the concept 'free will' can be achieved by conceiving a social system as a purposeful system. (A mechanistically conceived system is not attributed with a purpose of its own even though it may serve a purpose of the external controller.)

Ackoff¹⁹³ argues that a purposeful system is one which can "*produce the same outcomes in different ways in the same environment and can produce different outcomes in the same and different environments. This ability to change ends under constant conditions is what exemplifies free will. Such systems can not only learn and adapt; they can create. Human beings are examples of such systems.*"

¹⁹² R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

¹⁹³ *Ibid.*, p.9

The specific mechanisms which allow for this expression of free will is the self-organizing operating framework. It allows people to have the choice of how they achieve the required outputs (ends) rather than the means of achieving set outputs being prescribed as in the Machine model.

5.5.2 THE NATURE OF CONTROL

A mechanistic conception of control is based on the assumption that the manager (regulator) of the system has the ability to understand the operation of the part well enough to be in a position to command employees within the part on how to obtain the correct outputs. The managers commands can be viewed as inputs to the system attempting to alter the system output.

A social systemic conception of control is implemented through self-organization and feedback mechanisms. The feedback mechanisms are implemented through the meta-management system which implements control by aligning the parts with respect to purpose using a system of constraints (measures of performance) which restrict the degree of freedom of the enterprise units within agreed limits. According to Jackson¹⁹⁴, it is vital to understand that the measure of performance should be decided upon in a participatory manner. Both the regulator of the part and the employees within the part must reach consensus on what the measures of performance of the part are. If this is not done the social systemic conception of control transforms into a different conception of mechanistic control with managers continuing to control the actions of the parts directly. Furthermore, the manner in which corrective feedback action is taken when enterprise units move outside of agreed limits is not authoritarian in approach, but rather implemented via IMM type mechanisms (e.g. taxes).

5.5.3 THE NATURE OF THE ENVIRONMENT

The environment and its effects are taken into consideration in the social systems view of reality. The environment is consciously acknowledged by implementing adaptation mechanisms. Furthermore the complexity of the environment is acknowledged by providing a recursive type organization where enterprise units operating in a given part of the environment have the autonomy to make decisions themselves based on the understanding of the environment in which they are operating.

5.5.4 THE NATURE OF DEVELOPMENT

According to Ackoff¹⁹⁵, the dependency of development on growth as espoused in the mechanistic world view is a "*misconception of the nature of development.*"

¹⁹⁴ M. Jackson, Personal Communication, International Systems Thinking Conference, Cape Town, 4-7 November 1997

¹⁹⁵ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984p.12

Ackoff¹⁹⁶ argues that *"development has less to do with how much a person has than with how much he or she can do with what he does have....Development is the process in which individuals increase their abilities and desires to satisfy their own needs and legitimate desires, and those of others. It is at least as much a matter of motivation , information, knowledge and understanding as it is of wealth. An individuals level of development is his current ability and desire to satisfy his own needs and legitimate desires, and those of others ... by legitimate desires we mean the pursuit or fulfillment of which does not reduce the likelihood of other individuals fulfilling their need or (legitimate) desires."*

Although Ackoff is describing individuals, the same concept of development is applicable to the enterprise as a whole. Ackoff¹⁹⁷ continues to argue that *"it should be borne in mind that resources are more often taken than give. The more developed a person or an organization, the more resources he or it can find and develop. The more dependent one is on resources that are given, the less developed that person is. Put another way: resources are created by what man does with what nature provides. What nature provides is not a resource until man has transformed it or learns how to use it. The more developed man is, the more resources he can create or extract of natures offerings."*

In terms of Ackoff's¹⁹⁸ definition of social system as purposeful system, the purpose of the enterprise is to encourage and facilitate the development of their members and their stakeholders. Mitroff and Linstone¹⁹⁹ define a stakeholder as *"any individual, group, organization institution that can effect as well as be effected by an individuals, groups, organizations or institutions policy or policies ... an organization is the entire set of relationships it has with itself and its stakeholders."*

5.5.5 THE NATURE OF UNDERSTANDING

By conceiving the enterprise as a social system, both knowledge and understanding of the system are possible. This is a result of the enterprise being viewed in terms of its properties and behaviours (synthesis) rather than its component parts (analysis).

The recursive nature of the VMM also contributes to the understanding of the enterprise.

5.6 CONCLUSION

Table 13 illustrates the dramatic difference between the mechanistic and social systems conceptions of the enterprise using Churchman's nine appreciative conditions.

¹⁹⁶ Ibid.,p.12

¹⁹⁷ Ibid.,p.13

¹⁹⁸ Ibid.,p.13

¹⁹⁹ I. Mitroff and H. Linstone, *The Unbounded Mind*, (New York : Oxford University Press, 1995),p.142

Table 13 : Mechanistic versus social systemic conceptions of the enterprise.

Appreciative Condition	Social Systems Conception	Mechanistic Conception
Purpose	To serve the requirements of both the stakeholders and the owners.	To serve the requirements of the owners.
Measures of performance	Individual enterprise unit profits PLUS variables which measure the extent to which the requirements of the stakeholders are being met.	Overall enterprise profits received by owners.
Owners	Ownership distributed throughout the enterprise (autonomous profit centers).	Centralised ownership of the enterprise (Shareholders).
Purposeful parts	Autonomous enterprise units.	Function, product or market divisions.
Environment	Fast changing and complex and is acknowledged to have an effect on the enterprise.	Slow changing and is assumed to have a limited effect on the enterprise.
Decision maker	Distributed throughout enterprise at each level and within each enterprise unit.	Managers who have decision making powers delegated to them by the owners.
Designer	People performing the meta-management function at the different levels of recursion.	Shareholders (owners).
Designers intention	Development of the enterprise stakeholders.	Growth in terms of profit and enterprise size.
Maintenance of system stability	Self-organization and meta-management mechanisms.	Scalar chain of command and the authority and accountability of managers in the hierarchy.

It has been argued that a social systems conception of the enterprise provides the underlying systemic structures of organization which overcomes the dilemmas of the authoritarian mode. The VMM, which is an implementation of a social systemic conception of the enterprise, takes cognisance of the purposeful and complex

nature of social systems by providing structures of organization which embody the assumptions of the social systems paradigm.

The most significant aspect of the VMM is the manner in which control is implemented - high levels of autonomy are achieved, while at the same time, achieving high levels of control. This is achieved by implementing control using mechanisms which ensure alignment of the parts with respect to purpose, rather than through commanding and directing (authoritarianism). Alignment of the parts is achieved by using feedback and self-organizing mechanisms.

This implementation of control, allows people within the enterprise to exercise initiative and creative freedom in fulfilling both their own and the enterprise aspirations. Furthermore, the VMM is compatible with all the latest management innovations (e.g. flat organizations, virtual corporations, network organizations)²⁰⁰.

Concerns with the model are that in an internal market environment, disruptive competition between internal units could be greater than competition between internal units with external units. This concern places additional emphasis on the role of the meta-management system to create synergy and ease tensions between competing internal units.

There is however a concern that the model provides a conceptual perspective of organization but does not provide any guidelines or recipes for implementation. The concepts may sound seductively simple, however in practice it is difficult to implement as it challenges the traditional operating assumptions of people working in the enterprise. The purpose of the next chapter is to address this concern and to provide insights into how the model can be implemented in a real world enterprise.

²⁰⁰ Halal, Geranmayeh Pourdehnad , 'The Single Most Important Change in Management Today', in *Internal Markets*, eds. Halal, Geranmayeh and Pourdehnad, p.4 - referring to the IMM which is integrated into the VMM.

6. A SOFT SYSTEMS ENTERPRISE DESIGN METHODOLOGY

"Social paradigm : A constellation of concepts, values, perceptions, and practices shared by a community which forms a particular vision of reality that is the basis of the way the community organizes itself." - Capra²⁰¹

"Human beings do not start their inquiries into important social problems as geometry does with simple, clear intuitively obvious or self evident propositions unless we start our investigation of complex problems with a 'clear' recognition of their 'messiness', that is their inherent ambiguity and uncertainty then we seem destined to misperceive the exact nature of the problem." - Mitroff and Linstone²⁰²

"The activities associated with a social system, and the connections between them are certainly amenable to rational design; but any actual manifestation of such a system involving a group of real people will exhibit properties due to the natural characteristics of man the social animal." - Checkland²⁰³

The previous chapters of this dissertation have focused on presenting a synthesis of Strümpfer's modes of organization framework. It has been argued that the authoritarian mode of organization is not adequate for an enterprise operating in a fast changing, competitive and complex environment. The Viable Multidimensional Market (VMM) model of organization has been proposed as a complementary model of organization which will provide the underlying structures of organization for operation in the alignment and empowerment mode of organization.

A concern is that the VMM model does not provide any recipe or guideline for how it can be implemented in a 'real world' context - specifically in a context where the existing 'paradigm' is that of the mechanistic world view. In light of the above, a simple application of a model (content) onto a complex social system (context) is not going to provide successful results. An element of process (methodology) is required (see Figure 24).

6.1 'SOFT' VERSUS 'HARD' SYSTEM DESIGN METHODOLOGY

Section 2.7 presented a discussion of three modes of reasoning, namely theoretical, instrumental and practical reason. It was mentioned that hard systems engineering uses existing theoretical knowledge to achieve pre-determined ends when designing simple 'physical systems'. A typical hard systems design methodology is illustrated in Figure 25.

²⁰¹ F. Capra, *The Web of Life*, (London : Flamingo Publishers, 1997),p.6

²⁰² I. Mitroff and H. Linstone, *The Unbounded Mind*, (New York : Oxford Press, 1995),p.46.

²⁰³ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.120

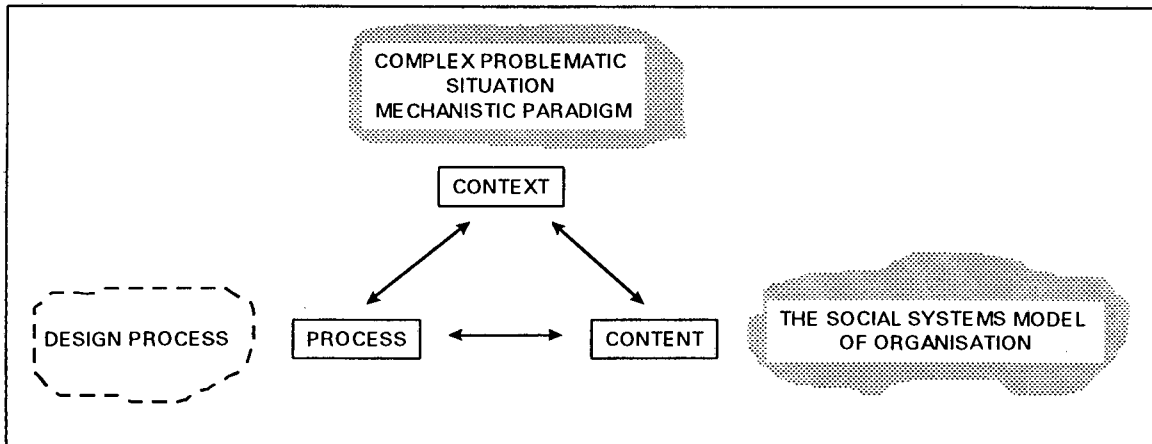


Figure 24: The interdependence of content, context and process.

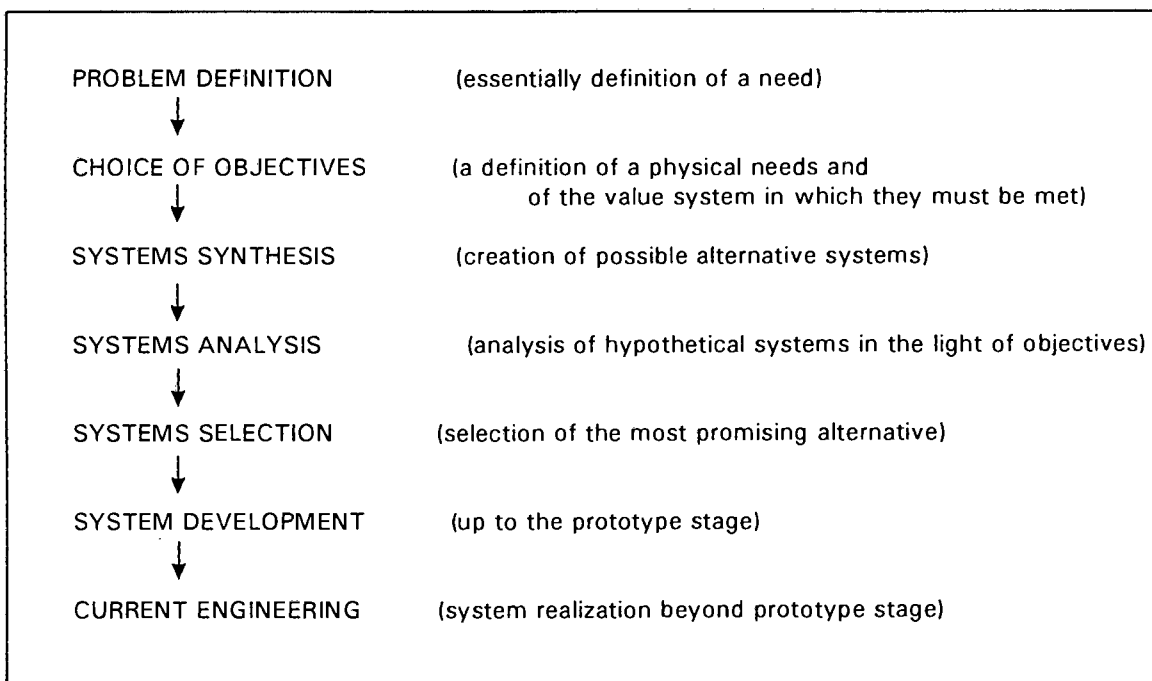


Figure 25 : Hard system engineering methodology.²⁰⁴

The hard systems engineering methodology is effective when the ends are clearly specified. However Checkland²⁰⁵ argues that *"selecting a means to achieve a defined objective constitutes only a small part of managerial decision making. Most management problems, cannot be formulated as hard problems in this way, and it would be surprising if methodology devised for problems which are 'hard' in this sense survived in tact the transfer to soft problems in which the inability to define precise objectives is at the core of the problem situation."*

²⁰⁴ Ibid.,p.136

²⁰⁵ Ibid.,p.144

Checkland²⁰⁶ defines two types of problems. The first type are *"structured problems which can be explicitly stated in a language which implies that a theory concerning their solution is available."* It is hard systems engineering methodology which is particularly useful in solving these structured problems.

The second type of problems are unstructured problems which *"are manifest in a feeling of unease but which cannot be simply stated without appearing to over simplify the situation."*

6.2 METHODOLOGICAL PRINCIPLES FOR A SOFT SYSTEM DESIGN PROCESS

In light of the discussion in the previous section, a number of methodological principles can be derived which should be used as a rationale basis for developing a 'soft system' design process which take cognisance of the social nature of unstructured problems when designing and implementing new 'human activity systems'.

6.2.1 MULTIPLE DESCRIPTIONS OF A PROBLEMATIC SITUATION

"Problematic situation: a nexus of real world events and ideas which at least one person perceives as problematic." - Checkland²⁰⁷

A specific characteristic of unstructured problems is that although they are recognizable they will not be defined in the same way by different observers. Furthermore, the content of unstructured problems changes with time and the *"influences to which they are subjected are so numerous that the passage of time always modifies the perception of the problem."*²⁰⁸

Different observers will also observe the same situation and define different problematic issues. Mitroff²⁰⁹ stresses the importance of recognizing that *"there are equally legitimate stories based on alternative sets of a priori assumptions."* Mitroff²¹⁰ continues that there is a requirement for *"active participation of the decision maker in the inquiry process. The decision maker must view the range of representations of societies problems and decide which one applies to the situation at hand."*²¹¹ This range of representation is in the form of various perspectives (stories) based on different world views. Mitroff continues to say that as a result of viewing a range of perspectives it is possible for all participants in the inquiry to produce *"a new model which is a creative synthesis of the initial ones."* According to Mitroff²¹², where two perspectives are operating from different / polarized assumptions the debate which follows will place the *"observer or decision maker in a stronger position to form his or her own position on a key issue."* It is therefore

²⁰⁶ *ibid.*,p.154

²⁰⁷ *ibid.*, p.316

²⁰⁸ *ibid.*,p.155

²⁰⁹ I. Mitroff and H. Linstone, *The Unbounded Mind*, (New York : Oxford Press, 1995),p.121

²¹⁰ *ibid.*,p.63

²¹¹ *ibid.*,p. 63

²¹² *ibid.*,p.79.

important to ensure that several participants, including the decision makers, are involved in the defining of problematic situation.

6.2.2 HUMAN BELIEF SYSTEMS

Flood and Jackson²¹³ argue that we all *"tell a particular story of the world based on taken for granted a priori assumptions."* An a priori assumption is one which begins from a set of axioms which are assumed to be true, rather than from experiences which have been undergone. World views of people are developed based on these a priori assumptions which form the belief (value) system of the individual. Flood and Jackson²¹⁴ continue to argue that certain *"world views cannot be seriously challenged by presenting them with new facts, which they will simply interpret according to their fixed presuppositions (world views) ."*

Strümpfer²¹⁵ suggests that managers and owners of enterprises fear the social systems based alignment and empowerment mode:- *"the business of alignment is feared because this is perceived as another gimmick to implement the traditional control structures, and avoid the empowerment bit because that is a sure route to censure in the hierarchical control structure"*.

The mechanistic view of reality is deeply embodied in anyone who has a western style education.²¹⁶ This results in the implementation of the Machine model of organization as a consequence of its simplicity and alignment with the mechanistic paradigm.

6.2.3 LEARNING AND CHANGE

"Certain experiences build up habits of expectation in the observer, and when this habit is broken upon by some unexpected event, the mind changes from belief to doubt, and should undertake a process of inquiry to explain the unexpected fact." - Peirce²¹⁷

When action is taken to bring about improvements in an undesirable complex problematic situation, the rationale for the specific action taken is based on some model of the dynamics of the undesirable situation and another model of how the dynamics will be expected to change if a specific action is taken. However, when the improvement actions do not produce the expected results, a feeling of doubt and uncertainty in the model used as a basis for action should be created. Where a mismatch is experienced and desired outcomes are not achieved, the designer has two alternatives (see Figure 26) :

²¹³ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.121

²¹⁴ Ibid.,p.121

²¹⁵ J. Strümpfer, 'Ensuring Delivery Through Organizational Design', International System Thinking Conference, University of Cape Town, November 1997

²¹⁶ Ibid., p.12

²¹⁷ C. Peirce, cited by, E. Reilly, *Charles Peirce's Theory of Scientific Method*, (New York: Fordham Univ. Press, 1970),p.30

1. Take additional action based on existing 'as-is' system conception - termed 'single loop' learning; or
2. Reflect upon the relevance of the 'as-is' system conception, adjust it such that it is aligned with the outcome of the previous action, and take additional action on this improved system conception - termed 'double loop' learning.

Doubt and uncertainty are the first elements of the thinking process which results in learning. There must be a desire to understand the underlying causes of events which "creates the dissatisfaction of having a sense of doubt."²¹⁸ Double loop learning occurs when a mismatch between expected and desired outcomes occurs, and before actions are taken to correct the mismatch, the underlying tacit mental models which govern the individuals actions are questioned and possibly altered as a result of the mismatch experience. Should this not happen, single loop learning will occur with the tacit or a priori mental models never being questioned (i.e. no development of underlying beliefs and world views will occur.)

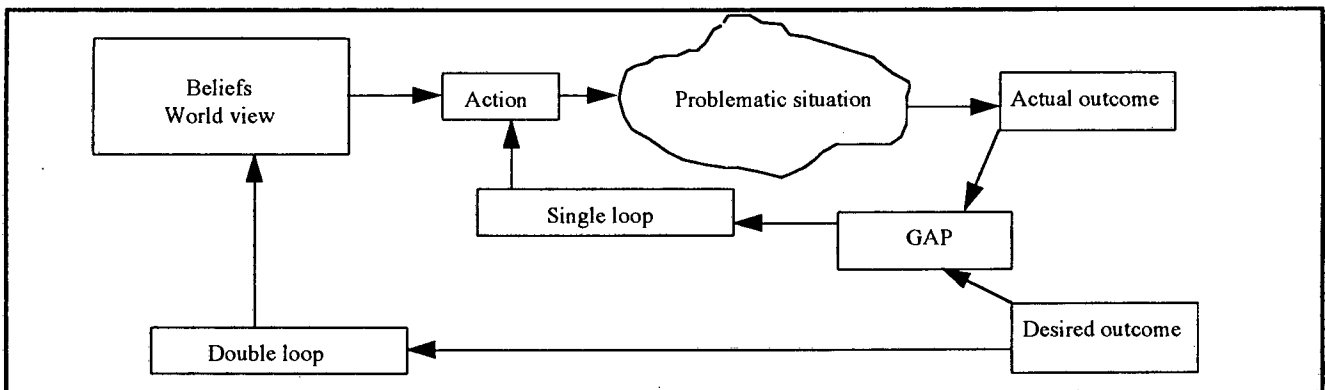


Figure 26 : Single and double loop learning.²¹⁹

The above mentioned learning process is aligned with Handy's²²⁰ theory of learning (see Figure 27). Handy²²¹ describes the theory of learning as the "theory at the heart of changing."

The theory of learning starts with a question (a problem, dilemma, uncertainty or doubt) to be resolved. An idea or theory is then developed as a possible answer to the question. The next step involves testing the solution followed by reflecting on the results of the test in terms of expected results. Reflection interprets the success or failure of the proposed solution (theory) to the problem. Depending upon the outcome of the reflection, a new question may exist (and hence the cyclical nature of the learning theory).

²¹⁸ Ibid.,p.15

²¹⁹ T. Ryan, 'A Note on Learning from Reading', Course Material, School of Engineering Management, University of Cape Town, p.3

²²⁰ C. Handy, *The Age of Unreason* (London: Arrow Books, 1991),p.45

²²¹ Ibid.,p.45

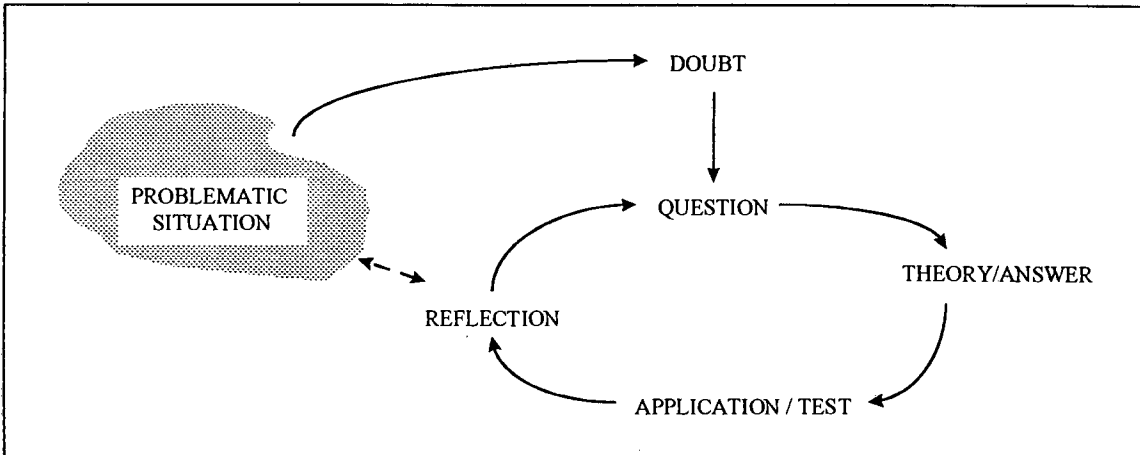


Figure 27 : Handy's 'cycle' of learning.²²²

6.2.4 COMPLETE REDESIGN OF THE WHOLE

As a result of the interconnected and complex nature of the enterprise, systemically desirable improvements cannot be achieved through 'quick fix' changes which attempt to 'plug holes' in the enterprise. For an enterprise to have its mode of organization changed significantly the entire underlying systemic structures of organization which give rise to the unwanted behavioural patterns must be replaced.

In cybernetic terms, the implementing of a sub set of the VMM model principles will not place the enterprise in a new 'basin of stability' (refer to cybernetic principles in section 2.4.3). The full set of principles must be implemented to bring the enterprise into a new basin of long term stability. Strümpfer²²³ believes that organizing correctly should be a 'deliberate' organization of the parts for the enterprise to achieve its purpose.

6.2.5 CHANGING THE STATE OF A COMPLEX SYSTEM

The previous section described the requirement for complete redesign of the whole. This complete redesign raises a concern regarding the implementation of a completely new design where an existing design already exists.

Two different approaches to implementing changes to a system exist, namely evolutionary change and revolutionary change. The difference between these approaches can best be described in terms of an analogy drawn from the field of electronic systems (physical designed systems) where the output of a designed

²²² Adapted from : T. Ryan, 'A Note on Learning from Reading', Course Material, School of Engineering Management, University of Cape Town, p.3

²²³ J. Strümpfer, 'Designing the Design Process Workshop', University of Cape Town, School of Engineering Management, 17-18 April 1997

physical system is required to be changed from one stable state to a different stable state²²⁴.

To bring about instantaneous changes in the output of an electronic system a step input is applied which is expected to bring the output to the new desired level. This step input creates dramatic disturbances within the designed system until after a period of time the system returns to a new stable state which is a function of the new input. This will be referred to as revolutionary change (see Figure 28).

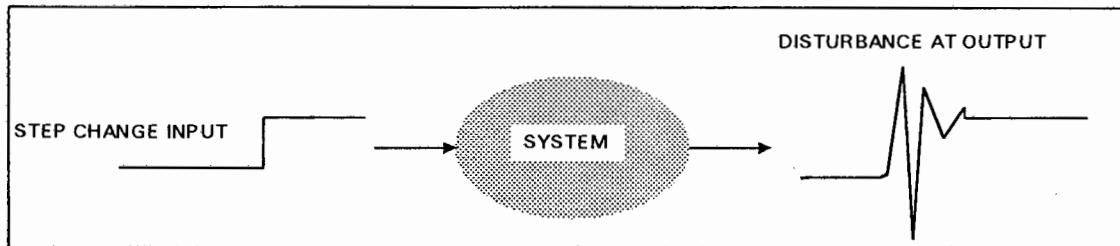


Figure 28 : Revolutionary approach - step changes to a system state.

An alternative to a revolutionary approach is an evolutionary one which attempts to make gradual changes in system states. This would require the gradual increase on the system input until the system output reached the required level. This would not (in most cases) produce the dramatic disturbances in the system output (see Figure 29).

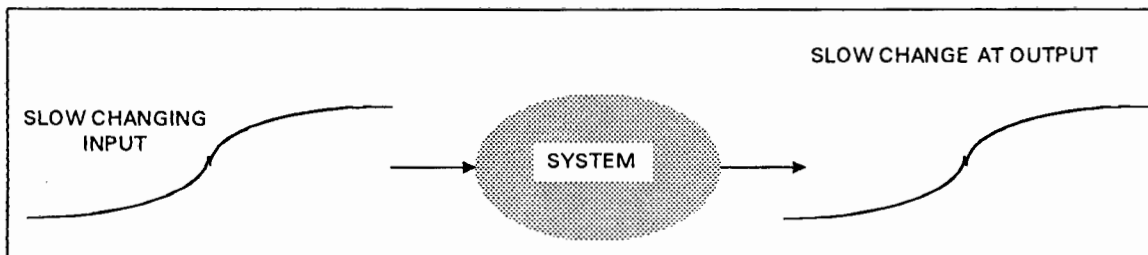


Figure 29 : Evolutionary approach - Gradual change to a system state.

It is the writer's opinion that an evolutionary approach is most suitable when considering changing the state of a complex social (human activity) systems. A sudden step change would create disturbances (disruption) in the situation which will not necessarily bring about the required improvements - the new design will not describe the new system completely. If this social situation is an enterprise, this disturbance could result in massive loss in productivity and motivation.

²²⁴ The writer is aware that this analogy is a simplification of what is a highly complex topic, however the writer believes that the analogy is useful for the reader in the context of this dissertation.

6.3 DESCRIPTION OF THE SOFT SYSTEM ENTERPRISE DESIGN PROCESS²²⁵

"The process of planning is more important than the actual plan produced."-
Ackoff²²⁶

Strümpfer²²⁷ believes that developing an enterprise design should be viewed as a problem solving process which can be facilitated using a set of 'systems approach' problem solving tools. Figure 30 represents the a proposed 'soft system idealized enterprise design' methodology. The design process has the methodological principles described in section 6.2 as its basis and consists of 7 sub-processes.

6.3.1 ESTABLISH NEED FOR CHANGE IN DECISION MAKERS

The purpose of the first sub process is to establish a need for change in decision makers. This is a significantly difficult task, considering the fact that most decision makers will hold the mechanistic paradigm. Without capturing the support of the decision makers the design exercise will not be possible. The purpose of the sub process is to create a definite sense of unease with the status quo amongst the decision makers. Strümpfer²²⁸ believes that scenario planning exercises provide a useful approach which can *"creates a felt need for change."*

Schwartz²²⁹ defines the purpose of scenarios as a way of helping change the view of reality - *"to match it up more closely with reality as it is, and reality as it is going to be. The end result , however, is not an accurate picture of tomorrow, but better decisions about the future. The planner and the executive are partners in taking a long view."*

²²⁵ The underlying basis of the enterprise design process is an outcome of a 'Designing the Design Process Workshop', University of Cape Town, School of Engineering Management, 17-18 April 1997, facilitated by J. Strümpfer.

²²⁶ R. Ackoff cited by R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.48

²²⁷ J. Strümpfer, 'Designing the Design Process Workshop', University of Cape Town, School of Engineering Management, 17-18 April 1997

²²⁸ Ibid.

²²⁹ P. Schwartz, *The Art of the Long View*, (New York : Doubleday, 1991),p.9

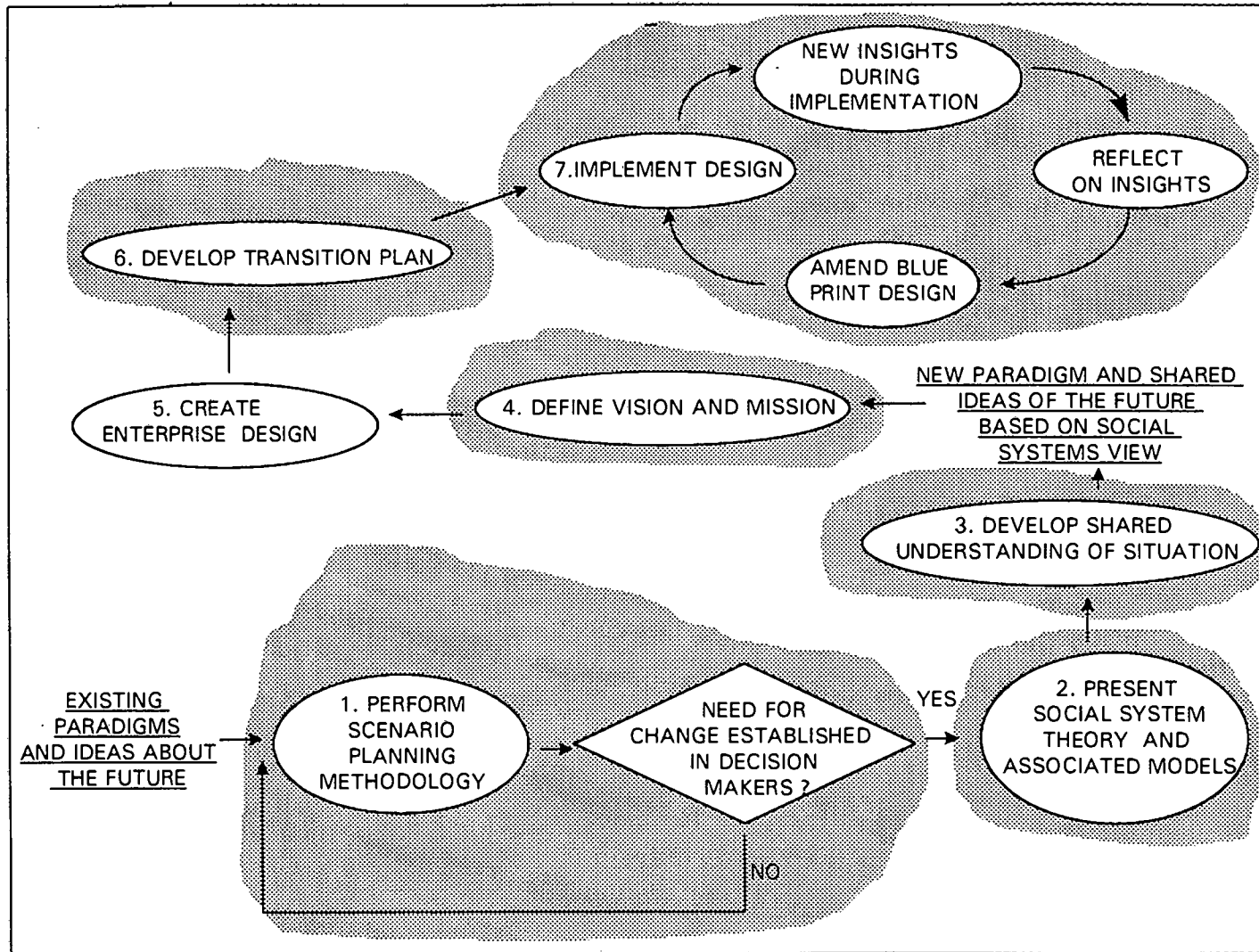


Figure 30 : Soft systems enterprise design process.

Schwartz²³⁰ presents a scenario planning methodology which can be used to change the mind sets of decision makers. The methodology consciously acknowledges that *"to operate in an uncertain world, people need to be able to re-perceive - to question their assumptions about the way the world works, so they can see the world more clearly."*

Performing a scenario planning exercise with decision makers should create a sense of doubt in the status quo. Without having buy in from the decision makers, the cycle of learning cannot be started and the probability of achieving a comprehensive, acceptable design is very low.

6.3.2 PRESENT SOCIAL SYSTEM THEORY AND ASSOCIATED MODELS

Given that the decision makers are sufficiently concerned with the status quo, they should be looking for answers (theory) which will remove the sense of unease. The social systems paradigm should then be presented and it should be described how the alternative paradigm resolves the dilemmas of the mechanistic paradigm.

By providing the decision makers with a new paradigm, they will be placed in a better position to re-perceive the existing situation based on the new paradigm.

6.3.3 DEVELOP SHARED UNDERSTANDING OF SITUATION

Given that the decision makers understand the philosophy and principles of the new social systems paradigm and the associated models of organization (i.e. the VSM, IMM and MDO), it is necessary to achieve consensus amongst the decision makers regarding the nature of the problematic situation which they are faced with.

Although the decision makers may all agree that change is necessary and that the social systems approach is the best solution, it could be that they all have different perceptions regarding the nature of the problematic situation. It is now necessary to develop a shared understanding of the situation. The development of a shared understanding of the situation would include a consideration of the boundary of the system in focus.

Systems methodologies which can be used as tools to facilitate this sub-process are :

- 'Soft system methodology : Developed by Checkland²³¹ and uses system ideas to facilitate problem solving in the real-world (unstructured problems) through the use of debate amongst participants;

²³⁰ A description of Shwartz's methodology is outside the scope of this dissertation. Interested readers can refer to : P. Schwartz, *The Art of the Long View*, (New York : Doubleday, 1991)

²³¹ For a comprehensive description of the Soft Systems Methodology please consult : P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.149

- Viable System Diagnosis : Developed by Beer²³² and uses the VSM as a tool to diagnose 'problems' of organization.

6.3.4 DEFINE IDEALIZED ENTERPRISE VISION AND MISSION

Strümpfer²³³ believes that, *"problem solving should build a shared understanding of the problem, alignment with respect to ends (this does not mean ends must be specified - it only checks for alignment); and agreement on action (which creates incentive for change)."*

The previous sub processes should have created a shared understanding of the problem situation as well as agreement that there is a need to re-organize using the VMM model of organization as a basis. The next step is to create alignment with respect to ends. Strümpfer²³⁴ defines alignment with respect to ends as alignment amongst the participants concerning the vision and mission of the enterprise. Senge²³⁵ defines these components as *'the what' or 'picture of the future' and the 'the why' or 'purpose for existence'*.

Flood and Jackson²³⁶ define a mission as *"a general purpose statement incorporating the organizations responsibilities to its environment and stakeholders, and propounding a vision of what the organization could be like which generates commitment."*

The vision and mission should be an idealized description of what 'ought' to be, based on the shared understanding of the problematic situation.

6.3.5 CREATE IDEALIZED ENTERPRISE DESIGN

Given that alignment with respect to ends has been achieved amongst participants, it is necessary to perform a redesign of the enterprise which will provide the underlying structures of organization to achieve the vision and mission of the enterprise.

The design methodology is based on a set of enterprise design questions which are structured around Strümpfer's system viewpoints framework. The set of questions is derived from the Viable Multidimensional Model (VMM) model of organization.

Strümpfer recommends that the design process begins from the process viewpoint - it is necessary to design the processes which would be used to deliver the outputs required by the stakeholders.

²³² For a description of Viable System Diagnosis please consult : R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.87

²³³ J. Strümpfer, 'Designing the Design Process Workshop', University of Cape Town, School of Engineering Management, 17-18 April 1997

²³⁴ Ibid.

²³⁵ P. Senge, *The Fifth Discipline*, (New York : Doubleday Publishers, 1990)p.223

²³⁶ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.151

1. Business Process Re-engineering (Process Viewpoint)

"A system which serves another cannot be defined and modeled until a definition and model of the system being served is available." - Checkland²³⁷

Mitroff and Linstone²³⁸ define stakeholders as *"any individual, group, organization, institution that can affect as well as be affected by an individuals, groups, organizations, or institutions policy or policies ... - an organization is the entire set of relationships it has with itself and its stakeholders. An organization is not a physical "thing" per se but a series of social and institutional relationships between a wide series of parties."*

Simplistically stated, Business Process Re-engineering²³⁹ (BPR) is concerned with the inputs, outputs and transformations required to fulfill a particular output. BPR should begin with defining the stakeholder which will be served by the 'system' under consideration and the associated outputs which the stakeholders require from the system. This process should include the stakeholders inputs, otherwise the enterprise designers would design an enterprise for the assumed needs of the stakeholders (most importantly the customers).

BPR is used to design processes which will achieve the required output in an efficient manner. System Dynamic Modeling is a systems based tool which can assist with the Business Process Re-engineering task.

The output of the BPR will be a series of inter-linked transformations providing a specific output. Strümpfer suggests that the next step is to identify group transformations which fulfill similar functions.

2. Grouping Transformations (function viewpoint)

Strümpfer suggests that transformations which fulfill a similar function within the context of the containing system should be grouped together. This grouping of transformations into similar functions moves the design to the function viewpoint.

The concept of 'purpose' is fundamental to the grouping function. Grouping transformations which fulfill similar purposes provides an efficient means of managing variety and ensuring that the enterprise remains aligned with respect to purpose using an external meta-management system.

²³⁷ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994), p.237

²³⁸ I. Mitroff and H. Linstone, *The Unbounded Mind*, (New York : Oxford University Press, 1995), p.142.

²³⁹ The philosophy, principles and methodology of Business Process Re-engineering are not within the scope of this dissertation.

The spreading of purpose throughout the enterprise design and providing a rational scheme of structuring the grouped transformation can be implemented using specific structural principles of the VSM and the MDO as a basis.

3. Providing an element of structure (structure viewpoint)

Providing structure requires dividing the transformations for purposes of regulation (communication and control). The VSM proposes a recursive structure which spreads 'viability' and purposefulness to all levels of the enterprise.

The Multidimensional models main idea is that labour can be divided into three dimensions (the MDO allows for a recursive structure). It is therefore necessary to divide the grouped elements into the MDO's proposed, input, output and market segments.

Up to this stage of the design process, a structure of purposeful transformation elements (parts) exists, with clear definitions of what flows between the transformation elements (i.e. process.)

The next step in the design process is to provide a regulatory system to ensure that the structured transformation activities have behave as a whole and at the same time continuously changing to deal with the fast changing external environment.

4. Providing regulation (Regulation viewpoint)

The VSM and IMM models of organization provide a set of enterprise design principles based on the principles of systemic control which provide a meta-management element and a self-organizing element.

6.3.6 DEVELOP TRANSITION PLAN

Implementing the new enterprise design is a complex task, especially considering how disruptive change is. To minimize this disruption, it is necessary to develop a carefully devised transition plan. This should be a participatory process which includes all decision makers effected by the changes. The approach to the development of a transition plan should be one of evolutionary change within fixed time scale.

6.3.7 IMPLEMENT DESIGN

Implementation of the design should be a carefully managed process, with significant reflection on the actual impact of changes compared to expected results. Implementation of the new design will inevitability provide new insights into the nature of the enterprise and could result in continuous amendments to the blue print design. If an inquirer wants to understand something well, then the inquirer should try changing it²⁴⁰.

²⁴⁰ M. Smith, R. Thorpe and A. Lowe . *Management Research : An introduction* (London:Sage, 1993),p.8

6.4 CONCLUSION

This chapter has described a process for creating an idealized enterprise design within the context of complex human activity systems. The difficulty in the process revolve around the concept of 'practical reason', where it is necessary to get multiple participants (each with different world views and motives) to agree on the nature of the problematic situation and the idealized 'ends'. In certain cases, participants will not perceive a problem at the start of the process and would find it difficult to take an active interest in the process. The process is dependent upon participants reaching consensus on the nature of the problems and agreement on a plan of action to resolve the problem - *"An idealized design is one which the relevant stakeholders would replace the existing system with today if they were free to do so."*²⁴¹

The process described is from the perspective of organizational structure and ignores the culture of the organization. According to Handy²⁴² there are several cultures (which he compares to Greek gods) which can exist within an organization and *"each culture works on quite different assumptions about the basis of power and influence, about what motivates people, how they think and learn, how things can be changed. These assumptions result in quite different styles of management , structures, procedures and reward systems. Each will work well in certain situations, but get the wrong god (culture) in the wrong place and there will be trouble."* Senge²⁴³ argues that *"a vision not consistent with the values (culture) that people live by day by day will not only fail to inspire genuine enthusiasm, it will also foster outright cynicism."*

In a real life application, it would be necessary to involve several other processes, operating in parallel, which will focus on aligning the values / culture of the people and the organization with the requirements of a particular structure. This should support the vision and mission of the organization.

²⁴¹ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.150

²⁴² C. Handy, *Gods of Management*, (Business Books, 1991),p.11

²⁴³ P. Senge, *The Fifth Discipline* (New York : Doubleday, 1990)p.223

7. A DESIGN METHODOLOGY FOR AN 'INDIVIDUAL EFFORT' CONCEPTUAL ENTERPRISE DESIGN

"The fundamental triangle of societal problem solving requires that a team, working with the appropriate methodology, addresses the issue to be resolved. Because of the extensive difference between an individual and a group, it would be astonishing if the same methodology of exploration or inquiry would be equally effective for individuals and groups." - Warfield²⁴⁴

A principle which has been carried throughout this dissertation is that different observers will create different system conceptions of the same external reality. It has also been suggested that one of the challenges of practical reason is to ensure that there is consensus that the nature of the ends has been sufficiently debated, and that the ends are acceptable to those responsible for the design as well as those effected by the design. The previous chapter presented a methodology which embodies these ideas in an attempt to create an 'idealized design'.

A concern is that this 'idealized design' methodology is not used practically in the context of this dissertation. The scope of work involved in using the methodology in practice is significantly large, particularly in a context where management of the enterprise do not perceive any significant problems with the status quo from an 'organization' perspective. To obtain commitment to the extent that a participatory design process could be achieved is significantly difficult.

The approach taken by the writer to overcome this dilemma has been to develop a conceptual²⁴⁵ enterprise design as an 'individual effort' in an attempt to illustrate an understanding of how a design could be implemented.

7.1 ACTUAL DESIGN METHODOLOGY USED

The actual design methodology used is an extremely limited version of the design methodology described in the previous chapter. The methodology used consists of only two elements of the idealized design process described in the previous chapter, namely :

- A description of the writers perception of the Network Build divisions mode of organization and the associated dilemmas of organization faced by the Telkom Network Build division; and
- A proposed conceptual enterprise design which could resolve these dilemmas (individual effort design).

²⁴⁴ J. Warfield, *Societal Systems*, (California: Intersystems Publications, 1989), p.42

²⁴⁵ The term 'conceptual' is explicitly used as a consequence of the definition of 'idealized' in the previous chapter.

7.1.1 DESCRIPTION OF CURRENT DILEMMAS OF ORGANIZATION

The inputs which were used to describe the existing Telkom Network Build mode of organization and to create develop the synthesis of the organizational dilemmas (presented in chapter 8) are :

1. Interviews

Interviews were conducted with the line managers of the Network Build divisions. A set of questions developed by Dodds and adapted by Strümpfer²⁴⁶ are used as a basis for the interviews. The questions were based on Strümpfer's system viewpoint framework. The interviews mainly provided insights into the existing structure, process and regulation of the Network Build division.

2. Existing research

During November and December 1996 a 'climate survey' was performed by external consultants. The survey required that employees respond to questions covering several categories concerned with prevailing conditions within the company. The purpose of the survey was to measure staffs perceptions of Telkom and its management.

3. Enterprise design theory

The theory developed in chapters 3 and 5 was used as a 'diagnostic tool' to identify problems with the existing mode of organization.

7.1.2 CREATION OF THE CONCEPTUAL DESIGN

The same design process which is described in section 6.3.5 was used in the individual effort application, however it was not based on a participative process. Table 14 represents the design questions which were used by the writer to facilitate the design.

Table 14 : Enterprise design questions.

Process Viewpoint (How do the parts interrelate ?)
Is there evidence of market interactions between parts ?
Who are the stakeholders being served by the whole / parts ?
What are the requirements of the stakeholders ?
What processes (inputs, transformations and sub-outputs) produce the outputs required by the stakeholders ?

²⁴⁶ J. Strümpfer, Course Material, Programme for Systems Management, Unit 1, Organizational Design, 1992.

Table 14 : Enterprise design questions...

Function Viewpoint (What is the purpose of the whole ?)
What is the overall purpose of the enterprise (whole) ?
How can the process transformations be grouped in such a manner that transformations fulfilling similar purposes are grouped together ?
How do the purposes of the grouped transformations contribute to the purpose of the whole ?
What functions are required to ensure viability ?
Structural Viewpoint (What are the parts ?)
How can the grouped transformations be arranged in a multidimensional structure ?
What identifiable levels of recursion exist between the parts ?
Regulation Viewpoint (How should the whole be put together ?)
How can market principles be introduced to regulate interactions between parts ?
What are the important system variables (measure performance) of the parts ?
What constraints are placed on the parts in terms of limits to system variables ?
What feedback mechanisms are in place to ensure that corrective feedback action is taken when system variables move out of agreed limits ?
What mechanisms are there to ensure that communication links between the parts and recursive levels do not fail ?
What indication is there that units have operating autonomy ?
What mechanisms are in place to ensure that the enterprise adapts to the external environment ?
What is the function of top management ?
What channels of communication exist between the parts ?
Is the focus of top management (leaders) on policy and ensuring a dynamic balance between the changing external environment and day to day operational requirements ?

The next chapter will present a synthesis of the outcomes of the writers inquiry into the existing mode of organization of the Telkom Network Build division.

8. TELKOM NETWORK BUILD AND ITS MODE OF ORGANIZATION

The previous chapter mentioned that for the purpose of this dissertation, an 'individual effort' design methodology would be used. The purpose of this chapter is to present a synthesis of the 'individual effort' inquiry into the Telkom Network Build divisions mode of organization.

The chapter argues that the Telkom Network Build division appears to be operating in the authoritarian mode of organization as a consequence of the principles of the Machine model being used as basis for organization. The evidence of the authoritarian mode of organization and the associated dilemmas of organization which are being experienced are described.

However, before details of the current mode of organization are described, a brief introduction to Telkom and the Network Build division is presented.

[Appendix D presents more detail on the Telkom Network Build division and a high level overview of Telkom's Technology and Network Business Unit (TNBU) in which the Network Build division is contained.]

8.1 BACKGROUND TO TELKOM

Telkom is the South African telecommunications operator which has been allocated a license by the Minister of Posts, Telecommunications and Broadcasting to *"construct maintain and use the Public Switched Telecommunications Network in the republic and to provide Public Switched Telecommunication Services."*²⁴⁷

Prior to 1991 Telkom was a division of the Department of Post and Telecommunications. In 1991, Telkom was transformed to a commercial venture (parastatal), with the South African government retaining 100% of the company's shares.

Subsequent to commercialization in 1991 several changes have taken place within Telkoms' internal and external environment :

- A new government was elected in 1994 which resulted in a change in the country's political environment. These changes have resulted in South Africa coming out of isolation and becoming part of the global community. This has increased the requirement for a world class, quality telecommunications network which can be used South African companies operating within the global business environment.
- Two license were issued to mobile telephone operators to provide mobile voice communication. This provided direct competition with Telkom's fixed line public telephone service.

²⁴⁷ South African Government Gazette, 7 May 1997, pg. 20

- A new 'Telecommunication Act' was adopted by parliament in 1996. This act made provision for the allocation of a license to provide switched public telecommunication services. The license contains several clauses which specify the performance required by the license holder (Telkom):
 - Telkom retains the monopoly for providing telecommunication services for the next 5 years. Thereafter, Telkom will be exposed to competition in the provision of a switched public telecommunications network.
 - Specifies the requirements for the number of new telephone lines to be rolled out (see Figure 31). A penalty provision is also included for failure to achieve the roll out targets set by the license.

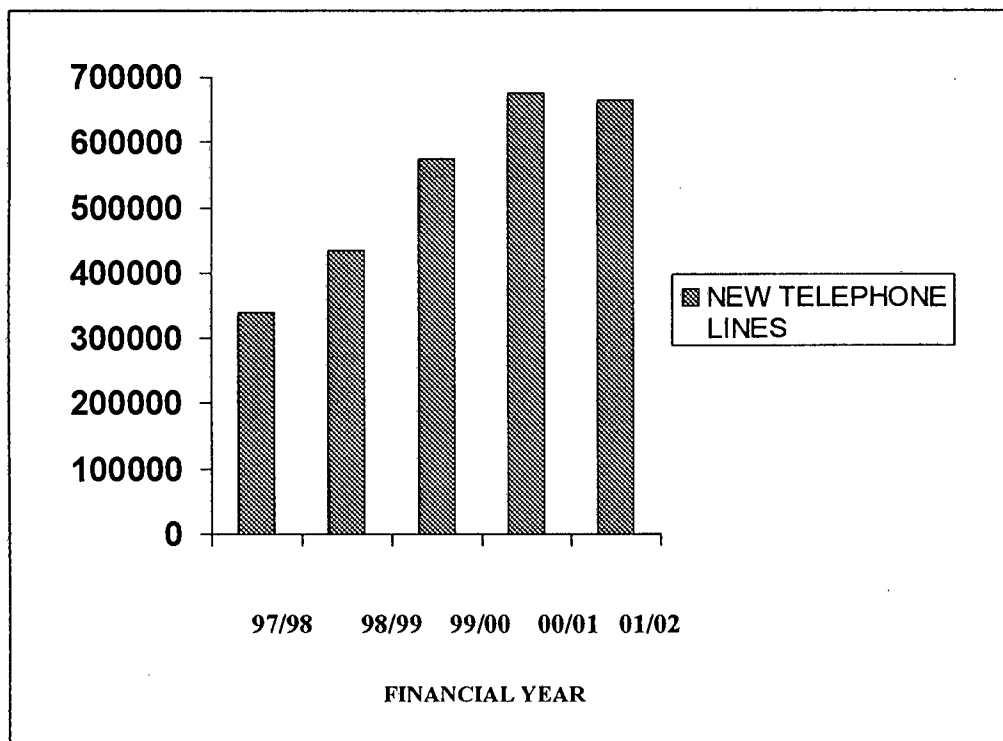


Figure 31: New line roll out targets ²⁴⁸.

Re-organization and network build initiatives were launched in response to the above mentioned changes in Telkom's environment. The purpose of the two initiatives were to ensure Telkom's survival and development in the new global environment.

²⁴⁸ South African Government Gazette, 7 May 1997, pg. 59

8.1.1 RE-ORGANIZATION INITIATIVE

The re-organization initiative is an attempt to transform Telkom from a large, bureaucratic hierarchy into a more customer focused and efficient enterprise. One of the components of the re-organization was a structural change. Telkom was changed from a functional hierarchy into several business units. The basis for dividing the enterprise into business units was the telecommunications service provision value chain.

Figure 32 illustrates the new Telkom business units, each with their own focus area.

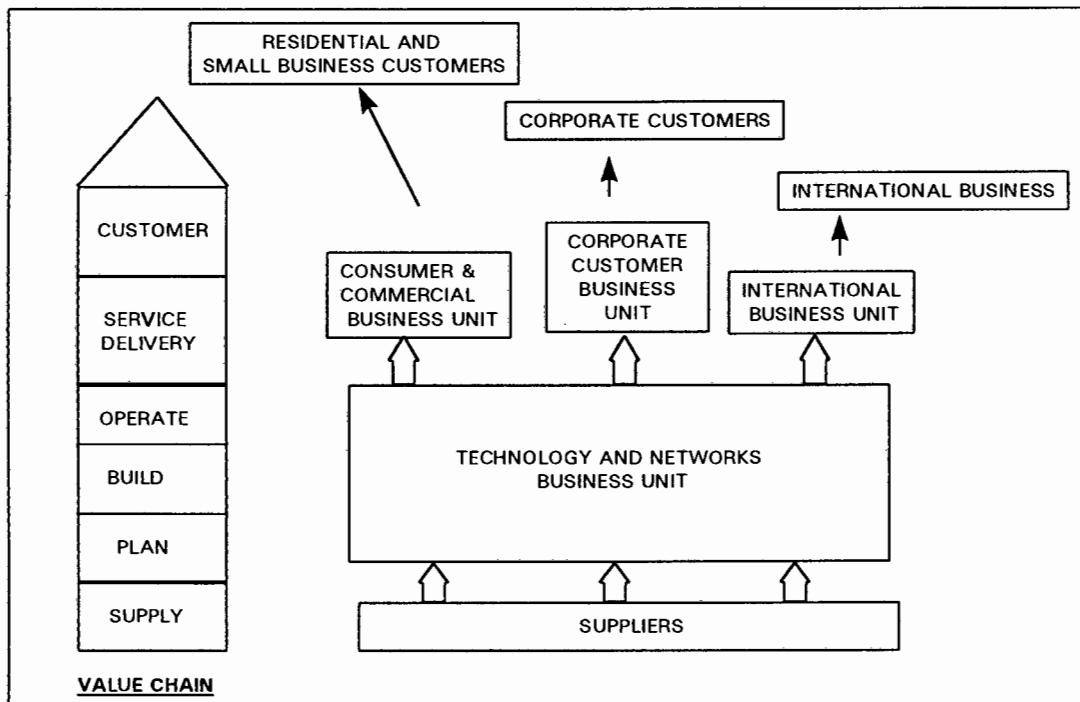


Figure 32: Telkom Business Units.

8.1.2 NETWORK BUILD INITIATIVE

The network build initiative is focused on expanding the network capacity (and thereby increasing the customer base) and improving the network service quality. This is an attempt to achieve the targets set by the telecommunications license agreement.

Service quality will be improved by upgrading the existing network to a fully digital network. The 'new line' targets will be satisfied by rolling out the 2.6 million new telephone lines by the end of the 2000/2001 financial year (refer to Figure 31).

It is in the regional 'Network Build' division where most of the pressure lies to fulfill the requirements of the license agreement as they are responsible for the planning and installing of the new lines.

8.2 TELKOM'S NETWORK BUILD DIVISION

The 'Network Build' division is a part of the Technology and Network Business Unit (TNBU) and is located in each of the regions of South Africa.

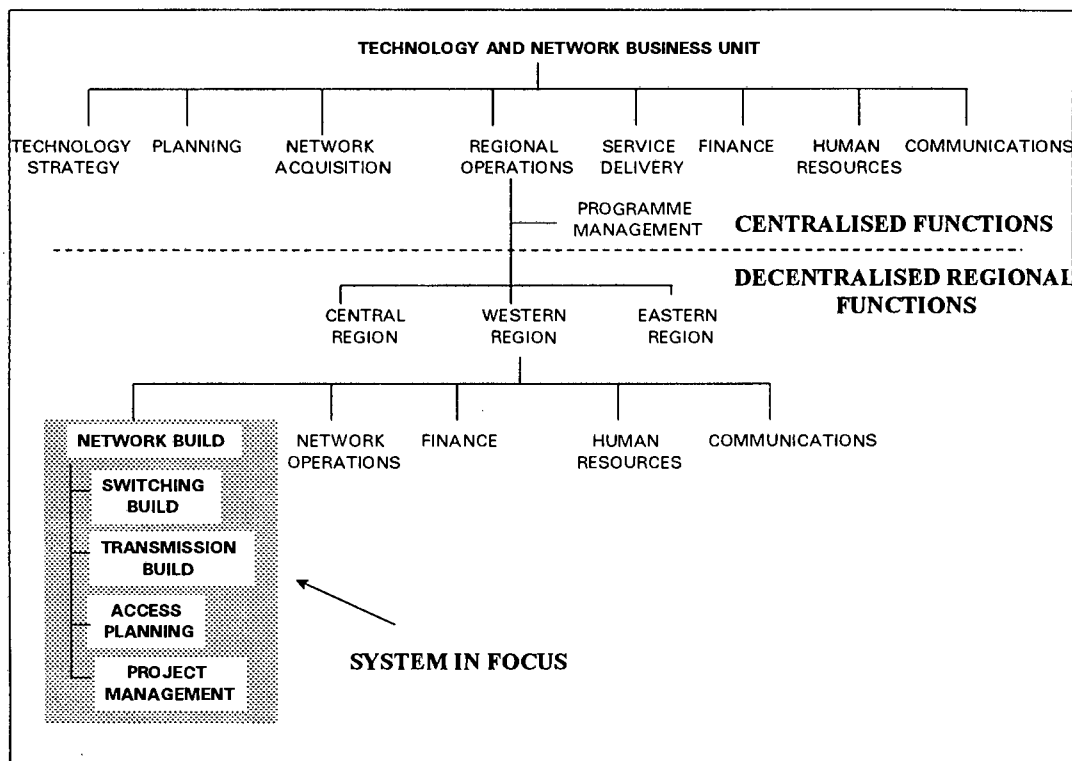


Figure 33 : Technology and Network Business Unit - Regional Operations.

It is a concern of this dissertation that the Network Build division is not organized appropriately to deal with the above mentioned challenge of rolling out the new network. Furthermore, a number of challenges will be experienced in the future competitive environment (i.e. when additional fixed line licenses are allocated) for which Network Build must be organized to adapt to the fast changing environment.

8.3 NETWORK BUILD : EVIDENCE OF THE AUTHORITARIAN MODE OF ORGANIZATION

It appears to the writer that the Machine model of organization has been used as a basis for designing the underlying systemic structures of organization for the Network Build division (refer to Table 15 on page 88). In no cases could evidence of systemic structures which correspond to the Viable Multidimensional Market (VMM) model of organization be found.

Results from a 'Climate survey'²⁴⁹ substantiates that the mode of organization could be perceived as being authoritarian (see Figure 34). The survey reflected that management feel that there are high levels of control and low levels of autonomy :

- Decision making centralised : reflects strong implementation of the scalar chain of command and authority;
- Too much time in meetings : reflects that there is not adequate co-ordination between the divisions and little understanding of how the enterprise operates;
- Too many approvals for routine decision making : reflects very low levels of autonomy and high levels of control.

According to the survey²⁵⁰, "Most managers (85 percent) feel that too much time is spent in meetings. Another 78 percent feel decision making is too centralised, and only 31 percent think the opinions and thinking of managers at their level are taken into account by top management. Less than 33% think that decision making authority is clear. Many managers (44 percent) are also frustrated that their decision making powers are not equal to their level of responsibility".

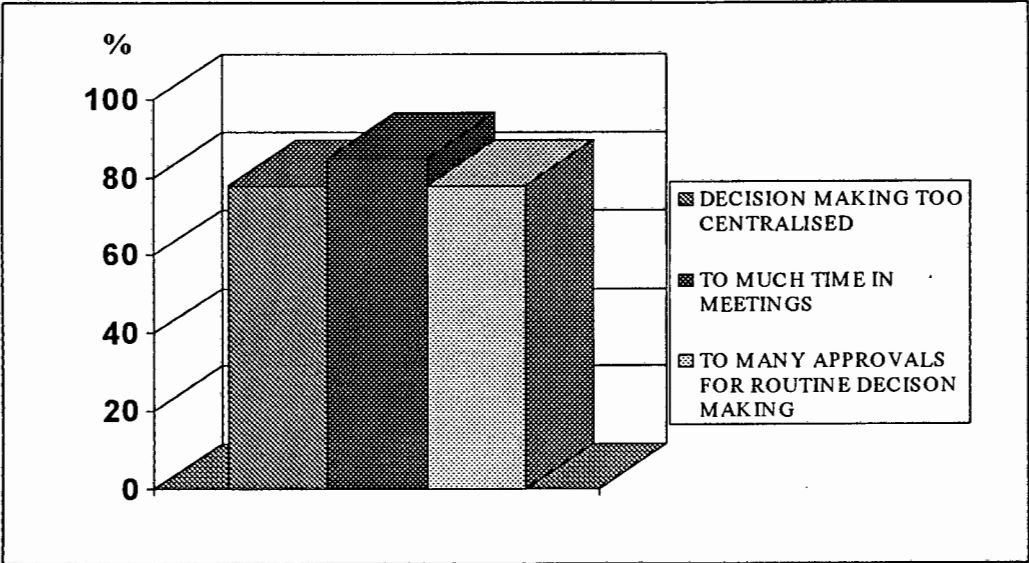
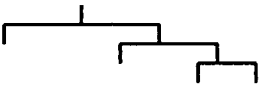


Figure 34 : Decision-making and authority : perceptions of management.

²⁴⁹ A 'climate survey' was performed by external consultants in November and December 1996. The purpose of the survey was to inquire into the prevailing conditions within the company and to measure the staffs perceptions of Telkom and its management.

²⁵⁰ Source : 'Employee Survey Results', *Telefokus : The Magazine for the Telkom Manager*, August 1997.

Table 15 : Evidence of mechanistic underlying structures of organization in the Network Build division.

Mechanistic Principle of organization	Evidence in Network Build
<p><u>Span of control</u></p> <p>The number of people reporting to one superior must not be so large that it creates problems of communication and co-ordination.</p>	<p>A four level supervisory hierarchy has been established to ensure that adequate communication and control of the employees is retained within the Network Build division.</p> <p>1 : Senior manager, 2: Line managers, 3 : 2nd Level Supervisor, 4 : 1st Level Supervisors, 5 : 'Workers'</p>
<p><u>Division of work</u></p> <p>Management should aim to achieve a degree of specialisation designed to achieve the goal of the organization in an efficient manner.</p>	<p>Labour has been divided into different areas of specialisation using market, input and output functions as a basis for the division - however the division takes place at different levels within the enterprise (i.e. unlike the Multidimensional model).</p> <p>Network Architecture (Output) Geographic area (market) Technology type (input)</p> 
<p><u>Unity of command</u></p> <p>An employee should receive orders from only one superior.</p>	<p>The division of specialist labour and the supervisory structure have been assembled into a hierarchy with each employee in the hierarchy reporting to a single supervisor.</p>
<p><u>Scalar chain</u></p> <p>The line of authority from superior to subordinate, should be used as a channel for communication and decision making.</p>	<p>Information and commands are passed to workers via the supervisory chain of command. Supervisors make decisions as to what information is applicable to the next level 'downwards' based on the supervisors perception of what the information requirements of the next level are.</p>
<p><u>Authority and responsibility</u></p> <p>Attention should be paid to the right to give orders and to exact obedience.</p>	<p>The supervisors are held responsible for all staff reporting to them, including decisions and mistakes made by subordinates. Often, workers only accepts commands from their bosses.</p>
<p><u>Centralisation (of authority)</u></p> <p>Should always be present to some degree. This may vary to optimize the use of faculties of personnel.</p>	<p>Decisions making authority is centralised to line manger level. Supervisors are limited to decisions concerning the day to day operation of the divisions but may not make decisions concerning changes to the operation of the division.</p>

8.4 NETWORK BUILD : DILEMMAS AND CONCERNS OF ORGANIZATION

The previous section presented findings which indicated that the Machine model of organization had been used as a basis for organizing the Network Build division. Furthermore, survey findings were presented which indicated that managers and workers perceptions are that Network Build is operating in an authoritarian type mode.

Chapter 4 described a number of dilemmas which could be experienced by enterprises operating in the authoritarian mode of organization. The purpose of this section is to describe practical evidence of some of these dilemmas being experienced within the Network Build division. Examples of this practical evidence is :

- Network build does not acknowledge the external environment;
- Network Build parts are not appropriately aligned;
- Environmental complexity does not appear to be managed effectively;
- A social system (i.e. 'people populated system') is treated as a machine; and
- Other issues such as resource shortages and fragmentation of functions.

These are described in detail in the next sections :

8.4.1 ACKNOWLEDGMENT OF THE ENVIRONMENT

One of the base assumption of the Machine model (which provides the systemic basis for the authoritarian mode) is that the environment can be ignored. However, in a fast changing and competitive environment this assumption is no longer valid. Two factors account for the statement that environment is not acknowledged by Network Build :

1. Buffering of the production function from the external environment;
1. An obsolete network architecture continuing to be used as a basis for dividing labour.

1. BUFFERING OF THE PRODUCTION FUNCTION

From an operations management perspective, the Network Build division can be viewed as a production unit (or network factory) for the Technology and Networks Business Unit (TNBU). The regional Network Build divisions are responsible for the activities of producing the goods and services of the TNBU.

According to Chase²⁵¹, in most enterprises, the production unit is an internal function that is buffered from the external environment by other enterprise functions (e.g. sales). According to Chase, buffering the production function from

²⁵¹ R. Chase and N. Aquilano, *Production and Operations Management*, (Boston: Irwin Publications, 1992),p.6

direct environmental influences has traditionally been seen as desirable. Chase²⁵² argues that the rationale for this is that :

- The environment is viewed as a disturbing influence on production activities;
- The direct production process is often more efficient than the processes required for obtaining inputs and disposing of finished goods;
- The managerial skills required for successful operation of the production process are different from those required for successful operation of the boundary systems of marketing and personnel, for example.

Based on the inquiry into the Network Build division, it appears that this is the view reflected in the design of the Network build division. There are no mechanisms for interface with the external environment (i.e. no mechanisms for interfacing with the system being served by the Network Build division).

Chase argues that there are inherent disadvantages to production being an internal function. The disadvantages are :

- Information lags between boundary functions (i.e. between sales and production) - this leads to inevitable inflexibility;
- For high technology products in particular, communications between the shop floor and the customer can be extremely valuable in solving technical problems during production.

In a fast changing and competitive environment, flexibility and focus on the system being served is very important. It is the writer's opinion that the social systems model's principle of multidimensional division of labour can provide a basis for providing mechanisms for interfacing with the system being served (i.e. the market units).

2. OBSOLETE NETWORK ARCHITECTURE AS A BASIS FOR DIVIDING LABOUR

Figure 35 illustrates the rate at which new telecommunications services are becoming available. It is widely agreed that the telecommunications industry is one of the fastest changing of all industries. The reason for this view is locked up in the environmental changes around telecommunications. Some of these reasons are rather technical in this context. The readers patience is requested with this detail while the writer illustrates this point , because although the technical details differ, the same situation occurs in other organizations.

Technological changes, particularly in the access network (see section 15.1.2 for a description of the access network), have resulted in difficulties in accommodating the planning of new technologies in the existing framework of organization where there are separated transmission, switching and access planning divisions residing under different line managers.

²⁵² Ibid.,p.7

Traditionally the telecommunications system consists of three parts :

- An access network which consists of copper cables with specialist copper planners performing the planing function;
- A transmission network which consist of transmission technologies with specialist transmission planners performing the planning function;
- Switching units which specialist switching planners performing the planning functions.

This sub-division of the telecommunication network was therefore used as basis for dividing labour at the highest level of the Network Build hierarchy.

However today the telecommunications network architecture has changed significantly :

- Copper wire is becoming less desirable in the access network and new radio and fibre optic technologies are replacing copper. The nature of these technologies is significantly different to copper wire. Specific expertise are required to plan each of these technologies. Currently these expertise are spread throughout switching, transmission and access planning divisions. Planning a new 'wireless local loop' technology in the traditional copper based access network environment requires knowledge and expertise of :
 - radio planning (traditionally in the transmission division);
 - traffic planning (traditionally in the switching division);
 - customer distribution patterns (traditional in the access division);
 - equipment accommodation and power (transmission and switching division);

Therefore, access network planners who are traditionally trained to perform planning of underground and overhead copper cable networks require a completely new set of competencies which are currently distributed within the Network Build sub-divisions.

In addition to the revolutionary new technologies in the access network, traditional switching and transmission technologies which have been used exclusively in the transmission and switching environments are moving into the access network. This results in blurring of the traditional boundaries of transmission planning and switching planning.

All three planning divisions, resident under different line managers, are planning the same portion of the network (i.e. access). The impact of this is that roles and responsibilities with respect to planning in the access network are becoming increasingly uncertain.

Example of this blurring of areas of responsibility are :

- advances in technology now allow a single telecommunications system to deliver services which were previously delivered via three distinctly separate systems, each of which are planned by different divisions (switching, transmission and access planning).

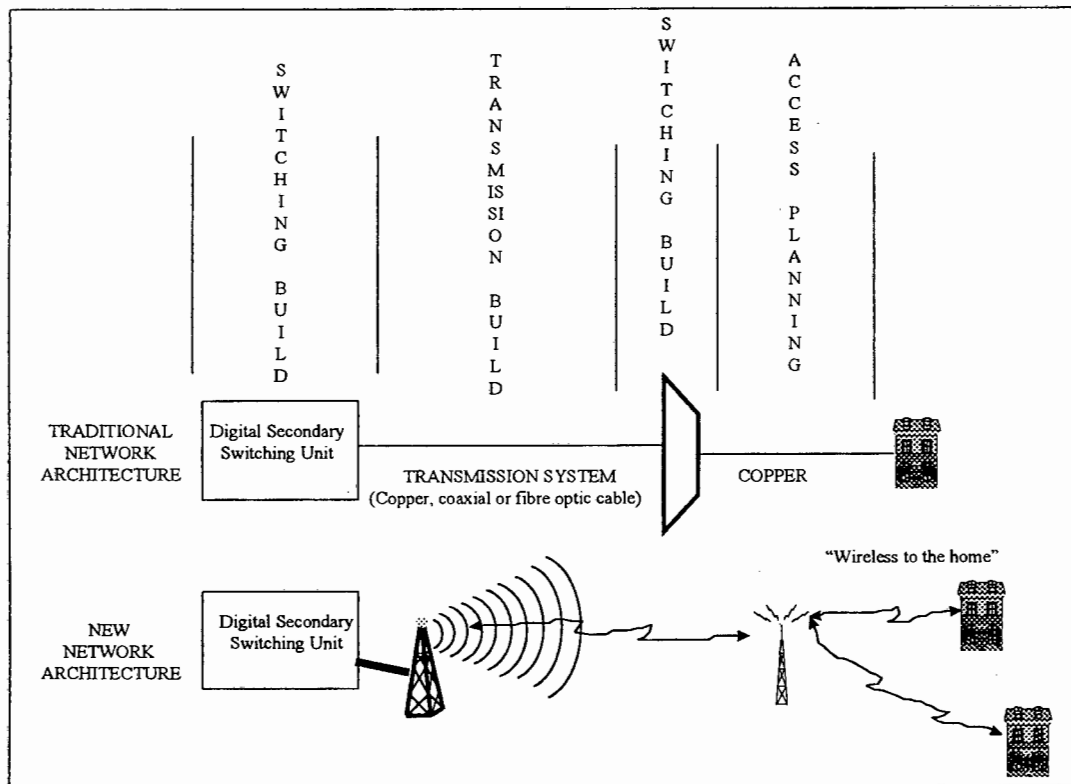


Figure 36 : Integrated technologies replacing the traditional network architecture.

- Similarly, fibre optic cable was previously the exclusive domain of the transmission division. Today, and increasingly in the future, fibre optic cable will be used in large scales within the access network. With separate recording systems, it is possible that the transmission division will not be aware of optic fibre infrastructure which could be shared.
- The traditional centralised telephone exchange is now becoming distributed into the access network, with only certain elements of the switching functionality remaining centralised.

The above mentioned changes in telecommunications network architecture has resulted in a situation where the expertise to plan the traditional telecommunications network and the division of this expertise into the traditional switching, transmission and access divisions is no longer valid :

- **Traditional network architecture as basis for dividing skills (labour)**

A single technology now spans all the areas of the network with the result that expertise is distributed amongst the traditional line sections;

- **Traditional technologies as a basis for dividing skills (labour)**

The variety of technologies and the expertise required to plan them cannot be "squeezed" into a structure which was created using the traditional telecommunications network architecture (which is now obsolete) as a basis;

- **Geographic areas as a basis for dividing skills (labour)**

The level complexity and variety of technologies which can be used in a particular geographic area are increasing to such an extent that a planner responsible for a specific area cannot have all the competencies to plan any technology.

A mode of organization is required which have the ability to adapt to the rapid changes in the technology and have the ability to accommodate the planning and installation of these technologies while at the same time making optimum use of the specialist skills available.

However, a characteristic of the authoritarian mode of organization is inflexibility. It is the opinion of the writer that underlying structures of organization need to have characteristics of flexibility and adaptation to the changes in the environment. This requires a re-evaluation of the basis of dividing skills (labour) and the rigid control structure (scalar command) provided by the Machine model. Flexible and adaptive characteristics can be provided by implementing the alignment and empowerment mode of organization.

8.4.2 ALIGNMENT OF NETWORK BUILD PARTS

Another problems which the above mentioned basis for dividing labour presents is that the purpose of building an integrated 'systemically sound' network cannot be inferred from the manner in which the parts have been divided. What is meant by 'systemically sound' is that a network should be designed which is optimised as a whole system and not in terms of the parts.

The criteria for dividing labour in the Network Build divisions is based on the functional disciplines of switching, transmission and access planning. These functional line divisions are essential to the Network Build function. In Ackoff's²⁵⁴ words :- "*without one of them the system cannot carry out its defining function.*"

²⁵⁴ R. Ackoff, *The Democratic Corporation*, (New York: Oxford Press, 1994),p.19

Line managers are allocated to each of these divisions and have performance indicators based on the optimization of each of the sections (i.e. management is focused on improvement of the performance of the essential parts. An example of this is the 'Switching Build' division which has worked towards ISO 9000 accreditation. It is the writers opinion that this is a clear attempt to optimize a part. In a telecommunications system, the system is only as reliable as its weakest link - In Ackoff's²⁵⁵ words :- "*The defining function of the system cannot be carried out by any part of the system separately.*")

By organizing in this way it is assumed that the performance of the sum of the parts equals the performance of the whole. However, according to Ackoff²⁵⁶, "*the performance of a systems is rather the product of its interactions.*"

In the context of the authoritarian mode, focus on the interactions between the parts, and the systems as a whole, is neglected as a consequence of the 'silo mentality' created by the scalar chain of command.

8.4.3 DEALING WITH ENVIRONMENTAL COMPLEXITY

A consequence of dividing labour at the highest level using the traditional network architecture as a basis, at the next level of hierarchy, labour is divided using the planing and installation phases as a basis. Although this is not in itself a concern, the concern surfaces when viewed from the perspective of management of complexity.

It was mentioned previously that authority was centralised to the level of the manager of the specific line function. This implies that, for example, the line manager of Transmission Build is responsible for controlling and directing the activities of both the planning and installation phases.

As a consequence of the vastly different nature of the work performed in these phases, significantly different issues must be dealt with by management who control and direct these activities (i.e. management must deal with the variety of planning and installation phases) (see Figure 37 on page 96).

It is the opinion of the writer that in terms of the law of requisite variety, the manager cannot deal with this variety. What is required is the implementation of variety filtering mechanisms. The VMM model and its mechanisms for reducing environmental variety can be used as basis for implementing mechanisms which will assist management in dealing with variety effectively.

²⁵⁵ Ibid.,p.22

²⁵⁶ Ibid.,p.23

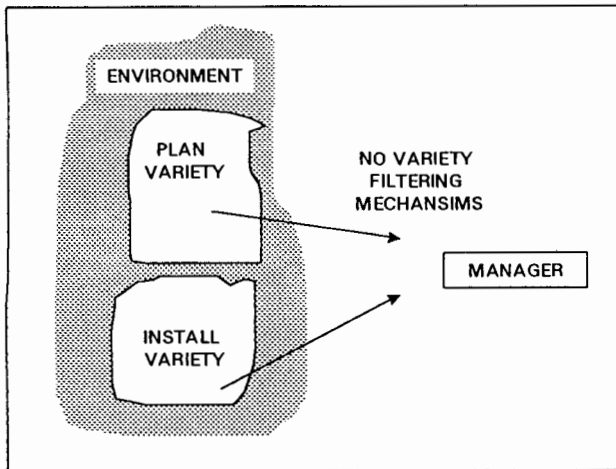


Figure 37 : Complexity faced by line management.

8.4.4 TREATING A SOCIAL SYSTEM AS A MACHINE

Figure 38 illustrates findings of the climate survey. The percentage of staff who believe that management has credibility and that fair decisions are taken by the managers. In both cases it is illustrated that Telkom's results are significantly low when compared with similar surveys performed for other South African and international companies.

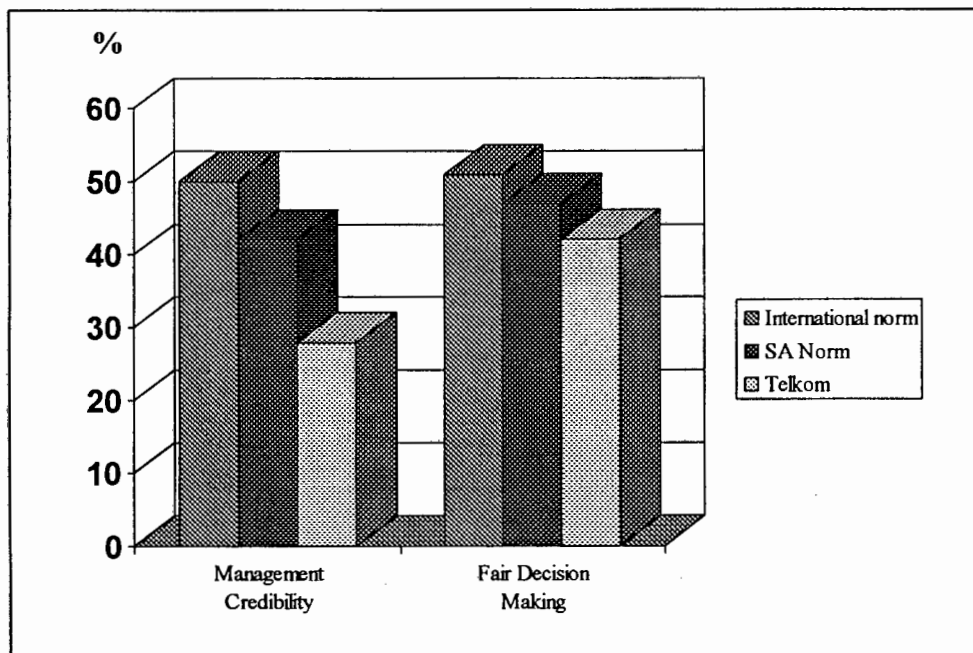


Figure 38 : Management credibility and fairness of decision making²⁵⁷.

²⁵⁷ Source : 'Employee Survey Results', *Telefokus : The Magazine for the Telkom Manager*, August 1997.

Similarly, indications of expectations of 'machine like' behavior are illustrated in Figure 39. The figure illustrates the number of new lines which are required to be installed every year in terms of the license agreement (see section 8.1) compared to the number of lines which were installed in previous years. This work must be performed by employees in the Network Build division. Employees level of effort will therefore be expected to increase threefold. However, no employee reward system or performance measurement system is operational to support this increase in employee output.

This means that employees must triple their output for no return on the effort. This is the equivalent of increasing the output of a machine with the assumption that the parts will also increase their outputs as they are part of the machine and have no choice.

People are however not machines and cannot be treated in this manner if they are to be more productive. Rather, the development, empowerment and reward of staff should be used as mechanisms to increase motivation and effectiveness.

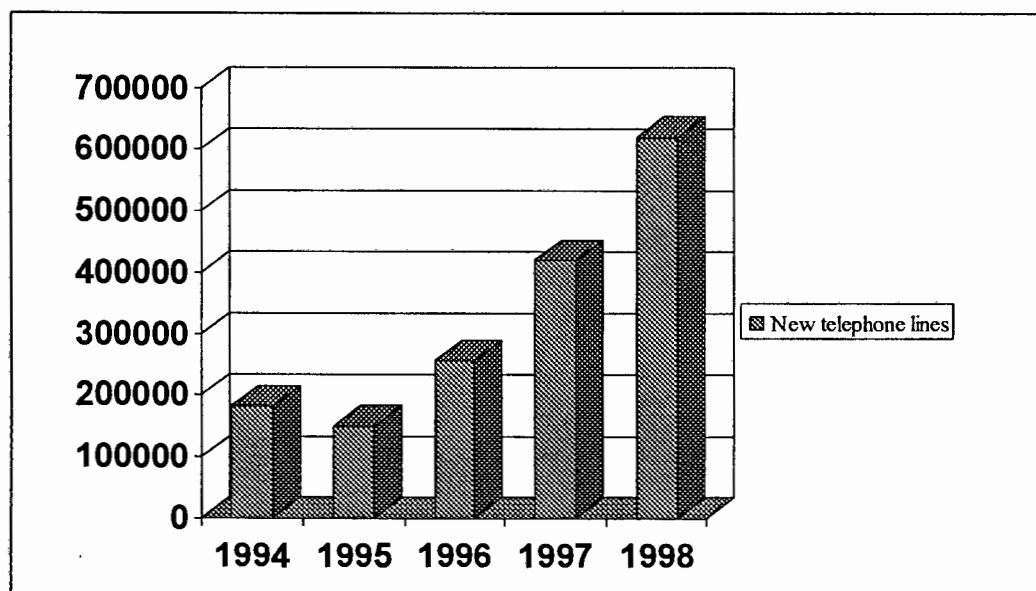


Figure 39 : Telkom's accelerated line roll out ²⁵⁸

It is the opinion of the writer that operating in the alignment and empowerment mode would provide the underlying systemic structures which could consciously acknowledge that employees are humans and not machines. Furthermore, the implementation of market mechanisms would allow units to achieve required outputs in an 'entrepreneurial spirit'.

²⁵⁸ Source : *Telkom Performance Report '96/97'*

8.5 OTHER EMERGENT THEMES

The emergent themes described in this section are not particular to the authoritarian mode of organization, but emerged as general themes during the interviews with the participants. It is the opinion of the writer that these concerns could be argued to be consequence of the authoritarian mode of organization and may also be resolved by implementing the VMM model of organization.

8.5.1 FRAGMENTATION OF FUNCTIONS

Dividing labour with functional line divisions under the control of separate line managers has results in fragmentation of functions which are common to all the divisions. As a result of the functions reporting to separate line managers there are no lines of co-ordination and control between the fragmented functions. Table 16 on page 98 illustrates the impact of fragmented functions.

It is the opinion of the writer that this fragmentation of functions (and the associated lack of synergy) can be resolved by implementing the VMM model which provides an alternative to dividing labour as well as mechanisms for centralised support functions.

Table 16 : Examples of the impact of fragmented functions.

<p><u>Equipment accommodation</u></p> <p>Separate equipment rooms in the Telkom buildings exist with Transmission Planning only allowing transmission equipment in transmission rooms and Switching Planning only allowing switching equipment in switching rooms. With the convergence of technologies this distinction is no longer valid, and a situation has arisen where utilization of telecommunications buildings is becoming highly inefficient.</p>
<p><u>Network records</u></p> <p>Each functional planning division has its own record system to account for the network configuration, the capacity available and the customers connected to the network. This results in there being no integrated record of the telecommunications network.</p>
<p><u>Fragmented long term planning</u></p> <p>Each functional line division has separate functions co-ordinating the budgeting and long term planning of the network. These people often do not communicate with one another as a result of having limited contact (a consequence of separate lines of authority).</p>

8.5.2 SHORTAGE OF RESOURCES

All supervisors interviewed voiced concerns of lack of physical and human resources as well as a lack of training of the existing staff as barriers to performance of the divisions which they supervise. The supervisors are not empowered to change this and are dependent upon line management to authorize training, employment of additional staff and purchase of new physical resources (information technology equipment, vehicles, test equipment etc.). This lack of resources contributes to a dilemma concerning the division of labour.

Labour resources are scarce and need to be employed as effectively as possible. The dilemma is that the Machine model of organization only makes provision for division of labour in a single dimension at a specific level in the organization. When dividing geographically, skilled staff are needed for each geographic area. When dividing labour using technology as a basis, skilled staff must spend a significant amount of time traveling. With the increase in new technologies, the issue of utilizing skilled staff effectively is becoming increasingly important.

It is the opinion of the writer that this concern regarding lack of resources can be resolved by implementing the VMM model of organization. By implementing the principle of internal markets, supervisors in effect become general managers of the unit and empowered to spend funds as they see fit (they are empowered with economic constraints). Furthermore the principle of multidimensional division of labour can be used to overcome the dilemma of effective use of skilled employees.

8.6 A REFLECTION ON THE DILEMMAS OF NETWORK BUILD

This chapter has described a number of undesirable issues concerning the organization of the regional Network Build function. It is argued that these concerns and dilemmas are a consequence of the Machine model being used as a basis for organization. The question which now must be asked is whether the concerns are sufficiently significant to warrant a major re-organization.

It is the writers opinion that this change is most definitely warranted. The reason for this is that in four years time, Telkom will be exposed to full competition and all protective legislation will be removed. Telkom will not have the ability to survive in the future competitive environment unless it becomes more flexible to environmental changes and has the ability to deal with the complex environment in which it operates :- *"Competition ... it is coming ... you cannot avoid it."* - Telkom Executive members.²⁵⁹

The alignment and empowerment mode of organization (and the associated VMM model) has been presented as an alternative to the authoritarian mode, and it has briefly been motivated as to why the writer believes that implementation of the VMM can resolve the dilemmas and inefficiencies within Telkom Network Build.

²⁵⁹ Telkom Video News, 'Partnership in Progress : A Chat with Exco. Members', June 1997

The purpose of the next chapter is to present a conceptual enterprise design for the organization of the Network Build division. The conceptual design will provide the underlying systemic structures of organization for operation in the empowerment and alignment mode.

9. A CONCEPTUAL DESIGN FOR THE ORGANIZATION OF NETWORK BUILD

The purpose of this chapter is to describe a conceptual enterprise design for the Telkom Network Build division. The basis of the design is the VMM model of organization and its associated set of principles described in chapter 5. Using these principles as a basis, a conceptual design will be produced which has the underlying systemic structures of organization which will allow the Network Build division to operate in the alignment and empowerment mode. The proposed conceptual design is the writers 'individual effort' and the methodology used to create the design was presented in the chapter 7.

Although the conceptual design being presented is bounded to Network Build, the writer believes that it is essential for the reader to understand how Telkom (as a whole enterprise) could be re-perceived as internal market economy.

9.1 INTERNAL MARKET MODE OF ORGANIZATION

Section 8.1 described Telkom as structurally consisting of three Customer Facing Business Units (CFBU's) and a Technology and Network focused Business Units (TNBU). The business units are funded with a yearly operating and capital budget which is allocated by top management within the enterprise. The source of these funds is income from telecommunication network usage and loans from various financial markets.

The operating budget is allocated to the various Telkom divisions based on requests from regional management based on expected requirements for the year to support staff salaries and other miscellaneous requirements. The capital budget is allocated to capital projects which are perceived to be aligned with Telkom's strategic objectives.

However, for the purposes of the conceptual design application, Telkom should be re-perceived as consisting of five primary parts operating as autonomous profit centres within an internal market framework (see Figure 40):

Customer Operations (market unit)

Responsible for interfacing with the customer, maintaining the customer billing system, marketing and sales of telecommunications services. Income would be derived directly from external customers.

Network Operations (output unit)

Income would be derived for operating the telecommunications network (i.e. ensuring that the telecommunications network operates adequately and that network faults are cleared.) This income would be regulated using simple contracts between the Customer Operations and Network Build units.

Network Build (input unit)

Income would be derived from building telecommunications network infrastructure at the request of either Customer Operations or Network Operations.

Service Group

Income would be derived from providing financial, procurement, communication and human resource services.

Corporate Meta-management Unit

The meta-management function can be perceived as a unit which contains the high level strategic type units of the enterprise as a whole (i.e. performing the VSM meta-management functions which ensure the viability of the whole). Income would be derived from taxes on the above mentioned units.

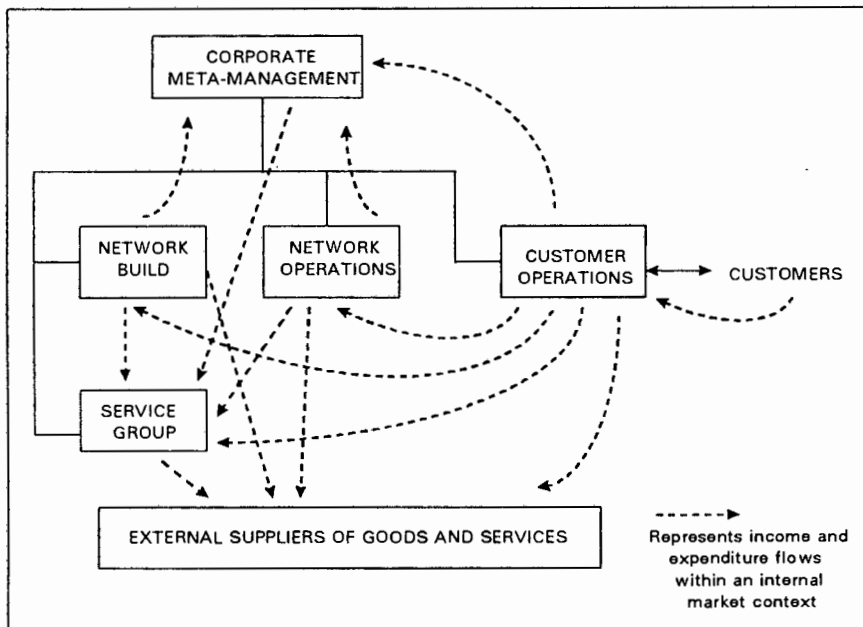


Figure 40 : Telkom operating within an internal market context.

The rationale for dividing in this manner is the Telkom value chain presented in Figure 32 on page 85.

9.2 BOUNDARY ASSUMPTIONS FOR THE SYSTEM IN FOCUS

9.2.1 ENTERPRISE UNITS INCLUDED IN DESIGN

Figure 33 on page 86 presented an organigram which illustrates the existing organization of the Telkom Technology and Networks Business Unit (TNBU). The organigram clearly distinguishes between parts which are decentralised regionally or centralised (see section 15.2 for a description of the purpose of both the centralised and regionally decentralised parts).

Several of these centralised parts perform Network Build related functions, particularly at the policy and long term level. For the purpose of this dissertation the functions of these centralised units have not been taken into cognisance.

9.2.2 INTERNAL SERVICE UNITS FOR NETWORK BUILD

Details concerning internal 'service groups' (e.g. Financial Management, Human Resources Communication and Procurement) are excluded from the design. These service groups would be organized within separate autonomous profit centres to facilitate focus and promote synergy (i.e. the Human Resources Service Group will be viewed as an external contractor to Network Build).

9.3 PURPOSE STATEMENT FOR NETWORK BUILD

In the context of Network Build operating within an internal market context, the purpose of the Network Build division would be to:

1. Supply new telecommunications network infrastructure to both internal (Customer and Network Operations) and external customers.
2. Upgrade the existing telecommunications infrastructure to ensure that advanced 'world class' telecommunications services are continually available.

9.4 DESCRIPTION OF NETWORK BUILD STAKEHOLDERS

Table 17 describes the customers (stakeholders) whose requirements should be served by Network Build.

Table 17 : Deliverables of the Network Build division.

Customers	Output
Telkom Customer Operations	New network capacity
Other telecommunication license holders (e.g. Mobile telephone network operators)	New network capacity
Television Broadcasters Paging operators	New network capacity
Telkom Network Operations	Upgrading the quality of the network (e.g. replacing obsolete network technologies).

9.5 CONCEPTUAL DESIGN : RECURSION LEVEL 1 (NETWORK BUILD)

The conceptual design process was described in section 6.3.5. The design process proposes that the starting point is the design of processes which deliver the stakeholders required outputs.

9.5.1 PROCESS DESIGN

"Operating system defined : a configuration of resources combined for the provision of goods or services" - Wild²⁶⁰.

Wild²⁶¹ defines the first objective of operating systems as *"the conversion of input for the satisfaction of customer wants. Customer service is therefore a key objective of operations management."* It is therefore the writer's opinion that Network Build should be conceived as a purposeful operating system with a 'project process' transforming customer requests into outputs which satisfy the customer request. Figure 41 illustrates the traditional transformation process performed by an operating system which deals with a number of differing customer requests. This transformation process is described as a project process which consists of five major actions.

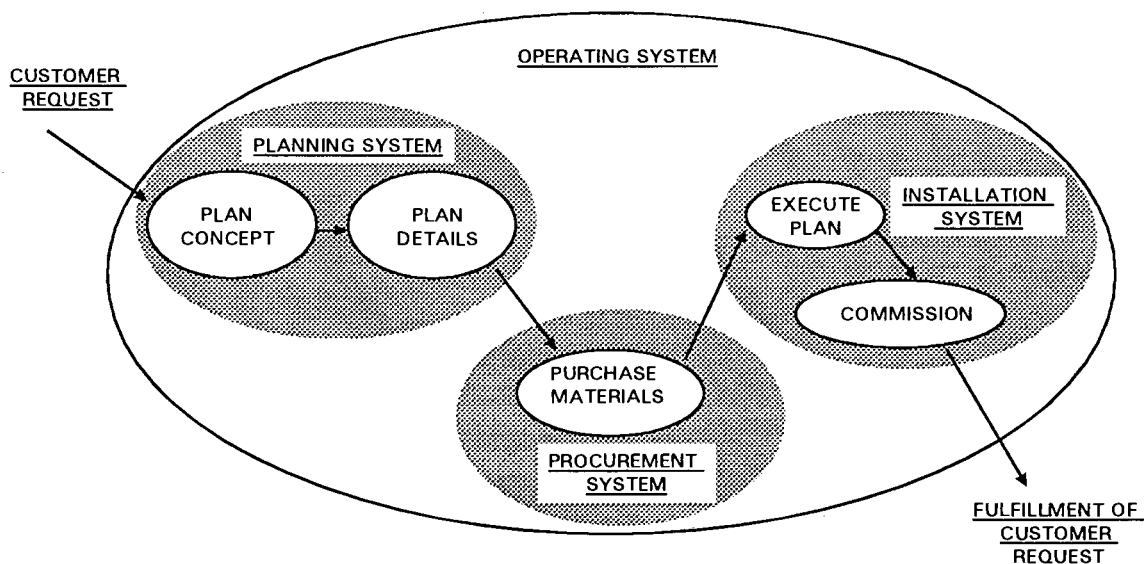


Figure 41 : An operating system and its project transformation process.

²⁶⁰ R. Wild, *Production and Operations Management*, (London : Cassell Edu., 1995),p.4

²⁶¹ Ibid.,p.5

9.5.2 FUNCTION DESIGN

Using the generic operations process as a basis for fulfilling the customer needs, it is possible to identify three groupings amongst the five major actions. These groupings are illustrated by means of shading in Figure 41 (see previous page).

The rationale for dividing the process into the specific planning, procurement and installation systems (i.e. the boundary judgment) is that the nature of the work performed by each system is significantly different. Perceiving them as three distinct systems, each with their own environment, means that the environmental complexity can be dealt with more effectively. Furthermore, grouping in this manner allows the unit executives to develop and focus the unit in terms of the specialist purpose.

1. Planning Group

The input to the Planning Group is a customer request. The transforming of the customer request into a completed plan consist of the following planning activities:

- Plan concept : Determining the project scope and solution to the customer request (i.e. conceptually defining how the customer request is to be satisfied);
- Plan details : Translation of the project concept into detailed plans. This detailed plan also includes a detailed 'bill of quantities'.

The output of this phase is the bill of quantities and a detailed plan which can be considered as an 'executable work package' which will be executed and commissioned during the execution phase. However, before this 'work package' can be executed, equipment and installation materials need to be procured.

2. Procurement Group

The procurement system is responsible for making the equipment as per the bill of quantities available to the installation system. Activities performed by this system include ordering of equipment, managing equipment storage, dispatch and transport of equipment to installation sites.

The procurement function could be classified as a service unit and grouped within the 'Procurement Service Group'. The rationale for this is that procurement services are required throughout Telkom. Grouping the 'Network Build Procurement Group' within a 'Telkom Procurement Service Group' will enable the unit to benefit from synergies of belonging to a larger group fulfilling a very similar purpose within the wider context of Telkom as a whole.

3. Installation Group

The Installation Group is responsible for implementing the plans (executable work packages) using the equipment made available by the Procurement Group. This transformation is achieved by the following activities :

- Execution of the plan : Performing the physical work of transforming the planning into something which will be useful to the customer;
- Commissioning : Testing the installed telecommunications system and confirming that the output of the execution phase is acceptable in terms of satisfying the customer's initial request.

9.5.3 REGULATION DESIGN

The purpose of the regulation design is to provide self-organization and external meta-management elements which will allow the Network Build groups to behave as a whole and ensure their viability in the long term.

It is the regulation design (more specifically the internal market concept) which provides the most significant change in the mode of organization of Network Build (It is the writer's opinion that these changes would be necessary throughout Telkom to achieve maximum benefit of the internal market concept - The idea of Telkom operating as an internal market was presented in section 9.1).

1. Self-organization element

The basis of the self-organizing element is the principle of internal market mechanisms regulating the behaviour of the parts, with each group being treated as an autonomous profit centre.

The Network Build division should be perceived as being a profit driven enterprise in the business of planning and installing telecommunications networks. The network being built would be funded by the stakeholder who requests the network capacity.

Planning and Installation work would be performed on a contractual basis for both internal and external stakeholders. Management of the Planning and Install Groups will have entrepreneurial freedom of being enabled to seek business opportunities outside of Telkom if necessary.

2. External meta-management element

The purpose of the external meta-management function is the implementation of co-ordination and adaptation mechanisms to ensure that the Network Build Unit remains viable within the fast changing external environment.

2.1 Co-ordination mechanism (VSM function 2)

The co-ordination mechanism could be implemented by creating a Project Management Unit (PMU), a Quality Management Unit (QMU) and an enterprise wide communication network (e.g. email).

The PMU would be responsible for co-ordinating the activities of Network Build, contract management and interface with stakeholders of the enterprise. The division will be responsible for ensuring that work performed by Network Build is performed within cost, time and quality specifications.

The QMU would be responsible for implementing a 'Quality Management System' which would provide documentation of processes, quality indicators, standardized methods and procedures.

The communication network would be implemented by the Information Technology Service Group who would provide information technology services to Network Build.

2.2 Adaptation mechanism (VSM functions 3,4,5)

The adaptation mechanisms is implemented by explicitly defining the Policy, Intelligence and Control functions specified by the VSM (see section 14.3.1).

The intelligence function can be implemented by creating a 'Market Development Unit' (MDU). The MDU would be responsible for ensuring that the telecommunications network build services being offered by the Network Build division are aligned with the requirements of the external market. The unit will also continuously be attempting to seek opportunities in the external market.

A Network Build 'executive' position would be created to develop policies within Network Build which provide an 'alignment framework'. His/her role would be to ensure that the Network Build policies reflects a balance between the needs of the Plan and Build Groups versus the requirements to adapt to the external environment. The requirement to adapt would be motivated for by the MDU.

The control function would be implemented by creating Planning Group and Install Group 'executive' management structures. The executives would be responsible for ensuring that policy is implemented (i.e. they would perform a feedback function to ensure that the parts remained aligned). Where the Planning and Install Groups do not produce the outputs which are committed to the PMU, the units will be penalized financially.

Unit executives would also be responsible for entering into and managing the contracts between the various service groups (e.g. the Human Resources and Information Technology Service Groups).

9.5.4 STRUCTURAL DESIGN

The grouping of transformations above represents grouping of functions at the highest level of recursion within Network Build. Subsequent iterations of the design process will focus on the detailed organization of the specific groups (e.g. Planning Group).

Figure 42 presents a structural viewpoint of the highest level of recursion for regional Network Build.

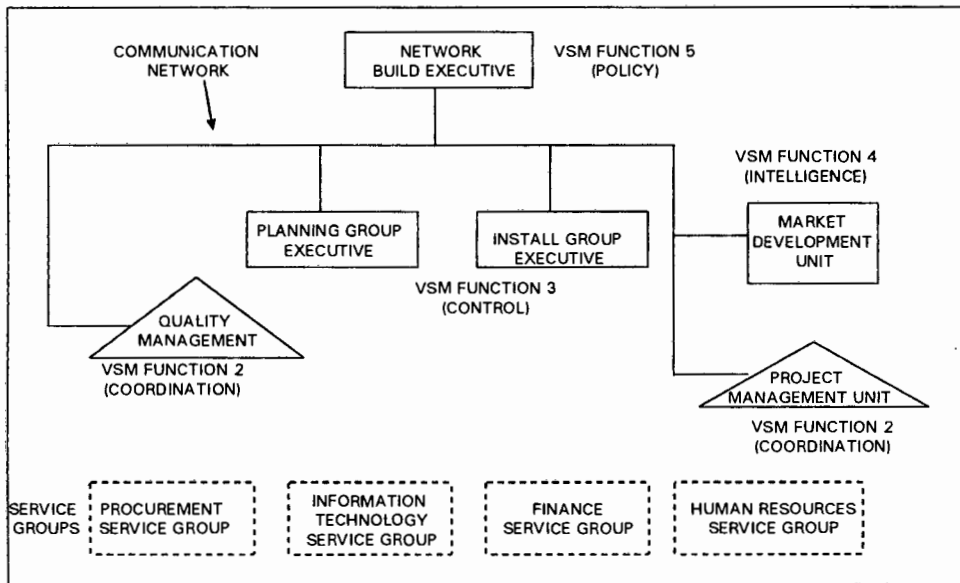


Figure 42 : Structural viewpoint.

9.6 RESOLUTION OF NETWORK BUILD CONCERNS AND DILEMMAS

Chapter 7 described a number of concerns and dilemmas which are a consequence of the authoritarian mode of organization. The approach for reflecting on the conceptual design will be to comment on the extent to which the writer believes the concerns and dilemmas of the authoritarian mode are resolved by the new conceptual design.

9.6.1 ACKNOWLEDGMENT OF THE ENVIRONMENT

(Refer to : 8.4.1)

Buffering of the production function

The conceptual design consciously acknowledges the environment. Mechanisms which provide interface with the environment are the Project Management unit and the 'Market Development' unit.

Obsolete network architecture as a basis for dividing labour

The division of labour proposed by the conceptual design for Network Build is not based on network architecture and therefore a changing network architecture will not have a significant change on the organization of the Network Build Group.

9.6.2 ALIGNMENT OF NETWORK BUILD PARTS

(Refer to : 8.4.2)

The conceptual design provides a framework where the Planning Group and the Install Group are each integrated purposeful wholes with separate management. Each group contributes to the purpose of the containing whole. Alignment of these purposeful parts is achieved through a clearly defined meta-management regulatory element.

9.6.3 DEALING WITH ENVIRONMENTAL COMPLEXITY

(Refer to : 8.4.3)

The conceptual design 'chunks' the environment by using the project process phases as a basis for grouping parts. Furthermore, the recursive nature of the organization and the provision of autonomous market units allows each division to deal with a different part of the environmental complexity in a manner in which they feel is best. Environmental variety is reduced by ensuring that Planning and Installation varieties are managed by separate units.

9.6.4 TREATING A SOCIAL SYSTEM AS A MACHINE

(Refer to : 8.4.4)

The conceptual design provides self-organizing mechanisms (particularly the autonomy of units and the internal market concept) which allows people to exercise freedom of choice in deciding how specific outputs are to be achieved. Furthermore, it provides people with the entrepreneurial freedom to find other areas of business.

9.6.5 FRAGMENTATION OF FUNCTIONS

(Refer to : 8.5.1)

The conceptual design proposes a single integrated Planning Group. This allows for the fragmented functions (e.g. record keeping etc.) to be centralized in a holistic manner within a single autonomous Planning Group. Fragmented planning is eliminated by creating this single Planning Group. Implementation of a meta-management element within the Planning Group itself, would contribute greatly to avoiding fragmented planning within the group.

9.6.6 SHORTAGE OF RESOURCES

(Refer to : 8.5.2)

The conceptual design is based on autonomous profit centres which empowers the units to obtain resources within their respective profitability constraints.

9.7 CONCLUSION

The section has provided a brief conceptual description of the proposed Network Build unit. Although detailed descriptions were not provided, the level of detail (together with an understanding of the VMM model of organization) is adequate to provide the reader with a relatively clear conceptual idea of how the alignment and empowerment mode could be implemented within Telkom Network Build division.

The most significant change is the re-perceiving of Telkom and the Network Build division within an internal market context - this would require the entire Telkom to change as changes to Network Build alone would not exploit the benefits on an internal market type economy.

10. A CRITICAL REFLECTION UPON THE OUTCOMES OF THE DISSERTATION

"Every world view is terribly restricted."- Churchman²⁶²

The purpose of this chapter is to critically reflect on what has been presented in this dissertation. A theme which has been woven throughout the dissertation is that of the 'systems approach'. It has been argued to be an approach to problem solving which takes multiple views of a problem and is concerned with the nature of the ends - it is an exercise in practical reason. Ulrich²⁶³ argues that practical reason *"can tell us how to use our freedom of choice to realize better human (social) systems."* He continues to say that *"the challenge is to use this freedom reasonably, that is determining the ends and means of ones actions with reason."*

Ulrich²⁶⁴ believes that it is not acceptable to step back from a proposed 'social design' and justify the design from *"behind a veil of objectivity"* - *"System planners cannot seek refuge in the common argument that they merely provide tools for those legitimately in control of purposes. Practical reason cannot be reduced to instrumental reason which is an application of theoretical reason."*

Theoretical reason justifies outcomes by means of testable and repeatable experiments. This approach is acceptable when problems are structured and the system boundaries for the problem definition are clear. However, social systems do not present structured problem situations. Planners will inevitably make system boundary definitions for the problematic situation which exclude many influences which could effect the design - *"when planners apply system design methods to the 'real world' they inevitably make assumptions about what is inside the system of concern and what belongs to its environment. These boundary judgments reflect the designers 'whole system judgments' about what is relevant to the design task."*²⁶⁵

Two planners making different boundary definitions for a problematic situation will arrive at significantly different solutions to the same problem. These boundary definition are typically based on the a priori value assumptions which determine what should be included or excluded in the system conception.

Ulrich argues that it is necessary to *"uncover the normative content of social designs."* By 'normative content' Ulrich²⁶⁶ refers to *"the underlying value assumptions that inevitably flow into planning and also the consequences and side effects for those affected by the planning."*

²⁶² W. Churchman cited by R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.200

²⁶³ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983)p.24

²⁶⁴ *Ibid.*,p.20

²⁶⁵ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.205

²⁶⁶ W. Ulrich cited by R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.198

This chapter is not a theoretical justification for the proposed conceptual enterprise design for Network Build. Rather, the chapter adopts a critical approach which aims at a strictly heuristic reflection on the work presented. A heuristic reflection is one which attempts to uncover the deception in system designs which are a consequence of the boundary definitions made. Ulrich²⁶⁷ provide a 'critical systems' approach which provides a practical means for critically reflecting on goals attained. This approach is called Critical System Heuristics (CSH).

10.1 CRITICAL SYSTEM HEURISTICS

CSH is "a method which can be used by planners and concerned citizens alike to reveal the 'normative content' of actual and proposed systems designs."²⁶⁸ Ulrich²⁶⁹ states that planning is rational, from the perspective of CSH "if the involved planners and the effected citizens make transparent to themselves and to each other this 'normative content'."

10.1.1 CRITICAL SYSTEM HEURISTICS DEFINED

CSH is defined by Ulrich as :

- Critical²⁷⁰ : "To be critical then above all means to be self-reflective in respect to the presuppositions flowing into one's own judgments, both in the search for true knowledge and rational action ... In the context of social inquiry, it means to make transparent to oneself the value assumptions underlying practical judgments, rather than concealing them behind a veil of objectivity."
- System²⁷¹ : Ulrich uses the term 'system' in the sense espoused by Kant -"Kant uses the systems concept as a critical idea of reason, namely, as an idea that reminds us precisely of the unavoidable incomprehensiveness and selectivity of every definition of a system." This idea was explored in section 2.5.
- Heuristic²⁷² : A heuristic approach is one "which does not theoretically justify its own basic concepts and its own normative content but must rather remain self-reflective with respect to its theoretically problematic and practically normative character". A heuristic approach serves to discover deception in social designs but at the same time remains aware that there is a lack of guarantee of discovering this deception.

²⁶⁷ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.198

²⁶⁸ Ibid.,p.198

²⁶⁹ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983)p.20

²⁷⁰ Ibid.,p.20

²⁷¹ Ibid.,p.21

²⁷² Ibid.,p.23

Flood and Jackson²⁷³ described CSH as useful when *"the powerful seek to impose their proposals upon other participants (planners planning for others). Critical system heuristics enables us to reveal the true interests and motivations underlying proposals and assists with challenging the proposals and constructing counter-proposals, and insists that no plans are rational which have not been approved by the 'affected but not involved'."*

10.1.2 CRITICAL SYSTEMS HEURISTICS PRINCIPLES

Flood and Jackson²⁷⁴ describe four principles upon which CSH is based.

1. Concept of purposefulness

Social systems should be designed as purposeful systems, otherwise *"they are likely to serve people and purposes other than those intended."*²⁷⁵ Ulrich²⁷⁶ argues It is the purposeful nature of social systems which differentiate them from mechanistic and organismic system.

2. Systems idea

The systems idea insists that planners *"reflect upon the inevitable lack of comprehensiveness in out attempts to map social reality and to produce social designs."*²⁷⁷

3. Moral idea

The idea insists that planners *"constantly ask what values are built into the designs, and consider the moral imperfections of the designs."*²⁷⁸ Those who are 'affected but not involved' should always be considered.

4. Guarantor idea

The idea insists that planners seek opinions from many experts and from different stakeholder groups. There is no absolute guarantee that planning will lead to improvements.

The writer believes that a fifth principle is that of 'system stakeholder'. Systems stakeholders are those which Flood and Jackson²⁷⁹ refer to as the 'involved and affected'. System stakeholder perspectives must be considered when creating social system designs. The affected are called 'witnesses', and they are those stakeholders who typically do not have a say in the nature of the design. The involved typically consist of 'clients' who are beneficiaries of the design, 'decision' makers who validate the designs and the 'planner' who creates the designs for the

²⁷³ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.198

²⁷⁴ Ibid.,p.202

²⁷⁵ Ibid.,p.203

²⁷⁶ W. Ulrich cited by R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.203

²⁷⁷ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.203

²⁷⁸ Ibid.,p.203

²⁷⁹ Ibid.,p.198

client. Each of the systems stakeholders has a different perspective of what the system boundaries for the design should be.

10.1.3 CRITICAL SYSTEMS HEURISTICS METHODOLOGY

According to Flood and Jackson²⁸⁰, The Critical System Heuristics methodology consists of two parts. The first part helps planners "*make transparent to themselves and others the presuppositions that inevitably enter into social systems designs*". The second part provides a practical tool which enables planners to subject their designs to debate with the 'witnesses'. The first part on the methodology will be dealt with in this dissertation.

CSH provides a set of questions as the first part of the methodology. These questions reflect on the planners 'whole systems judgments' from the perspectives of the involved and those affected. The question interrogate systems designs to reveal the boundary judgments being made. The questions are most powerful when phrased in the 'is' and 'ought' mode. Contrasting the answers highlights the lack of comprehensiveness in the system design.

The questions consist of four groups of three questions directed at each of the system stakeholders. The sets of three questions directed at each stakeholders are inquire into the social roles, the role specific concerns, and the key problems with the boundary judgment of the particular system stakeholders (See Table 18 on page 115 for a list of the questions expressed the 'is' mode).

- Questions 1-3 : Examine sources of the clients motivation and the value basis of the design ;
- Questions 4-6 : Examine sources of decision maker control and their basis of power;
- Questions 7-9 : Examine the designers sources of expertise and their basis of guarantee in the design;
- Questions 10-12 : Examine sources of legitimization in the design for the 'witnesses'.

²⁸⁰ Ibid.,p.204

Table 18 : Ulrich's 12 CSH boundary questions in the 'is' mode.²⁸¹

1.	Who is the actual client of S's design, i.e. who belongs to the group of those whose purposes(interests and values) are served, in distinction to those who do not benefit but may have to bear he costs or other disadvantages ?
2.	What is the actual purpose of S's design, as being measured not in terms of declared intentions of the involved but in terms of actual consequences ?
3.	What, judged by the designs consequences, is its built in measures of success ?
4.	Who is actually the decision taker, i.e. who can actually change the measure of success ?
5.	What conditions of successful planning and implementation of S are really controlled by the decision taker ?
6.	What conditions are not controlled by the decision taker, i.e. what represents 'environment' to him ?
7.	Who is actually involved as planner ?
8.	Who is involved as expert, of what kind is his/her expertise, what role does he/she actually play ?
9.	Where do the involved see the guarantee that their planning will be successful? (e.g. In the theoretical competence of experts? In consensus among experts? In the validity of empirical data ? In the relevance of mathematical models or computer simulations? In political support on the part of interest groups? In the experience and intuition of the involved? etc.) Can these guarantors secure the designs success, or are they false guarantors ?
10.	Who among the involved witnesses represents the concerns of the effected? Who is or may be affected without being involved ?
12	What word view is actually underlying the design of S? Is it the world view of (some of) the involved or of (some of) the affected ?

²⁸¹ R. Flood and M. Jackson, *Creative Problem Solving*, (Sussex: Wiley Publishers, 1991),p.206

10.2 A CRITICAL HEURISTIC REFLECTION OF THE DISSERTATION

The purpose of this section is to utilize the first part of the Critical System Heuristics methodology as a framework for reflection on the dissertation. Strümpfer²⁸² suggests that the reflection should be focused at three different levels (see Figure 43).

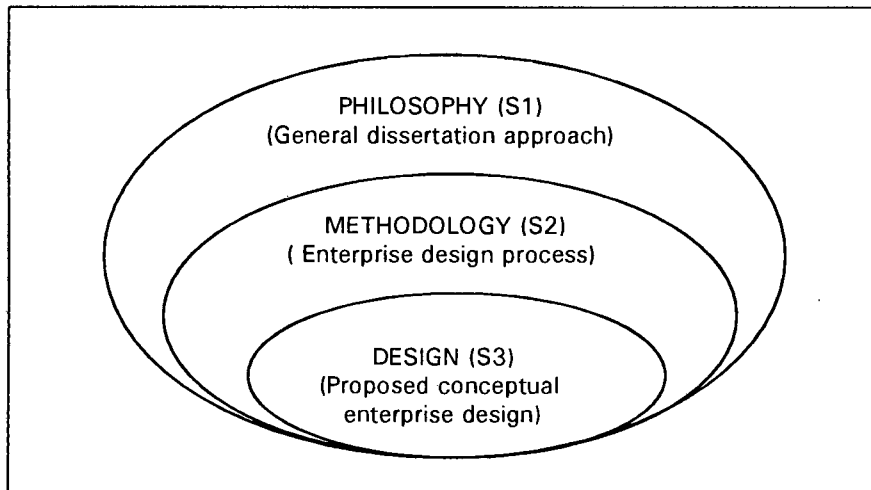


Figure 43: Different levels of focus for reflection.²⁸³

The levels can be conceived as three different 'systems designs' (S1, S2, S3) with each system having its own 'normative content' :

- The general dissertation research approach (S1);
- The methodology used to create the conceptual enterprise design (S2);and
- The conceptual enterprise design itself (S3).

The 'normative' content of each of the above mentioned system designs will be strongly correlated as a consequence of the methodology used (S2) being a function of the research approach (S1) and the conceptual enterprise design (S3) being a function of the methodology used to create the design (S2) (In a sense, the one contains the other - this is clearly illustrated in Figure 43 above):

The purpose of the following sections is to provide a synthesis of the significant issues which emerge when evaluating the different 'is' and 'ought' conceptions of the above mentioned systems.

²⁸² J. Strümpfer, Personal Communication, University of Cape Town, School of Engineering Management, 1997

²⁸³ Ibid.

10.2.1 A REFLECTION ON THE GENERAL APPROACH OF THE DISSERTATION

Table 19 on page 118 presents an application of the 12 critical systems questions to the general dissertation research approach (S1).

- The dissertation is biased towards pure research (which implies the re-examining of existing theories²⁸⁴) and applied research (which implies evaluation of an existing system or process²⁸⁵) rather than action research (which implies that research should lead to 'real world' change). These are different approach to research and produce significantly different outcomes.

Within the systems movement, there appears to be a strong relationship developing between systems practice (which implies using systemic and reflective practices to "*initiate and guide actions we take in the world*"²⁸⁶) and action research²⁸⁷. This is a consequence of what Flood²⁸⁸ refers to as "*lessons drawn from action research about reflective practice.*" Action research is a useful technique for demonstrating that the student is competent of achieving positive real world change.

Implementation of action research depends heavily on the support of management of the enterprise in which the research occurs. Unfortunately, as a consequence of the rapidly changing environment within the Telkom Network Build context, this support was not possible. It should also be noted that the volume of work required to perform an idealized design for Telkom Network Build would be outside the scope of the requirements for a masters half dissertation.

- The systems approach was used as a framework for reflecting upon the 'modes of organization' framework proposed by Strümpfer. For the purposes of this dissertation, the 'multiple views' of organization are limited to what Ackoff²⁸⁹ refers to as the mechanistic, organismic and social systems conception (metaphors) of organization. Conceptions of organization which revolve around other social theories and models of organization (e.g. political systems conceptions) are not considered.

The 'social systems conception' of organization is argued to be a better approach to organization than a purely mechanistic or organismic approach, however, it cannot be stated that this is the only approach to organizing without considering other conception of organization which might exist.

²⁸⁴ M. Smith, R. Thorpe and A Lowe, *Management Research : An introduction*, (London:Sage, 1993),p.7

²⁸⁵ *Ibid.*,p.7

²⁸⁶ P. Checkland, *Systems Thinking, Systems Practice*, (Sussex: Wiley Publishers, 1994),p.4

²⁸⁷ R. Flood, Editorial, *Journal of Systems Practice and Action Research*, Vol.11, No.1, 1998

²⁸⁸ *Ibid.*

²⁸⁹ R. Ackoff, 'Mechanisms, Organisms and Social Systems', *Strategic Management Journal*, Vol. 5, 1984

- The social systems conception of organization presents a mode of organization which aims to empower people. From a moral perspective, the social systems model can therefore be considered to be an improvement on the mechanistic conception of organization.
- The guarantor of the social systems conception of organization is that the systems ideas which have been developed to deal with the complex and fast changing nature of reality are embodied with the 'Viable Multidimensional Market' (VMM) model of organization.

Table 19 : CSH boundary questions interrogating S1.

	'IS MODE' - PHILOSOPHY	'OUGHT MODE' - PHILOSOPHY
1	Who is the actual client of S's design ? The student	Who ought to be the actual client (beneficiary) of S's design ? The management and people within the enterprise.
2	What is the actual purpose of S's design ? The systems approach is used as a framework to perform an inquiry into the topic of 'organization' (particularly Strümpfer's 'modes of organization' framework.	What ought to be the actual purpose of S's design ? The systems approach should be used as tool of practical reason to ensure that people within the enterprise create an enterprise design in a participatory and rigorous manner.
3	What, judged by the designs consequences, is its built in measures of success ? Multiple views of organization are explored (mechanistic and social systems views of organization) and each of the views are evaluated in terms of the fast changing complex environment in which enterprises should operate.	What ought to be S's measures of success (or improvement)? The implementation of an enterprise design which improves a problematic situation (it cannot however be assumed that a problem situation exists - there must be agreement by the client that a problematic situation does exist) and provides a mode of organization which improves the problem situation.
4	Who is actually the decision taker ? The external examiner.	Who ought to be the decision taker ? The management of the enterprise in which a new design is implemented.
5	What conditions of successful planning and implementation of S are really controlled by the decision taker ? N/A	What components (resources and constraints) of S ought to be controlled by the decision taker ? N/A
6	What conditions are not controlled by the decision taker, i.e. what represents 'environment' to him ? N/A	What resources and conditions ought to be part of S's environment, i.e. not be controlled by S's decision taker? N/A
7.	Who is actually involved as planner ? The writer (student)	Who ought to be involved as designer of S ? The student and a team of people working within the existing system for which a redesign and implementation occurs.
8.	Who is involved as expert, of what kind is his/her expertise, what role does he actually play ? The students supervisor.	What kind of expertise ought to flow into the design of S ? The team of people used as participants (knowledge of the existing system being redesigned) the student directly and the supervisor indirectly.
9.	Where do the involved see the guarantee that their planning will be successful? The supervisors understanding of what is expected from a half dissertation and the knowledge of the supervisor as an expert in the field	Who ought to be the guarantor of S? The supervisor and the student who ensure that an appropriate methodology is utilized.

Table 19 : CSH boundary questions interrogating S1...

10	Who among the involved witnesses represents the concerns of the effected? Who is or may be affected without being involved ? Essentially the student is both the planner and the effected. The supervisor therefore represents the interests of the student.	Who ought to be belong to the witnesses representing the concerns of the citizens that will or might be effected by the design of S ? The management of the enterprise in which the design is taking place will represent the people affected by the design and will have to stop an implementation process if they have a sense that it is going to fail.
11	Are the effected given an opportunity to emancipate themselves from the experts and to take their fate into their own hands ? N/A	To what degree and in what way ought the effected be given the chance of emancipation from the premises and promises of the involved ? N/A
12	What word view is actually underlying the design of S? Is it the world view of (some of) the involved or of (some of) the affected? The world view that a masters half dissertation does not require a real world intervention to be successful (i.e. a pure / applied research paradigm is acceptable).	Upon what word views of either the involved or the affected ought S's design be based ? The world view ought to be that the best way to demonstrate understanding of the principle the systems approach and theory of organization is to implement an actual design in a real world situation (i.e. an action research paradigm).

10.2.2 A REFLECTION ON THE ENTERPRISE DESIGN METHODOLOGY

Table 20 on page 120 represents the outcome of using the Critical Systems Heuristic questions when interrogating the design of S2 (i.e. the methodology used to create an enterprise design). This 'individual based' design methodology was described in chapter 7.

- The purpose of the methodology used was to demonstrate to the external examiner that the writer has an understanding of how the VMM model of organization could be applied to a real world enterprise unit. The methodology is based on an 'individual effort'. In terms of an action research approach, this approach to developing an enterprise design is unacceptable in that the methodology does have the system approach as its basis - it excludes debate regarding the nature of the initial 'problematic situation' and the appropriateness of the final conceptual design in improving the 'problematic situation'. Furthermore, the design does not take cognisance of the views of the decision makers nor the witnesses (people within Network Build).

In essence, the systems approach has been used in what Ulrich²⁹⁰ refers to as a 'scientific' manner rather than as "*an instrument of practical reason.*" Ulrich implies that a scientific approach uses the systems idea as a 'means' to achieve predetermined 'ends'. It has been argued in section 2.7 that, within the context of a social systems design, it is imperative that the nature of the 'ends' are debated by all stakeholders.

²⁹⁰ W. Ulrich, *Critical Heuristics of Social Planning : A New Approach to Practical Philosophy* (Stuttgart: Haupt, 1983)p.24

- Although the purpose of the methodology is used to demonstrate an understanding of how the VMM model could be used, the imperfections of the methodology should always be considered. The fact that the methodology is an individual effort provides no guarantee that the enterprise conceptual design produced could be developed further to become suitable for real world implementation

Table 20 : CSH boundary questions interrogating S2.

	'IS MODE' - DESIGN METHODOLOGY	'OUGHT MODE' - DESIGN METHODOLOGY
1	Who is the actual client of S's design ? The student - If the output from the process is not acceptable the student will not benefit from performing the work which S requires.	Who ought to be the actual client (beneficiary) of S's design ? All stakeholders of the enterprise.
2	What is the actual purpose of S's design ? To provide a methodology for performing an 'individual effort' enterprise design.	What ought to be the actual purpose of S's design ? To provide a practical methodology to perform a 'real world' enterprise design and implementation.
3	What, judged by the designs consequences, is its built in measures of success ? The interviews held with line supervisors working within the system in focus.; The set of enterprise design questions utilized to perform the design which have a solid theoretical basis developed in chapter 5.	What ought to be S's measures of success (or improvement)? A change in the paradigm of the client; Agreement from the client to continue with a participative design; Agreement from client to implement the design in the 'real world'.
4	Who is actually the decision taker ? The external examiner / dissertation supervisor.	Who ought to be the decision taker ?. The client (management).
5	What conditions of successful planning and implementation of S are really controlled by the decision taker ? All conditions are controlled by the supervisor but essentially the external examiner will control the final decision as to whether S is acceptable.	What components (resources and constraints) of S ought to be controlled by the decision taker ? The decision to proceed with an idealized design exercise. The decision to implement the completed idealized design.
6	What conditions are not controlled by the decision taker, i.e. what represents 'environment' to him ? N/A	What resources and conditions ought to be part of S's environment, i.e. not be controlled by S's decision taker? The inputs given by the participants in the design exercise who are not decision makers should not be affected by the decision maker (the decision maker must accept that different viewpoints concerning the situation exist).
7.	Who is actually involved as planner ? The student.	Who ought to be involved as designer of S ? The student.
8.	Who is involved as expert, of what kind is his/her expertise, what role does he actually play ? The supervisor is the expert who will validate the approach which S adopts.	What kind of expertise ought to flow into the design of S ? The expertise of the students supervisor, literature by other 'systems practitioners' regarding successful 'systems approaches' to a performing a successful enterprise design process.

Table 20 : CSH boundary questions interrogating S2...

9.	Where do the involved see the guarantee that their planning will be successful? The experience of the supervisor and his/her clear understanding of what is expected from an individual effort applied/pure research output.	Who ought to be the guarantor of S? The guarantor of S success is the approach which the methodology uses to achieve the explicit 'buy in' from the participants and the client before proceeding with the next phase of the methodology.
10	Who among the involved witnesses represents the concerns of the effected? Who is or may be affected without being involved ? As a consequence of the dissertation being an academic exercise, there are no witnesses who will be affected by the design of S.	Who ought to be belong to the witnesses representing the concerns of the citizens that will or might be effected by the design of S ? A witness who could be involved is the enterprise employee union representative.
11	Are the effected given an opportunity to emancipate themselves from the experts and to take their fate into their own hands ? N/A	To what degree and in what way ought the effected be given the chance of emancipation from the premises and promises of the involved ? The union representative could validate the approach which S adopts before the implementation of S begins (i.e. the participative nature, concept of changing paradigms etc.)
12	What word view is actually underlying the design of S? Is it the world view of (some of) the involved or of (some of) the affected? The world view which actually underlies S is that it is acceptable to perform an enterprise design as an individual effort (with no implementation component) for academic purposes.	Upon what word views of either the involved or the affected ought S's design be based ? The world view which ought to underlie S is that to demonstrate academic competence, the student should perform a real world design and implementation exercise.

10.2.3 A REFLECTION ON THE OUTCOMES OF THE PROPOSED DESIGN

Table 21 on page 122 represents the outcome of using the Critical Systems Heuristic questions when interrogating the design of S3 (i.e. the dilemmas of Network Build's existing mode of organization, and the proposed conceptual design).

- The purpose of the conceptual enterprise design is to demonstrate an understanding of the social systems model of organization. The design is not intended for implementation.
- The design has attempted to illustrate a conceptual implementation of the VMM. The VMM has the Internal Market, Viable Systems and Multidimensional Organization Models as its basis represents a social systems conception of enterprise organization. The proposed design has not attempted to map all the complexity of the existing real world organization of Network Build into the design. The design is rather a conceptual design which provides insights into the form which a comprehensive mapping might take.
- Ignoring the bulk of the real world complexities clearly places the design in the context of an intellectual exercise . The guarantor that the design is adequate therefore depends upon the approval of the design by the dissertation supervisor.

Table 21: CSH boundary questions interrogating S3.

	'IS MODE' - CONCEPTUAL DESIGN	'OUGHT MODE' - CONCEPTUAL DESIGN
1	Who is the actual client of S's design ? The external examiner.	Who ought to be the actual client (beneficiary) of S's design ? Management of the enterprise for which the design is being performed.
2	What is the actual purpose of S's design ? To demonstrate an understanding of the theory developed in chapter 3,4 and 5.	What ought to be the actual purpose of S's design ? To create 'real world' improvements in the enterprise which would demonstrate an understanding of the subject matter (i.e. as part of an academic process).
3	What, judged by the designs consequences, is its built in measures of success ? The design is based on a solid theoretical foundation which is based on the Viable System Model, Internal Market Model and the Multidimensional model of organization.	What ought to be S's measures of success (or improvement)? The perception of the client (management) with respect to the utility of the final design and the 'real world' improvements achieved.
4	Who is actually the decision taker ? The student.	Who ought to be the decision taker ? The client (management).
5	What conditions of successful planning and implementation of S are really controlled by the decision taker ?	What components (resources and constraints) of S ought to be controlled by the decision taker ? All components of S are controlled by the decision taker, however this 'control' should be limited as a consequence of the participative nature of the methodology which produces the final design.
6	What conditions are not controlled by the decision taker, i.e. what represents 'environment' to him ? The requirement of the supervisor of what is considered an acceptable final enterprise design are not controlled by the student.	What resources and conditions ought to be part of S's environment, i.e. not be controlled by S's decision taker? Any mechanistic paradigms or ideas which the decision maker holds should not be included in the design through the control of the decision maker.
7.	Who is actually involved as planner ? The student is planner (and decision maker).	Who ought to be involved as designer of S ? The student and a selected group of stakeholders who will be affected by the design.
8.	Who is involved as expert, of what kind is his/her expertise, what role does he actually play ? The supervisor could be considered the expert. However, the student is also an 'expert' as a consequence of the design being based on a synthesis of enterprise design theory which was created by the student.	What kind of expertise ought to flow into the design of S ? The expertise should include the student (who should hold content based expertise) and the stakeholder participants (who should hold context based expertise).
9.	Where do the involved see the guarantee that their planning will be successful? The supervisors feedback and boundary requirements for the level of detail included in the design provides a 'guarantee' that the client (external examiner) will accept the design.	Who ought to be the guarantor of S? The social system paradigm and the associated models of organization. The participative methodology used to create the design.
10	Who among the involved witnesses represents the concerns of the effected? Who is or may be affected without being involved ? The student is effected if S is not successful. The role of the supervisor could be considered to represent the concerns of the student.	Who ought to be belong to the witnesses representing the concerns of the citizens that will or might be effected by the design of S ? Union representatives could be included in the stakeholder group who develop the design in a participatory manner.

Table 21: CSH boundary questions interrogating S3...

11	Are the effected given an opportunity to emancipate themselves from the experts and to take their fate into their own hands ? The student does have the option to ignore the supervisor.	To what degree and in what way ought the effected be given the chance of emancipation from the premises and promises of the involved ? The participatory manner in which employee union representatives contribute to S. It is however very important that the employee union participant represents the affected subscribes to the motives of the people being represented and not personal motives.
12	What word view is actually underlying the design of S? Is it the world view of (some of) the involved or of (some of) the affected? The social system view of reality is the most appropriate view, particularly when considering a fast changing and complex environment. Furthermore, it is acceptable for academic purposes to produce a design which is not developed in a participatory manner.	Upon what word views of either the involved or the affected ought S's design be based ? The social system view of reality is the most appropriate view, particularly when considering a fast changing and complex environment.

10.3 CONCLUSION

This chapter has attempted to present a short critical reflection of the boundary judgments which have influenced the outcome of the dissertation. The reflection has attempted to underline the fallacy of the methodology used to create the conceptual design and the conceptual design itself. This fallacy is a consequence of the systems approach being applied in a scientific manner rather than as an 'instrument of practical reason'.

Although the writer is aware that any social systems design will have an element of fallibility, the non-participatory nature of the 'individual effort' methodology makes the situation increasingly less desirable.

Notwithstanding the above mentioned fallibility, the dissertation has attempted to present a synthesis of 'enterprise design' theory. If this theory is used in conjunction with the systems approach (as an instrument of practical reason), the enterprise designer will be in a position to create an enterprise which is flexible to change but at the same time retains stability.

The individual based design process is unsound in terms of a 'soft' systems approach. However, it does illustrate how a completely different enterprise design is achieved by providing the underlying systemic structure of organization which are aligned with the proposed social systems conception of organization.

Warfield²⁹¹ argues that increasing levels of complexity and interdependencies of societal problems has led to people becoming more specialized. Warfield²⁹² adds that *"as issues grow more complex, it becomes progressively more difficult to communicate across the scope of an issue in a verbal setting, the quality of the debate deteriorates, and the valuable benefits of dialectic begin to disappear."* To

²⁹¹ J. Warfield, 'Societal Systems', (California: Intersystems Publications, 1989), p.49

²⁹² Ibid., p.49

overcome this problem of complexity and level of specialisation, Warfield²⁹³ states that *"in discussing the organized conduct of inquiry into complex issues, it would be as much an oversight to overlook the possibility for isolated individual contributions as to avoid the question of how groups can be effective."*

--- END ---

²⁹³ Ibid.,p.73

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12. APPENDIX A - THE INTERNAL MARKET MODEL OF ORGANIZATION

This appendix is a synthesis of the Internal Market Model (IMM) of organization proposed by W. Halal, A. Geranmayeh and J. Pourdehnad. The primary source for this appendix is the compilation : 'Internal Markets : Bringing the Power of Free Enterprise Inside Your Organization', edited by W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley).

12.1 PHILOSOPHY OF THE IMM

The external environment is changing rapidly and global competition is increasing which is causing institutions which have worked in the past to begin failing. This is evident from the decline of major corporations, crisis in government bureaucrisis and the collapse of communism.²⁹⁴ Furthermore, it is expected that the information revolution will increase the complexity as well as the competition.²⁹⁵

The current bureaucratic and authoritarian approach to enterprise organization (based on the mechanistic conception of the enterprise) is no longer valid for a complex rapidly changing environment. *"In an ironic twist of history, capitalist corporations are trapped in centrally planned, hierarchic structures of the past."*²⁹⁶ What is required is an enterprise which is agile, responsive and customer focused.

The internal market approach to organization offers an approach which will produce continuous adaptation and change in a complex, competitive environment. The IMM is a conceptual system designed to produce continual rapid structural change, that transcends ordinary organizational structures.²⁹⁷

Market mechanisms have existed successfully for several hundred years as a basis for macro-economic organization and also should operate successfully in a micro-economy of an organization.

*"Free enterprise, whether internal or external, remains the only economic philosophy able to produce an unending stream of adaptive change rapidly and efficiently."*²⁹⁸

*"The IMM provides a logical foundation for forming the alliances that are crucial for world competitiveness."*²⁹⁹

²⁹⁴ W. Halal, A. Geranmayeh and J. Pourdehnad, 'The Single Most Important Change in Management Today', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.1

²⁹⁵ Ibid., p.1

²⁹⁶ W. Halal, 'The Transition from Hierarchy to ... What ?', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.28

²⁹⁷ W. Halal, A. Geranmayeh and J. Pourdehnad, 'The Single Most Important Change in Management Today', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.4

²⁹⁸ Ibid.,p.8

²⁹⁹ W. Halal, 'The Transition from Hierarchy to ... What ?', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.48

*"Although not every market economy has flourished, all truly vital economies have been market economies."*³⁰⁰

12.2 PRINCIPLES OF THE IMM

12.2.1 MARKET FORCES

Redefining the enterprise as a cluster of small autonomous units allows each unit to engage in interactions which are co-ordinated by market mechanisms. Market mechanisms rely on voluntary market interactions to co-ordinate and integrate the activities between operational units.

Market relationships are explicit with the performance required in the relationship being defined in terms of measures for compensation.

*"Internal markets provide a sound economic foundation for modern management based on the dynamic principles of free enterprise."*³⁰¹

12.2.2 ENTREPRENEURSHIP

Enterprises should have decision making autonomy decentralised to the lowest level with subordinates having freedom to make operational decisions and take advantage of opportunities which present themselves by using their own judgment. At the same time subordinates are accountable for the results achieved. This entrepreneurship provides an element of risk, which enables the enterprise to move forward. By taking risks the opportunity to learn also improved when outcomes are different to what are intended.

In enterprises with true entrepreneurial spirit, the concept 'authority' disappears and is replaced with a freedom of choice at the lowest level. This freedom of choice can be regulated by pay for performance schemes based on specific desirable goals.

Entrepreneurial enterprises do however require an element of regulation to ensure that decisions made by autonomous units are in the best interests of the enterprise as a whole.

12.2.3 MANAGEMENT'S ROLE

A fundamental principle in the behaviour of a system asserts that policies favouring the short run always degrade the long run.³⁰² Enterprises therefore require a certain degree of regulation which is the role of the management system. Management

³⁰⁰ R. Ackoff, 'Corporate Perestroika', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley), p.15

³⁰¹ W. Halal, 'The Transition from Hierarchy to ... What?'; in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley), p.29

³⁰² J. Forrester, 'Reconsidering "A New Corporate Design"', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley), p.63

policies and interventions regulate the interactions between the units in certain circumstances where the actions of a single unit may not be desirable for the operation of the enterprise as a whole.

Rethinking the nature of managerial work is an important part of changing peoples world views and assumptions. Management should be seen as responsible for developing commitment, building knowledge and designing and guiding the process (e.g. establishing common systems for accounting, communications and policies) rather than planning, organizing and controlling operating units.

According to Senge³⁰³, a central task of management will be to build knowledge by developing better enterprise processes and systems. This will enrich peoples understanding of the web of interdependencies within which they operate by helping them see the long term systemic consequences of their actions.

"Management's role is to create a supportive environment, that respects freedom of action and nurtures the creative energies of enterprise members, and to manage the relationship of the of the unit as a whole with its environment. The whole enterprise is biased towards action because members enjoy unprecedented freedom to act. Along with this freedom comes accountability and responsibility. Survival of each unit, like that of the enterprise as a whole, depends on its performance." ³⁰⁴

12.2.4 AVAILABILITY OF INFORMATION.

People in an enterprise should receive up to date information on the performance of the enterprise without relying on the middle management chain of command to filter the information for them (This is the role of middle management in mechanistic enterprises .)

Information technology is providing a means to disseminate information freely throughout an enterprise. By using this information technology to co-ordinate activities of operational units a different mode of organization is established were information is freely available and communication channels exist which cut across enterprise boundaries.

According to Halal³⁰⁵, by using internal market mechanisms enterprises will be *"able to manage a new age of complexity in an organic self-organizing manner...and the organization is no longer a hierarchy of power but a web of changing business connections held together by a cluster of internal enterprises."* Halal³⁰⁶ continues to say that *"the lesson seems clear : information technology is replacing hierarchies with markets everywhere."*

³⁰³ P. Senge, 'Internal Markets and Learning Organizations', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.96

³⁰⁴ A. Geranmayeh and J. Pourdehnad, 'Its a Great Idea ! But...', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.120

³⁰⁵ W. Halal, 'The Transition from Hierarchy to ... What ?', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.35

³⁰⁶ Ibid.,p.39

12.3 DESCRIPTION OF THE IMM

12.3.1 PROFIT CENTRES

All operational units act as profit centres which have the freedom to purchase from whom they choose and to sell outputs at whatever price they want. The profit centres are autonomous and are accountable for their own performance.

Profit may be accumulated by a profit centre up to a specific amount. Any money above the set amount should be passed on to the parent structure for investment in other units. Interest is paid to operating units which allocate profits to higher level units. Operational units may also reinvest profits themselves in their own units if the investment provides financially viable returns.³⁰⁷

If funds over and above those received as income for services provided is required, it may be obtained via investment from either the executive unit or other internal market units. Funds are motivated for on a sound business basis (e.g. return on investment).

The units are members of the same enterprise for the same reasons as a traditional hierarchic enterprise. However, internal market units are free to leave the enterprise if they feel they can do better outside or there is a lack of synergy within the enterprise. The units should therefore continually evaluate their contribution to the enterprise as a whole.

Voluntary relationships are entered into between internal market units with simple contacts which clarify goals and outline how disputes should be solved. Units should be free to withdraw from relationships if they believe they are being unfairly treated. If the units are unable to withdraw then the openness and explicitness of the relationship is compromised.

Constitutional and contractual relationships ensure that individuals or small groups would not have the power to change the structure of the enterprise. Changes can only be made if corporate citizens are in a majority favour of the changes (the same principle as those of a constitution of a country).

Enterprise units which use services provided by other enterprise units should have a choice in deciding which support unit services are utilized. Units should be allowed to conduct business transactions either inside or outside of the enterprise. This forces units to reach a level of competitiveness at which it is able to compete with external enterprises.

As a general rule, technologies which represent proprietary knowledge should not be managed through internal market profit centers. As a result of these proprietary technologies being few in number, exempting them from the free market should rest

³⁰⁷ R. Ackoff, 'Corporate Perestroika', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley), p.21

with the enterprise Chief Executive Officer (CEO). It may also be feasible to keep a non-profitable division if it provides a service which is strategically critical to the parent. In this case, the CEO's office should be responsible for providing subsidies to the non-profitable units.

12.3.2 PERFORMANCE MANAGEMENT

Internal market units motivate staff through pay for performance schemes linked to the staffs contribution to the enterprise. In some cases staff can become temporary sub-contractors who have clearly specified contracts with the market unit. Rather than attaching salaries to rank, pay for performance schemes make it feasible to reward people at same level with different levels of compensation. Employees are therefore free agents contracting to management to deliver agreed upon performance goals.

The risk of entrepreneurship is balanced by a range of performance incentives (i.e. a reward system). This could create a difference in level of compensation of people at the same "level" rather than different levels having different compensation. The reward system also creates a greater motivation and sense of equity.

12.3.3 CORPORATE EXECUTIVES

The CEO must continually ensure that there is synergy and positive net benefit in being a member of the internal market for the market units. What makes a group of companies in a internal market different from a group of independent companies in the external environment is the synergy they create as a whole. Synergy is created by reduction of risk, a shared vision of the future and economies of scale.

Executives do not get involved in day to day decisions of the operational units and strategic planning takes place at all levels. The contents of the plans however differs at each level.

12.4 CHARACTERISTICS

Table 22 presents the behavioural characteristics enterprises organized using the Machine model versus the Internal Market Model of organization. The Machine model of organization is described in chapter 3.

Machine Model	Internal Market Model
<p>Authoritarian culture with impersonal superior subordinate relationships leaving staff with little motivation to perform and discouragement of free enterprise attitudes. Jobs are routine with security and little accountability for performance. Decentralization typically reaches down one or two levels to operating divisions with the smaller units continuing in the authoritarian behaviour patterns. Real entrepreneurship therefore does not extend to the level of individuals.³⁰⁸</p>	<p>Entrepreneurial management culture where staff are not provided a job but an opportunity to be paid for their effort. This provides autonomy, opportunities to advance, personal fulfillment with accountability for performance. Decentralization reaches down to the level of the individual.</p>
<p>Cross-subsidized, monopolistic providers of goods and services with resources allocated by people of authority. Information fed upwards is usually created to justify existence of an operation. This type of justification can result in internal monopolies being formed in certain parts of the enterprise which are responsive to higher level units which provide funds. The boss become the customer in that units attempt to make improvements based on what they perceive as important to the boss rather than improvements required by customers.</p>	<p>Financial resources allocated depending on the strength of the business motivation. Information systems make information freely available, difficult to tamper with and easily transmitted across the enterprise.</p>

Table 22 : Enterprise characteristics : Machine Model versus IMM (1).

³⁰⁸ J. Forrester, 'Reconsidering "A New Corporate Design"', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley), p.64

<p>Difficult to determine the economic value of cross-subsidized economic units because units do not know what the true costs are. Profits are only recognized at the level of end products. Component manufacturers pass on bloated costs down the value chain with end product users adding up all cost and adding a profit margin at the end.</p>	<p>End product manufacturers start with a market related price for the product and work out at what costs they can afford to purchase components</p>
<p>Internal products and services are more expensive and responsiveness to customers need is slow. Costs and service are not compared with external prices (no competition).</p>	<p>Increased responsiveness of internal supplier - units now have choice to go to external suppliers for the same service.</p>
<p>Interaction co-ordinated by internal schedules, procedures and routines (administrative control).</p>	<p>Interaction co-ordinated by clearly specified objectively structured contracts. Market interactions make behaviour more transparent by making linkages more transparent. Market relationships tend to be explicit.</p>
<p>Creation of functional silos as a result of lack of cooperation in attempting to 'protect turf'. Interactions between units are coloured by the hidden threat of politics, power and influence which guide behaviour.³⁰⁹ Suppliers of services are seen as the enemy who should be tied into complex and detailed formal legal contracts to ensure performance.</p>	<p>Voluntary relationships between units with simple contacts which clarify goals and outline how disputes should be solved. Relationships between units tend to be unambiguously established by ensuring that the units only source of income is the customer which is being serviced. This leads to a possibility of long term win-win relationships between units.</p>

Table 23 : Enterprise characteristics : Machine Model versus IMM (2).

³⁰⁹ A. Geranmayeh and J. Pourdehnad, 'Its a Great Idea ! But...', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.108

<p>Units grow as large as possible to ensure survival with small spans of control and excessive layering. This is caused by centralized planning in which those who plan for the enterprise are not aware of the over sizing and those who control the units judge status as proportional to the number of staff which they manage - To grow staff must be made managers and have staff allocated.</p>	<p>Units have an optimal size at which they are able to simultaneously provide a quality service and remain profitable. Vertical integration (moving backwards down the value chain with the belief that you are able to provide a service better yourself than a supplier - move towards functional hierarchy) is reduced by ensuring that each operation is profitable and provides a return on its capital employed. Vertical integration will be avoided if it is unable to create long term returns which would exceed the cost of capital required for integration.</p>
<p>The enterprise is stable and resists change. Centralized decision making requires flow of information upwards and back down the hierarchy.</p>	<p>The enterprise is in a constant state of adjustment to market, technological and other forces in the environment. Units which are operating in an internal market must remain relevant in a continuously changing environment. The IMM therefore provides a continual structural change as the autonomous units adapt to the changing environment. Should they not adapt they will no longer be able to compete against other quick moving external units.</p>
<p>Power is perceived to provide control.</p>	<p>Power is illusionary.³¹⁰</p>

Table 24 : Enterprise characteristics : Machine Model versus IMM (3).

³¹⁰ W. Halal, 'The Transition from Hierarchy to ... What ?', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley), p.44

12.5 ASSUMPTIONS OF THE IMM

The IMM assumes that a market economy is better than a tightly controlled and restricted economy (i.e. market mechanisms are often the most effective way to achieve co-ordination among enterprise units).³¹¹

12.6 ADVANTAGES OF THE IMM

- The market approach explicitly recognizes the purposeful nature of social systems by allowing voluntary relationships between autonomous units;³¹²
- Money is not necessarily the primary source of motivation in an internal market economy. The IMM provides a framework in which freedom, recognition for tasks well done and absence of frustrations imposed by others are conditions which induce dedication to the task at hand;³¹³
- Enterprises organized according to the IMM are always in a process of renewal and are in a state of continuous adjustment to market, technological and other forces in the environment;³¹⁴
- There are similar measures of performance between units as they are all profit centres;
- Managers are managers of autonomous units and should obtain general management experience. There is less demand for information from superiors and time can be spent finding valuable information which will assist profitability;
- The IMM is systemic in that it focuses on the market interactions rather than the parts. The model is dependent upon synergy existing between the parts;
- Overall corporate cost should decrease as a result of end products being costed as "end product price minus costs" rather than cost plus profit;
- Only profit and loss sheets and balance sheets need to be allocated to higher units - financial systems are therefore simplified;
- It is possible for internal market economy to operate within a centrally controlled enterprise;
- The removal of centralized control allows for local initiative and responsiveness which is a necessity in a fast changing environment;³¹⁵

³¹¹ A. Geranmayeh and J. Pourdehnad, 'Its a Great Idea ! But...', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.107

³¹² Ibid.,p.108

³¹³ J. Forrester, 'Reconsidering "A New Corporate Design"', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.57

³¹⁴ R. Miles and C. Snow, 'Internal Markets and Network Organizations', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.86

- IMM is compatible with all the latest management innovations (e.g. flat enterprises, entrepreneurship, virtual corporations, networked enterprises etc.) but provides a broad conceptual foundation based on the principle of free enterprise. : complete internal market economies that bring all the advantages of a free market inside an enterprise, just like the macro-economy³¹⁶ :
 - Control can be achieved through freedom;
 - Security can be increased by accepting risk;
 - Structure is enhanced by change .

12.7 LIMITATION OF THE IMM

- There is a concern that competition amongst internal units can be greater than between internal and external units. This could lead to negative effects of conflict if there is not very strong leadership in the enterprise who are continuously ensuring that synergy exists between the units;³¹⁷
- The balancing of the controlling of performance with autonomy is a difficult balance and a combination of measures of performance are required to ensure that short term profit is not emphasized by operational units at the detriment of long term survival;³¹⁸
- No guidelines for implementation are available. The IMM offers a conceptual perspective but does not explain details of implementation. The principles should be applied by management such that they are applicable to the specific industry or business.³¹⁹

12.8 IMPLICATIONS OF THE IMM

- The model provides a management paradigm which is not based on the mechanistic paradigm which is so deeply embedded in peoples thinking. The IMM cannot be implemented without changing this paradigm (e.g. the IMM demands a requirement for teamwork and sharing of information. Upper management are

³¹⁵ A. Geranmayeh and J. Pourdehnad, 'Its a Great Idea ! But...', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.119

³¹⁶ W. Halal, A. Geranmayeh and J. Pourdehnad, 'The Single Most Important Change in Management Today', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.4

³¹⁷ A. Geranmayeh and J. Pourdehnad, 'Its a Great Idea ! But...', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.108

³¹⁸ W. Halal, 'The Transition from Hierarchy to ... What ?', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.31

³¹⁹ W. Halal, A. Geranmayeh and J. Pourdehnad, 'The Single Most Important Change in Management Today', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.10

usually unable to imagine an organization without the superior subordinate relationship).³²⁰

According to Senge³²¹ all systems of management are built upon fundamental premises about people. The premises which are believed to be valid for authoritarian hierarchies need to be fundamentally changed. The mechanistic paradigm assumes that people need to be motivated by extrinsic factors. However Deming³²² argues that the intrinsic motivation (self esteem, dignity, curiosity and joy in learning) within people should rather be tapped to the full potential. To tap these intrinsic factors it is necessary to make individuals feel committed to the work they are doing. This may be achieved by making people responsible for their outputs. People must aspire to achieve something that they regard as truly important and can only be achieved over the long term (i.e. no focus on short term profit);

- Application of the IMM sometimes fails as a result of a lack of a "well defined transition plan."³²³ The significance of the transition must be clearly understood by all members of the enterprise. Members must have the ability and desire to function within an internal market economy. This desire can be created by the opportunity of a better work environment and a clear understanding of the advantages of the IMM over traditional mechanistic hierarchies.
- The change must be fundamental and must reach down to the individual level such that each individual may grow as an entrepreneur, otherwise the enterprise will drift back to a hierarchic dictatorship. Spinning off divisions into separate companies does not prevent the smaller companies operating as dictatorial hierarchies and retaining the original fundamental weakness;³²⁴
- Management will require training to perform their new role of enterprise designers rather than operators (e.g. systems dynamic modeling);³²⁵
- The national legal structure governing corporations may be required to be revised as present beliefs about labour and unions will not be appropriate. The corporate citizens will have control of the enterprise rather than management;³²⁶
- The IMM must be thought of as a total system and certain concepts cannot be adopted without adopting others.³²⁷ Three systems which require design are :

³²⁰ J. Forrester, 'Reconsidering "A New Corporate Design"', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.54

³²¹ P. Senge, 'Internal Markets and Learning Organizations', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.95

³²² Ibid.,p.96

³²³ A. Geranmayeh and J. Pourdehnad, 'Its a Great Idea ! But...', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.118

³²⁴ J. Forrester, 'Reconsidering "A New Corporate Design"', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.66

³²⁵ Ibid.,p.66

³²⁶ Ibid.,p.66

- Exchange system (buying and selling);
 - Role structure system (each unit must understand its role in the whole system);
 - Threat system (each unit must understand conditions under which it could lose membership, management intervention etc.).
- Managers must be prepared to share information;³²⁸
 - A certain degree of chaos is created by the inherent features of the IMM (e.g. allowing cross hierarchy communication by short circuiting upper management and the creation of more alternatives of action by units as a result total autonomy). It could however be argued that the growth and advantages of the entrepreneurial spirit of the IMM over-weighs the addition of an element of chaos (e.g. the IMM is not appropriate for an enterprise such as the military which requires the close co-ordination of many people with split second reaction times and little individual choice).³²⁹
 - Internal market units have an optimal size. When too many autonomous operating units are formed, the web of interactions between the units could become too difficult to conceptualize with a loss of understanding of what the purpose of the organization is.

³²⁷ A. Geranmayeh and J. Pourdehnad, 'Its a Great Idea ! But...', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.119

³²⁸ R. Ackoff, *The Democratic Corporation*, (New York: Oxford Press, 1994),p.166

³²⁹ W. Halal, 'The Transition from Hierarchy to ... What ?', in *Internal Markets*, eds. W. Halal, A. Geranmayeh and J. Pourdehnad (New York: Wiley),p.41

13. APPENDIX B - THE MULTIDIMENSIONAL MODEL OF ORGANIZATION

This appendix is a synthesis of the Multidimensional Model of Organization (MDO) proposed by R. Ackoff. The primary source for this appendix is : R. Ackoff, *The Democratic Corporation*, (New York: Wiley, 1994). The synthesis of the MDO is partly a result of a group process facilitated by J. Strümpfer at an 'Enterprise Design Workshop' hosted at the University of Cape Town, School of Engineering Management (24-28 February 1997).

13.1 PHILOSOPHY OF THE MDO

Enterprises are now in a rapidly changing and turbulent environment. Typically most enterprises re-organize frequently to stay abreast with change. A great deal of time and energy is required to re-organize and this naturally results in resistance - resistance to change.

Continuous re-organization and change is disruptive and counter productive. What is needed is an organizational design which allows for change without the necessity of disruptive changes to the organizational structure of the enterprise.

13.2 PRINCIPLES OF THE MDO

*"All re-organizations involve the changing of the relative importance of the three criteria used in dividing labour - that is changing the level at which these organizational types occur."*³³⁰

The need to organize derives from the need to divide labour. To organize is to divide labour and to co-ordinate it in such a way as to obtain a desired output. Ackoff's MDO proposes that there are only three ways of dividing labour:

- Functionally defined (input);
- Product or service defined where products and services are usually consumed or used externally(output); and
- Market defined units which are usually defined by classification of external customers.

Ackoff argues that an enterprise which contains all three of the above mentioned dimensions at the same time will allow an enterprise to adapt to change without re-organization.

In such an enterprise there is no need to re-organize in order to change the relative importance of criteria used in dividing work as each of the three dimensions exist at any given time.

³³⁰ R. Ackoff, *The Democratic Corporation*, (New York: Wiley, 1994),p.169

13.3 DESCRIPTION OF THE MDO

Enterprise units are designed in three dimensions namely input, output and market dimensions.

In general, every unit in a MDO can be organized in the same way as the enterprise as a whole (i.e. MDO structure is the same at all levels - it is recursive). However, sub units can still be designed in three dimensions even when higher or lower level units have not been so designed (see Figure 44).

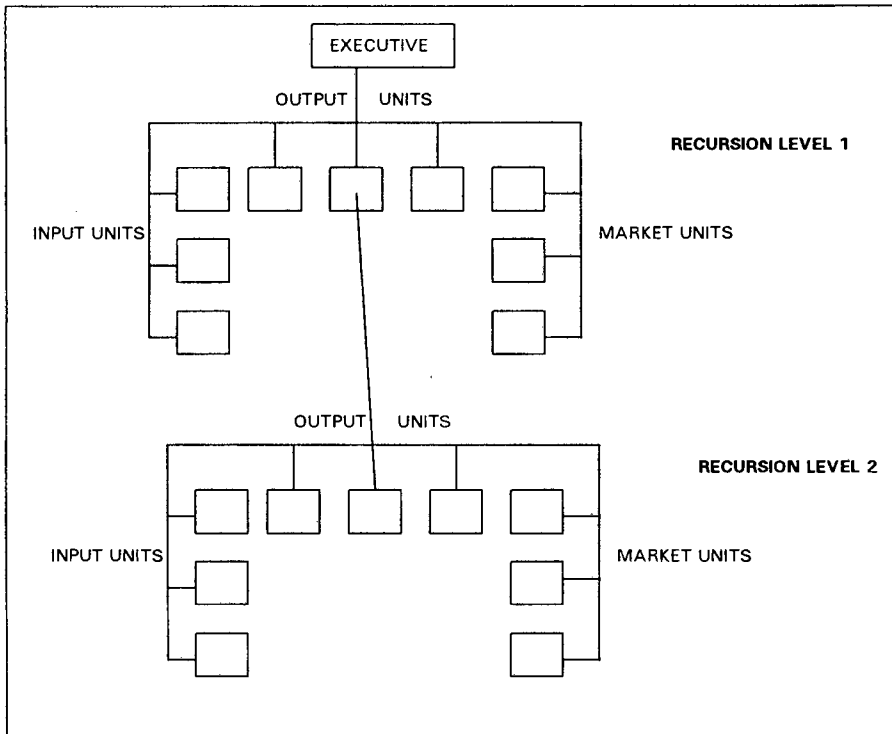


Figure 44 : The MDO.³³¹

Lower level managers are given autonomy of each units operation - lower level units operate as businesses in their own right. This is particularly effective if an enterprise organized using the MDO as a basis for dividing labour also operates within an internal market economy (see appendix A).

13.3.1 PRODUCT OR SERVICE DEFINED (OUTPUT) UNITS

These units consist of management and supporting staff but no other personnel. No other facilities are required for this unit other than facilities in which they are located (low investment requirement as they need no large capital items).

These units would typically co-ordinate the supply of products which are "manufactured" by the internal functional units or external companies. They are responsible for all activities required to make available and sell their products and/or services to customers. They can influence suppliers by using their purchasing power - they have no control over input units.

³³¹ Source : Adapted from : R. Ackoff, *The Democratic Corporation*, (New York: Wiley, 1994),p.173

Should a product unit be the exclusive user of an input unit for strategic reasons, then the input unit should be contained within the product unit as a cost centre.

13.3.2 FUNCTIONAL (INPUT) UNITS

These units provide goods or services which are used within the enterprise. When they perform more external work, they should be classified as output units. Examples of functional units are manufacturing, transportation, warehousing, personnel, legal and accounting.

13.3.2.1 MARKET DEFINED UNITS

Market units have two functions:

- Sell the output of any other unit in the enterprise who want to use their services; and
- Serve as advocates of the users in the market in which they operate and represent the market in the company (i.e. evaluate the activities of other enterprise units from the point of view of those outside the corporation over all the areas served).

13.4 CHARACTERISTICS OF THE MDO

- Input, output and market units all exist at the same level of recursion;
- Low levels of capital investment in output and market units;
- Low staff levels in input and output units.

13.5 ASSUMPTIONS OF THE MDO³³²

The MDO is based on the assumptions that:

- There are three basic functions (functional, product/service and market functions) within any enterprise. All re-organizations involve changing the relative importance of these three functions used in dividing labour.
- As the division of labour is increased, the need for increased co-ordination of the labour force is required in order to manage the enterprise.
- Re-organizing is usually resisted, especially at the lower levels of an enterprise, where its effects are usually greatest as it is unsettling and disruptive.

³³² J. Strümpfer, *Enterprise Design Workshop*, University of Cape Town, School of Engineering Management, (24-28 February 1997).

13.6 ADVANTAGES OF THE MDO

Table 25 presents advantages of the MDO.

ADVANTAGE	RATIONALE
Eliminates the need to change structure.	If the functional / product / market lines are established at every level of an enterprise, then the need to re-organize at any time is completely eliminated. Re-organization only requires the moving of staff between enterprise units. Input, output and market units can be added or subtracted at any time.
Provides an organized view of an enterprise (gives some order).	When deciding as to which existing units are input/output or market related, you are consciously asking questions as to what a unit contributes to the enterprise (Who does what) and grouping those units which contribute as input, output or market aspects of the enterprise.
The structure is supportive of general management development.	Every unit is a separate autonomous enterprise unit operating in a market economy. Every manager within a unit is a general manager no matter how specialized the work.
Product / service units easy to add and subtract.	Units can be added or subtracted (or modified) without altering the fundamental structure as all dimensions exist at the same time. Product and service units also have no fixed assets and contain relatively few people.
Assists in the identification of un-exploited opportunities or threats.	The market units evaluate the other units in performance across the areas served by the enterprise.

Table 25 : Advantages of the MDO.

13.7 LIMITATIONS OF THE MDO³³³

The MDO is seriously deficient when used in isolation. The model does not make explicit the inter-relationships of the enterprise units nor enterprise unit measures of performance. The social nature of the enterprise is also ignored. In order to get maximum benefit, it would have to be integrated with other models such as the Internal Market Model.

13.8 IMPLICATIONS OF THE MDO³³⁴

- The MDO is difficult to implement without the implementation of the Internal Market Model;
- Although the MDO can be applied at any level of an enterprise, in practice it has tended to be employed primarily at the upper level of enterprises or in semi-autonomous business units.

³³³ Ibid.

³³⁴ Ibid.

14. APPENDIX C - THE VIABLE SYSTEM MODEL OF ORGANIZATION

This appendix is a synthesis of the Viable Systems Model (VSM) of organization proposed by Stafford Beer. The primary source for this appendix is the compilation : Espejo and Harnden, eds. *The VSM : Interpretations and Applications of Stafford Beer's VSM* (New York: Wiley, 1989).

14.1 PHILOSOPHY OF THE VSM

There are high levels of complexity in an enterprises external and internal environment. This complexity can be attributed to an increase in the number of people competing for limited resources, increasing rates of technological change, increasing problems and opportunities, large volumes of information as well as an increase in the number of interdependencies between and within the enterprise.

Management of enterprises must have the ability to cope with this environmental complexity which is continually creating disturbances in the enterprise. The above mentioned situation tends to force management to spend most of their time dealing with present problems. Focus therefore becomes on short term profits rather than long term survival.

The question is - how is it possible for *"multiple control elements , human or mechanical, each one possessing only limited powers of perception, computation and action , to achieve the enormous task of regulation needed to achieve complex purposes, or even any kind of identifiable continuity-that is to say stability -in turbulent, noisy and sometimes aggressively competitive environment. The general answer is by making them subject to appropriately organized systems of constraints ... to organize is therefore to arrange for complex regulation. If the organization is to be viable then this system of constraints must continue to provide an effective regulator even though its environment may change."*³³⁵ The theory of organization attempts to determine what is appropriate for this.

The Viable System Model (VSM) *"provides a way of structuring an organization and provides a language for discussing its viability (long range effectiveness)."*³³⁶ Beer attempts to show how an organizational structure - the necessary requirements for achieving purposes -can be given its essential property - viability.

Cybernetics is defined as *"the science of effective organization."*³³⁷ According to Clemson³³⁸ the laws of cybernetics provided the general framework on which the VSM was developed. The VSM describes how systems are made viable - that is capable of independent existence.³³⁹

³³⁵ R. Anderton, 'The Need for Formal Development of the VSM', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.43

³³⁶ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984),p.126

³³⁷ *Ibid.*,p.19

³³⁸ *Ibid.*,p.99

³³⁹ S. Beer, 'The VSM: Its Provenance, Development, Methodology and Pathology', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.11

According to Ryan³⁴⁰, the role of management in ensuring the long term survival of an enterprise is to:

- Ensure that the enterprise is relevant in its environment (i.e. it must understand its external environment); and
- Ensure that the enterprise is doing the "right" thing (i.e. that operations are operating correctly).

Both the above mentioned environments are highly complex, and mechanisms are required to deal effectively with this complexity (see Figure 45). These mechanisms are provided by the VSM by embodying Ashby's laws of cybernetics.³⁴¹ *"The VSM is concerned with conditions under which autonomy can be exhibited within certain environmental constraints."*³⁴²

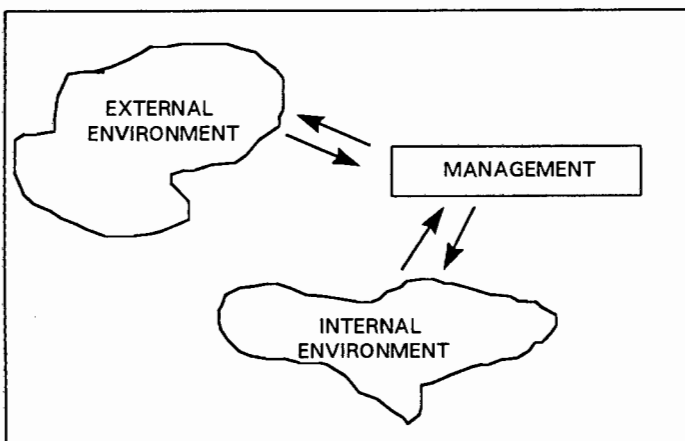


Figure 45 : Environmental complexity faced by management.³⁴³

The VSM can be categorized as an "organic" model of organization. According to Checkland³⁴⁴ *"much of the experimental work in cybernetics seeks to construct machines which exhibit intelligent behaviour, as a means of exploring possible mechanisms for models of the brain. Ashby himself, undertook this work (cybernetics) because of a prime interest in biological mechanisms, especially those by which living systems regulate their own behaviour"*. Beer³⁴⁵ also claims that he

³⁴⁰ T. Ryan, 'The VSM', School of Engineering Management, University of Cape Town(1993,1994),p.1

³⁴¹ A detailed description of Ashby's 'Cybernetic Laws' can be obtained from the source : B. Clemson, *Cybernetics: A New Management Tool* (Kent: Abacus, 1984)

³⁴² R. Anderton, 'The Need for Formal Development of the VSM', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.46

³⁴³ Source : T. Ryan, 'The VSM', Course Material, University of Cape Town (1993,1994),p.1

³⁴⁴ P Checkland, *Systems Thinking, Systems Practice* (Sussex: Wiley, 1994),p.86

³⁴⁵ S. Beer, 'The VSM: Its Provenance, Development, Methodology and Pathology', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.12

pursued the VSM through the use of "homomorphic mappings" with the human neurophysiological system.

14.2 PRINCIPLES OF THE VSM

14.2.1 CYBERNETIC LAWS

14.2.1.1 REQUISITE VARIETY

"Given a system and some regulator of that system, the amount of regulation attainable is absolutely limited by the variety of the regulator.

Corollary

Most of the regulation of very complex systems is achieved through the interaction of the parts (i.e. one part acts to regulate some other part).³⁴⁶

Beers³⁴⁷ first principle of organization, which is a corollary of Ashby's law of requisite variety, states that *"Managerial , operational and environmental varieties, diffusing through and institutional system, tend to equate; they should be designed to with minimal damage to people and to cost."*

14.2.1.2 SELF-ORGANIZATION³⁴⁸

"Complex systems organize themselves; The characteristic structural and behavioural patterns in a complex system are primarily the result of interactions among the parts.

or;

The system is the way it is because of the mutual adjustments the parts have made in the processor interacting with each other.

Corollary :

Complex systems have basins of stability separated by thresholds of instability i.e. some system configurations are stable and others are not."

³⁴⁶ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.36

³⁴⁷ S. Beer cited by B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.33

³⁴⁸ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.26

14.2.1.3 FEEDBACK³⁴⁹

"The outputs of a complex system is dominated by the feedback and within wide limits, the input is irrelevant.

corollary :

All outputs which are important to the system will have associated feedback loops."

14.2.2 STRUCTURE AND ENTERPRISE PURPOSE

*"An organization is a complex purposive system that man brings into being for the purpose of creating some desired change in his environment (i.e. in society)."*³⁵⁰

According to Anderton³⁵¹, *"human behaviour transcends rules. Humans make rules; sometimes they break rules. Mental life can only be described, in other than trivial cases, in terms of intentional characteristics - beliefs, preferences, purposes. But they can only achieve these purposes through structures - sets of constraints - which exist in the world...Beer shows us how an organizational structure - the necessary requirement for achieving purpose, can be given its essential property : viability."*

According to Clemson³⁵², *"a particular purpose implies some thing about appropriate structures for the organization. Most fundamentally a purpose implies that the organization needs parts which can do identifiable parts of the purpose."*

Clemson³⁵³ continues to say that *"making sure sub-units have the correct goals is operationally the task of making sure that the sub units have the appropriate internal structure (e.g. appropriate feedback loops, or to be more precise about it, the functions and networks specified by the VSM" - (See section 14.3 for a description of the networks specified by the VSM).*

The VSM provides a system of constraints which regulate the operational units of an enterprise such that the enterprise may achieve its desired purpose in a complex, fast changing environment.

³⁴⁹ Ibid.,p.28

³⁵⁰ F. Waelchli, 'The VSM and Ashby's Laws', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.54

³⁵¹ R. Anderton, 'The Need for Formal Development of the VSM', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.47

³⁵² B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.143

³⁵³ Ibid.,p.118

14.2.3 ORGANIZATIONAL RECURSION

According to Checkland³⁵⁴, the concept of "emergence and hierarchy" emerged from the field of biology where a view that living things consist of a hierarchy of structures. Checkland³⁵⁵ describes how from this initial biological view, a general model of organized complexity was developed - "there exists a hierarchy of levels of organization, each more complex than the one below, a level being characterised by emergent properties which do not exist at the lower level".

"Hierarchy theory is concerned with the fundamental differences between one level of complexity and another....(and the theory) is likely to be built on the fact that the emergent properties associated with a set of elements at one level in a hierarchy are associated with what may be looked upon as constraints upon the degree of freedom amongst the elements...This imposition of constraints upon an activity at one level which harnesses the laws at that level to yield activity meaningful at a higher level, is an example of regulatory or control action".³⁵⁶

According to Espejo³⁵⁷, primary activities are often split into two primary activities at a lower level as a result of increases in complexity of the primary activity which over loads management responsible for the primary activity. This is in essence allowing each lower activity to respond to chunks of environmental complexity which was previously all responded to by a single primary activity. According to the VSM, each of these lower level primary activities (sub-systems) should be viable systems themselves - *"In a recursive organizational structure, any viable system contains, and is contained in, a viable system."*³⁵⁸

The splitting of primary activities into smaller parts (sub systems) can be conceived as forming a hierarchy of activities (see Figure 46). Each sub-system of a primary activity in the hierarchy should also strive to be a viable system in its own right.³⁵⁹

³⁵⁴ P. Checkland, *Systems Thinking, Systems Practice* (Sussex: Wiley, 1994),p.78

³⁵⁵ Ibid.,p.78

³⁵⁶ Ibid.,p.81

³⁵⁷ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.89

³⁵⁸ S. Beer, 'The VSM: Its Provenance, Development, Methodology and Pathology', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.22

³⁵⁹ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.90

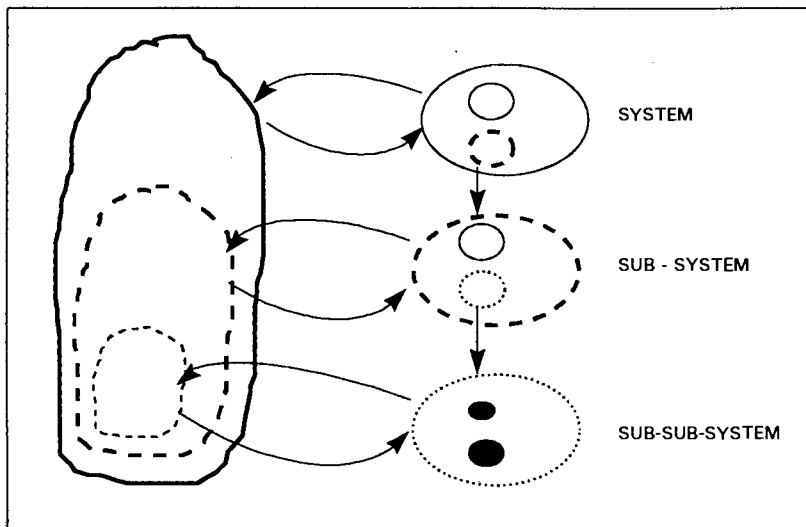


Figure 46 : Complexity unfolding.³⁶⁰

The principle of recursion is effective in dealing with complexity, because the all operational units should be structured as viable units, including the lowest level recursive units.

14.2.4 AUTONOMOUS OPERATING UNITS

Given the law of requisite variety, management is not able to be in total control of the enterprise. One of the most important way in reducing the complexity faced by a manager is for the manager to define a set of whole operational units with their own environments. The whole operational elements are then treated as autonomous black boxes. The managers job is to ensure that the boxes produce the intended outputs. Autonomy is enhanced by allowing management (at every level) the freedom to achieve the units required outputs in the way that local management thinks is best (i.e. the autonomous units should be able to make decisions without referring them to higher levels).

An advantage of autonomy is that each autonomous operating unit has far more flexibility, however, this means that the number of responses which each activity has to disturbances in the environment also increases. An element if control and co-ordination is therefore required to ensure that the responses to the disturbances are aligned with the overall identity (purpose) of the enterprise as a whole.

³⁶⁰ Source : R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.90

14.2.5 SYSTEMIC CONTROL

*"Much of the detail of the design of organizations is rooted in the need to design and engineer methods to transmit and manage very large amounts of information in real time."*³⁶¹ This information is used to provide control and co-ordination of operational units.

According to Checkland³⁶², organisms are open systems as a consequence of materials, energy and information being exchanged between itself and its environment. Checkland continues to say that (in general) a maintenance of a hierarchy of any open systems (as discussed in the recursion principle above), will entail *"a set of processes in which there is communication of information for purposes of regulation or control."*

*"Indeed it is intuitively obvious that a hierarchy of systems which are open must entail processes of communication and control if the systems are to survive the knocks administered by the systems environment."*³⁶³

These information and control systems are have been developed in hard engineering (control theory) and also exists in natural systems and *"a link between control mechanisms studied in natural systems and those engineered in man made systems is provided by the part of systems theory known as cybernetics."*³⁶⁴

Beer's VSM describes mechanisms necessary for effective control and communication in enterprises using the cybernetic laws of organization³⁶⁵ - *"The state of a system at any one time is the set of values held by its variables at that time. The value of these variables must remain within physiologically determined limits for the system to continue its existence - these are called "essential variables" of the system (e.g. blood pressure, temperature). Purposeful systems show a tendency towards a single or small range of values and when displaced from these exhibit a tendency to return. The variety of a complex system is the measure of the number of distinguishable states it can occupy. The concept of systemic control operates at two levels :*

- *Physiological control : Allows a system to continue its existence;*
- *Operational control : Control of one system by another which requires the maintenance of the values of a set of variables chosen by the controlling system*

³⁶¹ F. Waelchli, 'The VSM and Ashby's Laws', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.58

³⁶² P. Checkland, *Systems Thinking, Systems Practice* (Sussex: Wiley, 1994), p.83

³⁶³ *Ibid.*, p.83

³⁶⁴ *Ibid.*, p.84

³⁶⁵ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.77

, according to its purpose for existence. If operational control fails it can still live but fails to accomplish its purpose."³⁶⁶

14.2.6 ADAPTATION

"To remain viable an organization needs to have the capacity to adapt to new situations."³⁶⁷

Most efforts in reforming the enterprise take place by changing the inputs (e.g. by increasing training and changing procedures). The reform efforts seldom look at the enterprise outputs in a serious way.³⁶⁸ The implication of this is that the principle of feedback is ignored.

It is important that enterprises ensure that the actual outputs are compared with the desired outputs, and where a difference is experienced that control action is taken to adapt the outputs to the required outputs. These outputs will be determined such that they are supportive of the operational units desired purpose. Similarly, the environmental changes are necessary to be monitored with control action taken in the enterprise to adapt to the external environment.

According to Espejo³⁶⁹, an adaptation mechanism is required to ensure that policy makers / leaders of the enterprise visions about the enterprise identity (purpose) will support the enterprises long term goals. However, very often the policy makers have limited information processing capability to understand the complexity of what is happening in the external and internal environments. Filtering mechanisms are therefore required to filter the variety of the environments and provide them with information which can be processed effectively (low variety information) in making these decisions to change or alter key variables of the system. The policy makers need to be linked to the rest of the enterprise which can be done by designing well structured information processes.

14.3 DESCRIPTION OF THE VIABLE SYSTEM MODEL

The VSM specifies³⁷⁰ :

- The five broad functions that must be carried out in any enterprise that manages to both maintain internal stability and adapt to a changing environment; and
- The information flows (interaction) amongst the parts of the enterprise.

³⁶⁶ F. Waelchli, 'The VSM and Ashby's Laws', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.54

³⁶⁷ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.84

³⁶⁸ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.43

³⁶⁹ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.84

³⁷⁰ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.142

In terms of the VSM, the enterprise is divided into its markets, its management and its workers. They together form a complete, high variety, interlocked system, each of which is assumed to operate in obedience with Ashby's law of requisite variety.

The VSM views the enterprise as consisting of three interdependent parts. These parts are :

- The enterprise environment (internal and external);
- Purposeful operational units (where the enterprise jobs are performed) which serve the environment;
- Management which regulates the operational units through a system of constraints (feedback elements) to ensure the required purpose is achieved.

As a result of the differences in complexity of the three parts, an imbalance in the varieties of management, the enterprise and the environment exists. In terms of the cybernetic law of requisite variety, if these varieties tend to equate, then the enterprise should have the ability to have an adequate level of performance as the law of requisite variety has been fulfilled.

Very often however, these varieties do not balance and it is necessary to design variety management mechanisms which will ensure that the system is adaptable and has the ability to exercise control.

Espejo³⁷¹ argues that it is best to think of this in terms of 'residual variety' that needs to be balanced rather than all environmental variety matched. Residual variety is described as the variety which is relevant to the viable system (the part producing the disturbances). Espejo argues that the conception that managers should have the same level of variety as the environment is mistaken, and that management should rather have the variety to deal with the environmental variety which is not taken care of by the operation - *"To say that management controls the company does not mean that the varieties of both are the same, but that the residual variety that is left unattended by the process of self-organization and self regulation in the company has to be absorbed, equated, by management."*³⁷²

Espejo³⁷³ redefines Beers first principle of organization - *"The response varieties of a viable system and its management tend to equate, respectively, the residual varieties of the environment and the operations; they should be designed to do so with minimum damage to people and cost."*

Figure 47 illustrates this balance. The variety attenuators and amplifiers are provided by mechanisms incorporated into the VSM.

³⁷¹ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.79-82

³⁷² Ibid., p.81

³⁷³ Ibid., p.81

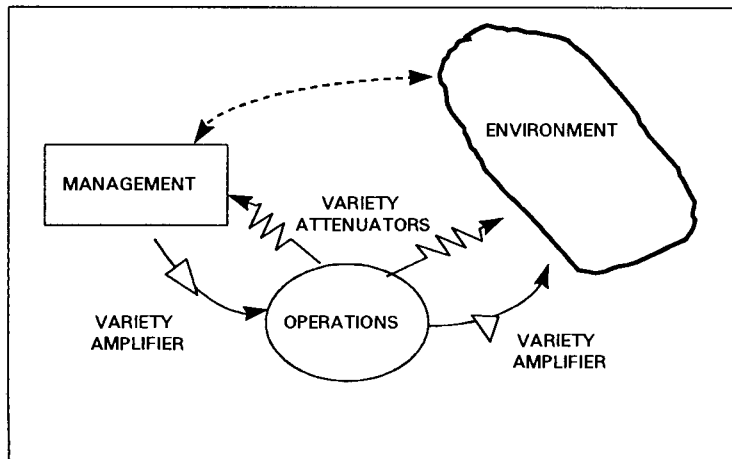


Figure 47: Balancing the variety of the environment, management and the operational units.³⁷⁴

14.3.1 VSM FUNCTIONS FOR VIABILITY³⁷⁵

14.3.1.1 OPERATIONAL UNITS (F1)

The operational units do the work of actually producing what ever the enterprise does. The operational units are autonomous and each contain their own management functions. Depending on the level of recursion, operational units generally consist of several smaller operating units (i.e. it is recursive).

Each operational unit is also a viable unit. This means that it has its own meta-management functions which provide a system of constraints which operate upon it from the next higher level of recursion. This meta-management system does not get directly involved in the activities of the operational units.

The meta-management system consists of three functions which:

- encourages synergy and interaction amongst the F1's ;
- is continually interacting and exchanging information between its 3 functions;
- creates a balance between the here and now and the future;
- is concerned with the relations between the operational systems and whether the operational systems considered together will meet and continue to meet some higher purpose.

The meta-management system can be conceived as a feedback mechanism to ensure that the operational units provide the output required by the containing system (see Figure 48).

³⁷⁴ Source : F. Waelchli, 'The VSM and Ashby's Laws', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.57

³⁷⁵ The VSM functions are typically labeled 'systems' in the literature, however Strümpfer argues that this leads to a misconception that the systems are hierarchical

14.3.1.2 THE META-MANAGEMENT SYSTEM

The meta-management system provides the policy, intelligence and control functions within the enterprise (see Figure 49). According to Ryan³⁷⁶, the variety (complexity) of the environments (external and internal) exceeds the variety of the management who perform the policy, control and intelligence functions. Ryan continues to say that these functions must therefore be organized to incorporate mechanisms which will filter the environmental variety (such that it is balanced with management's variety in accordance with Ashby's law of requisite variety).

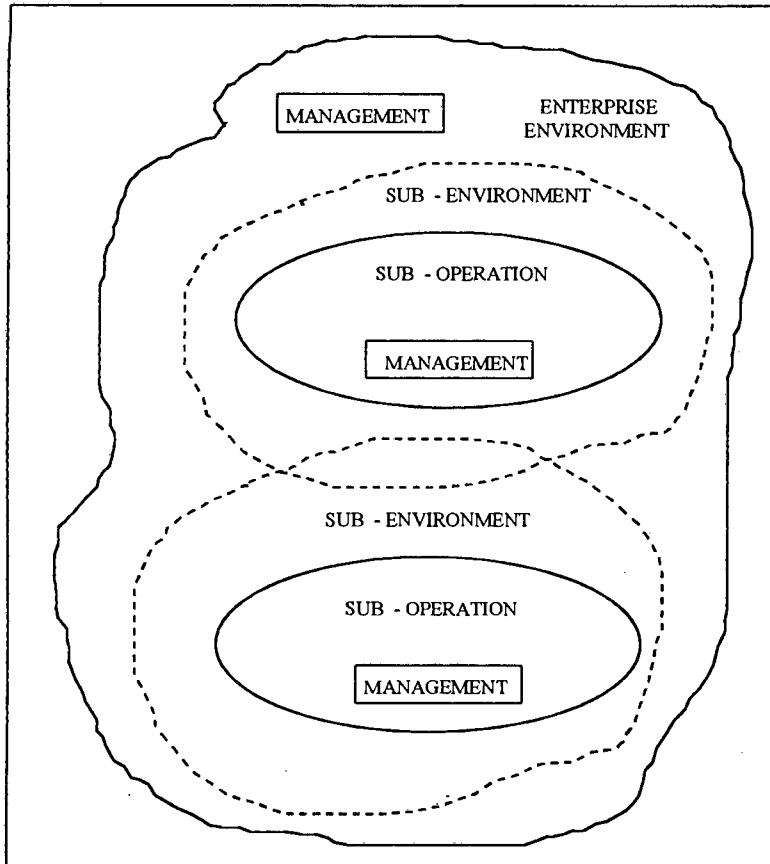


Figure 48 : Recursion and the meta-management system.

³⁷⁶ T. Ryan, 'The VSM' , School of Engineering Management, University of Cape Town (1993,1994)

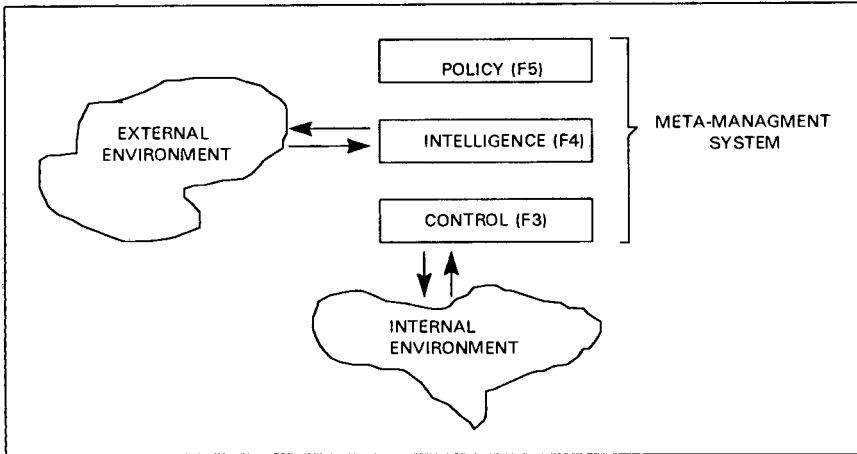


Figure 49 : Structural filters : the intelligence and control functions.³⁷⁷

³⁷⁷ Source : R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.85

FUNCTION 4 (F4) : EXTERNAL AND FUTURE (INTELLIGENCE)

- F4 is responsible for planning and foresight (interfaces and explores the environment, the future, growth and change, threats and opportunities, improvements for effectiveness and efficiency.)
- F4 prevents F3 (here and now) and F5 (policy) collapsing into one another as a result of current difficulties and pressures (i.e. it acts as a feedback element).

According to Clemson³⁷⁸, F4 has three main jobs:

- Create an explicit model of the enterprise [The model should have a few key system variables, which would give, if monitored some insight into what was happening within the unit (heart of the unit), some measure of the outputs and some measure of crucial inputs. The group of variables would give a snapshot of the state of the system at any time];
- Model the enterprises environment;
- Deal with the future using the above mentioned models (creating the enterprises desired future given the base of understanding of the environment an explicit model of the existing environment).

Clemson³⁷⁹ describes three major difficulties which exist in enterprises which lack explicit models:

1. Managers model's are implicit and sub conscious which means they do not fit together or include all of the enterprise;
1. A variety of models makes managers ideas appear incomprehensible to one each other;
1. The enterprise has no means of assessing the why some actions turned out the way the do (i.e. enterprises have difficult in learning from experiences).

FUNCTION 3 (F3) : INTERNAL AND NOW FUNCTION (CONTROL)

F3 (the traditional management function - see Figure 50) interfaces with the internal environment and according to Clemson³⁸⁰, F3 is charged with the following tasks:

- ensuring the enterprise produces outputs that the larger enterprise require of it;
- assuring that the internal operational elements produce the outputs they are assigned to produce;
- ensuring that internal elements are able to secure the resources (money, machines, people and raw materials)

³⁷⁸ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.132

³⁷⁹ *Ibid.*,p.133

³⁸⁰ *Ibid.*,p.135

- ensuring the co-ordination of internal elements (i.e. direct F2);
- ensuring synergy amongst operational units. F4 may help here by providing a model of the enterprise (i.e. must be concerned with the holistic properties that it has and none of its parts have - it must add value).

Reduction in the variety of the operational units is achieved by³⁸¹ :

- treating operational units as black boxes (i.e. autonomous units);
- focusing on essential variables (critical outputs);
- managing only the problems which cannot be solved at the level of the operational unit (i.e. residual variety).

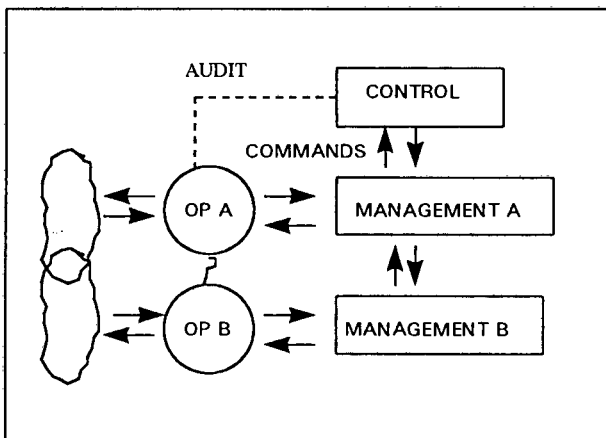


Figure 50 : The control function.³⁸²

The black box technique enables managers to ensure that the boxes produce the intended outputs, and the management at every level are free to achieve their own outputs in the way they think best.³⁸³

According to Espejo³⁸⁴, "the hallmark of management is that managers cannot know everything which is going on inside an organization, but that they are still accountable for any loss of control." As a result of the variety which reaches the control function being minimized / filtered by variety reducing mechanisms, it is vital that the variety which does reach F3 is correct and is a fair reflection of what is happening within the autonomous operating unit. A mechanism which validates the variety information reaching F3 is the monitoring/audit function which ensures that there is no breakdown in communication occurring.

³⁸¹ Ibid.,p.134

³⁸² Source : T. Ryan, 'The VSM' , School of Engineering Management, University of Cape Town (1993,1994)

³⁸³ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.123

³⁸⁴ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.91

FUNCTION 5 (F5) : POLICY

According to Clemson³⁸⁵, F5 should :

- As a primary task, maintain a creative tension between stability (F3) and change (F4);
- Provide an identity to the enterprise which enables it to decide on the balance between stability and change (i.e. it is overall responsible for integration of the whole).

According to Clemson³⁸⁶, F3 and F4 are logically superior to F1 in that they have a broader view, they see the whole and speak a meta-language competent to resolve issues which are not solvable / un-decidable at operational level (i.e. F5 must provide closure by making these decisions in terms of the enterprises identity and purpose) (See Figure 51). This function in an enterprise is typically fulfilled (at the highest level of recursion) by the board of directors.

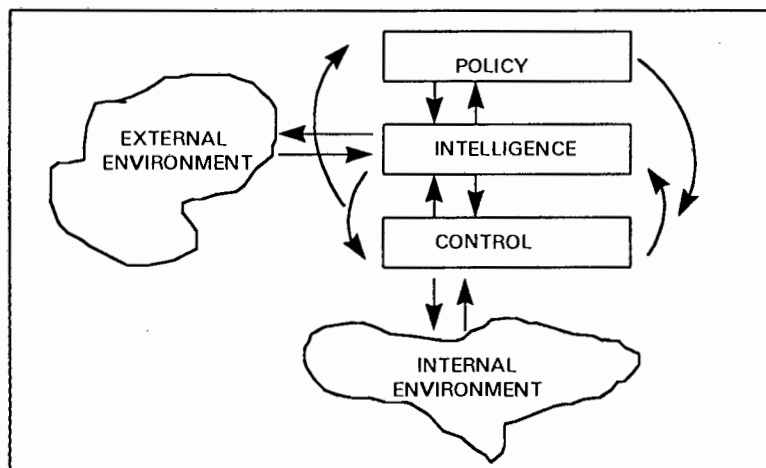


Figure 51 : Policy making : the mechanism for adaptation. ³⁸⁷

FUNCTION (F2) : CO-ORDINATION

Instability or oscillation due to time lags is very common when dealing with interconnected sets of feedback loop and are quite likely to happens in a model of organization such as the VSM.

According to Clemson³⁸⁸, *"F2 must be a real time co-ordination mechanism and should be a servant and not a second boss to the operational element. F2 is however part of the meta-system and therefore has the power of F3 behind it."*

³⁸⁵ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.137

³⁸⁶ *Ibid.*,p.138

³⁸⁷ Source : R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.88

³⁸⁸ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.137

According to Ryan³⁸⁹, "Operations function independently and often tend toward local optimums at the expense of the overall organizations optimum. They may get in each others way and often compete for resources. The result is local conflict and oscillation. The co-ordination function strives to solve local conflict, promotes harmonious interdependence and dampens oscillations. It co-ordinates operations in terms of local and current needs. It sets up the systems and routines for recurrent events that address the questions of co-ordination and balance between operations.

An effective co-ordination function understands the information need of various parts of the organization and actively seeks to gather and disseminate information accordingly. It seeks to develop well informed and knowledgeable local managers capable of local problem solving and decision making - enables decision making to take place at the most appropriate level in the organization. This reduces the information on load and frequency of decision making by control function. The co-ordination function is integral to the efficiency of a decentralised organization. The importance of this role increases in periods of rapid change."

F4 therefore reduces the variety which F3 must deal with by developing co-ordination (by providing adequate information) to the operational units such that informed decision making may occur at the level of the operational unit and not at the level of the control function (see Figure 52).

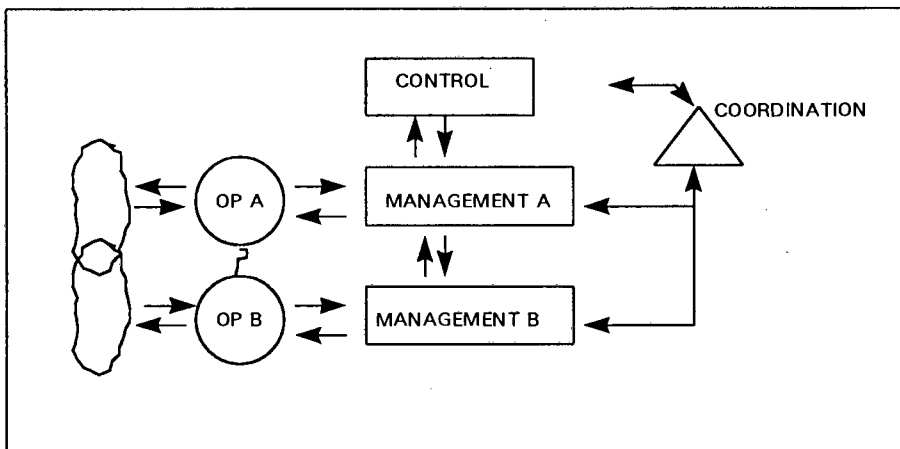


Figure 52: Co-ordination function.³⁹⁰

³⁸⁹ T. Ryan, 'The VSM', School of Engineering Management, University of Cape Town (1993,1994)

³⁹⁰ Source : T. Ryan, 'The VSM', School of Engineering Management, University of Cape Town (1993,1994)

14.3.2 SUMMARY OF INFORMATION FLOWS

The viable system model specifies the information flows (i.e. interactions) amongst the parts of the models³⁹¹ :

- The operational element interactions of environment with operations with management with models;
- The F1 interactions amongst several operational elements;
- The F2 channels amongst the operational element models to co-ordinate efforts and avoid oscillation;
- The F3 command channel;
- The F3 audit channel;
- F4 interactions with the environment;
- The F3 - F4 interactions;
- F5 monitoring of the 3-4 interface.

Figure 53 illustrates the complete VSM with all functions and communication channels present.

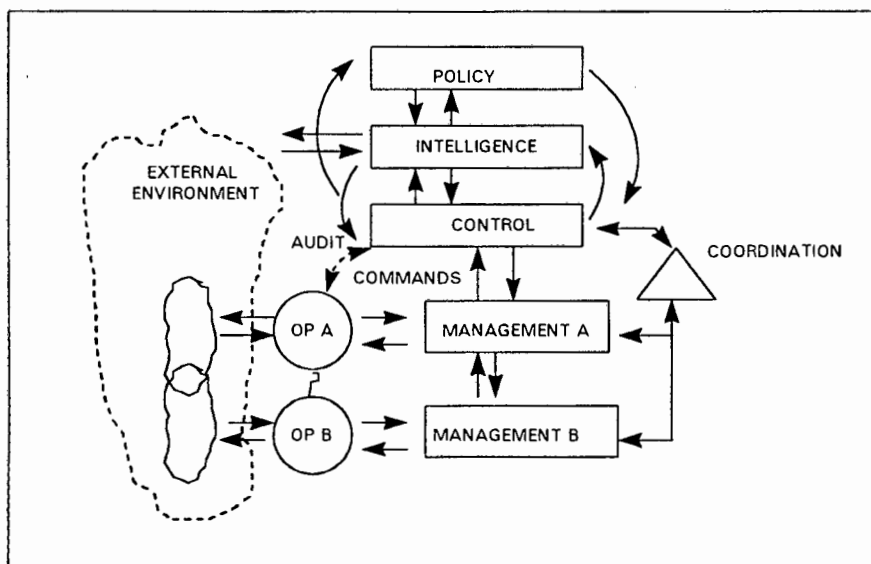


Figure 53 : The Viable System model.³⁹²

³⁹¹ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.143

³⁹² T. Ryan, 'The VSM', School of Engineering Management, University of Cape Town (1993,1994)

14.4 IDENTIFICATION OF OPERATIONAL UNITS (F1'S)

According to Clemson, "*the division of the organization into F1's is crucial for the following reasons* : ³⁹³

- *The F1's (at the various levels) both represent and simultaneously determine what the organization is all about;*
- *Each F1 must have an associated F2-5 if it is to be an effective unit;*
- *There is a real temptation to simply take the existing departments, divisions etc. and plug them into the viable system model. This is almost always a mistake because the organizational chart is both a historic relic (representing power blocks in the organization) and was designed mainly to apportion responsibility an authority, not to reflect what the organizations purpose is now."*

The VSM describes the requirements for simultaneously maintaining internal stability and adapting and are the same for enterprises of any size. The boxes found on organizational charts are however frequently not coherent wholes / autonomous viable entities. The organizational chart is artificial in that it does not reflect the purpose of the enterprise neither the way the enterprise is actually working.

According to Clemson³⁹⁴, the translation from an organizational chart to VSM is complex. Clemson recommends the first step in designing an enterprise using the VSM model is to decide which parts should constitute the operational elements of the system one at whatever level of recursion one is working. Clemson continues that the major guideline for identifying the operational elements (F1's) is that they are the parts which do or produce whatever the enterprise is supposed to do or produce.

Clemson³⁹⁵ offers a solution to the problem of dividing purposes into sub purposes by providing a possible solution of dividing up the enterprise so that essentially the purpose of the parts is the same as the purpose of the whole enterprise.

This can be summarized in the form of the following questions :

1. What is the overall purpose of the enterprise ?;
2. What parts produce or do whatever the enterprise is supposed to do or produce ?;
3. How can the enterprise be divided such that all parts have essentially the same goal as the total enterprise ?;

³⁹³ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.122

³⁹⁴ *Ibid.*, p.117

³⁹⁵ *Ibid.*, p.117

14.5 VIABLE SYSTEM DIAGNOSIS

According to Flood and Jackson³⁹⁶, " *the VSM can be used for diagnosing "problems" of organizations....particularly those that compromise purposeful organized parts and are open to a changing environment in which there is general or easily obtainable agreement about the goals or objectives to be pursued.*"

Flood and Jackson³⁹⁷ continue to say that " *the cybernetic approach (embodied by the VSM) comes to the fore, when, for example a business or firm are characterised by particular defects or pathologies, possibly localized which are resistant to or ignored by normal treatment. In such circumstances , the VSM assumes that natural cybernetic laws are being violated-hence the need for diagnosis and the use of cybernetic findings in re-organization*".

Flood and Jackson³⁹⁸ describes the procedure for performing a viable system diagnosis to diagnose the faults of proposed system design or an actual organization :

1. System identification :

- Identify purposes to be pursued;
- Taking purposes as given, determine the relevant system for achieving the purpose;
- Specify the viable parts of the F1 of the system in focus;
- Specify the viable system of which the system in focus is a part.

1. System diagnosis :

This involves asking a set of questions which draw upon cybernetic principles and principles of the VSM to check whether any laws or principles are being violated.

[A detailed description of the Viable System Diagnosis is provided in : R L Flood and M C Jackson, *Creative Problem Solving* (Sussex: Wiley, 1991),p.94].

³⁹⁶ R. Flood and M. Jackson, *Creative Problem Solving* (Sussex: Wiley, 1991),p.88

³⁹⁷ *Ibid.*,p.88

³⁹⁸ *Ibid.*,p.94

14.6 CHARACTERISTICS OF THE VSM

- The entire structure is loose as a result of each box (operational unit) having autonomy in its internal operation. The managers role at every level is to make sure the constituent boxes produce the intended outputs;³⁹⁹
- Continuous process of filtering environmental variety (autonomous units at each level of the recursion act as filters with only issues which cannot be dealt with at that level being passed upwards to higher levels);
- Information flows are not only up and down but are spread throughout the enterprise;
- The enterprise is flexible as a result of strong co-ordination which enables information to be provided to operational units concerning changes in the environment;
- The enterprise is stable as a result of the strong feedback and control elements;
- The entire structure is linked and integrated by the outputs of the "black boxes".⁴⁰⁰

14.7 ASSUMPTIONS OF THE VSM

- Humans can achieve purpose through the use of structures / constraints;⁴⁰¹
- We live in a world governed by the principles of cybernetics.

14.8 ADVANTAGES OF THE VSM

- The VSM defines the structure of the enterprise by the actual parts and actual communication channels in existence and not by the parts and lines of authority defined in an organizational chart;⁴⁰²
- The model helps make the implications of a purpose clear and thereby helps assess whether a given purpose is really what we want or not. ⁴⁰³ The VSM therefore makes a conscious reflection of the purpose of the enterprise (e.g. a school whose purpose is to make responsible citizens (implies autonomy provided to children) will be different from a school whose purpose is the provide children with facts (provides autonomy to the classroom));

³⁹⁹ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.123

⁴⁰⁰ *Ibid.*,p.123

⁴⁰¹ R. Anderton, 'The Need for Formal Development of the VSM', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),,p.47

⁴⁰² R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.79

⁴⁰³ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.121

- *"Organizational structure is essentially the same at every level. This essential sameness in structure provides an enormous simplification in thinking about or discussing the organization."*⁴⁰⁴
- The VSM allows managers to elaborate policies and to develop organizational structures in the clear understanding of the recursions in which they are supposed to operate, and to design regulatory systems within those recursions that do not pretend to disobey the fundamental canons of cybernetics;⁴⁰⁵
- The model demonstrates that autonomy and control are not opposites.⁴⁰⁶ (i.e. integration of the whole and autonomy of the parts is both possible and desirable);⁴⁰⁷
- Breakdowns in enterprises may be diagnosed by identifying the inadequacy in the system which is leading to the malfunctioning in of the five VSM functions, where one of the cybernetic features that compose the rules will not be functioning;
- The VSM enables enterprises to be viable by ensuring its long term survival. Managers attempting for short term profits (cheaper ways of doing things) attempt to repeal the law of requisite variety (e.g. retrenchments, low staff levels - only variety can absorb variety);
- Although a theory of organization does exist, non of the theories combine the operational usability with a clear theoretical base;⁴⁰⁸
- In hierarchies each level is preoccupied with the scrutiny of operations bellow it, particularly to detect deviation from budget plans (emphasis on operational control). The VSM provides a framework in which the proper tasks are performed at the correct level - formulating strategies. and identifying opportunities for the level immediately below. The recursive structure of black boxes within black boxes solves the problem of centralization versus decentralization. By concentrating on tasks appropriate to each level, overload can be avoided. The VSM shows what tasks these are and how they must be linked by flow of information.
- The law of requisite variety which is embodies in VSM *"plays a central role in the coherent ordering of historical management philosophy and practice."*⁴⁰⁹

⁴⁰⁴ Ibid.,p.123

⁴⁰⁵ S. Beer, 'The VSM: Its Provenance, Development, Methodology and Pathology', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.26

⁴⁰⁶ R. Espejo, 'The VSM Revisited', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.91

⁴⁰⁷ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.124

⁴⁰⁸ R. Anderton, 'The Need for Formal Development of the VSM', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.42

⁴⁰⁹ F. Waelchli, 'The VSM and Ashby's Laws', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley,1989),p.54

- *"The co-ordination function is seldom explicitly present in organization and the emphasis placed on it by VSM is perhaps one of the VSM's most important contributions to understanding of organizational viability."*⁴¹⁰

14.9 LIMITATIONS OF THE VSM

- The VSM does not provide insights to the organization of support units;
- The VSM could be criticised as using cybernetic (hard system concepts) laws applied to a social system (i.e. a system with human as parts who have choice and free will) which does not take cognisance of the human dimensions of enterprises.

[It is however coherently argued (in the writers opinion) by Waelchli⁴¹¹ that the law of requisite variety holds true when staff are given free will and are allowed to control their own destinies. Waelchli ⁴¹² argues that if 'workers' in enterprises are given freedom of choice, it is effectively turning them into managers, therefore decreasing the variety of the manager who then becomes a motivator and not a controller];

- It is possible that the use of the VSM could result in a mechanical approach to running an enterprise in the belief that it is capable of handling any situation that may arise;
- The VSM's simplicity is seductive, however, in reality it is complex and difficult to implement.

14.10 IMPLICATIONS OF THE VSM

- There is no way of proving the VSM, the only way is to attempt an application and prove on criterion of falsifiability;⁴¹³
- The law of requisite variety shows that we can forget about the notion of a dictator who is able to control all of his subordinates. Typically the dictator can only control only a few elements of the system;
- *"Erroneous ways of subdividing the overall purposes is perhaps one of the most common ways of making it quite impossible for an organization to achieve its*

⁴¹⁰ T. Ryan, 'The VSM' , School of Engineering Management, University of Cape Town (1993,1994)

⁴¹¹ F. Waelchli, 'The VSM and Ashby's Laws', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.66

⁴¹² Ibid., p.65-73

⁴¹³ S. Beer, 'The VSM: Its Provenance, Development, Methodology and Pathology', in *The Viable Systems Model*, eds. R. Espejo and R. Harnden (Wiley, 1989), p.15

intended mission . Careful analysis of purpose and sub purpose is called for." ⁴¹⁴
Furthermore , " purposes are often not easily separable into pieces.";⁴¹⁵

Very often the inferred goals of an enterprise are very different to the intended goals. It is essential that the correct variables are monitored and that these variables are of the intended goals and not inferred goals - this is because of the feedback systems which create inferred goals;

- It is an agreed aspect of the definition of viability that there should be a closely regulated/controlled environment;
- It is important that all the VSM functions (i.e. F1-F5) are present in a design. An enterprise which only implements say three of the five functions will not be effective in balancing stability with change.

As mentioned in section 14.2 the VSM was developed using the analogy between the human nervous system and a man-made enterprise as a basis for designing a model of organization. This analogy is extended to a human adapting its actions based on previous experience which relies on more than one system to take evasive action (e.g. burning a finger on a hot plate where the reaction can be attributed to more than the human nervous system alone) :

*"In a cybernetic analysis of the process in which a person thinks, acts and modifies subsequent behaviour in the light of preceding acts, all these items may be seen as information processing. Bateson argues that the total self corrective unit which does this processing is not however, the human being; it is a system whose boundaries extend beyond the human body. The system is a network of information - transmitting pathways including some external other actor ; on this view mind is not simply associated with the human body but is immanent in brain, plus body, plus environment."*⁴¹⁶

The system which Bateson describes as *"the total self corrective unit"* is analogous to the meta-management system, of which all parts are required for the network to process information effectively to take adaptive action.

15. APPENDIX D : DESCRIPTION OF THE TELKOM REGIONAL NETWORK BUILD DIVISION

The purpose of this appendix is to describe the organization of the regional Network Build division. The regional Network Build division is the system in focus for which conceptual enterprise design is being developed.

⁴¹⁴ B. Clemson, *Cybernetics: A New Management Tool* (Kent:Abacus, 1984) p.143

⁴¹⁵ *Ibid.*,p.117

⁴¹⁶ P. Checkland, *Systems Thinking, Systems Practice* (Sussex: Wiley, 1994),p.86.

The appendix begins with an overview of Telkom and provides a high level description of the Technology and Network Business Unit (TNBU) of which the regional Network Build division is a part. The description does not comment on the mode of organization but rather describes the high level purpose of the various TNBU divisions which contribute to the TNBU achieving its overall purpose⁴¹⁷. The rationale for describing the TNBU at a high level is to provide the reader with an overall understanding of how the regional Network Build divisions is part of a larger whole which contributes to building and operating the Telkom telecommunications network.

The complexity of the Network Build division's organization makes it significantly difficult for the writer to provide a detailed account of exactly how the division operates. This appendix presents a brief description of the regional Network Build division and the centralised functions of the TNBU. The rationale for the description is to provide the reader with an insights into the current organization of the Network Build division. This should be useful to assist in understanding the concerns and dilemmas which surface during the inquiry into the Network Build division's mode of organization.

Before the description of the regional Network Build division is presented, a high level overview of Telkom and the Public Telecommunications Network is presented. This background will provide the reader with the required understanding of how the Network Build division contributes to Telkom's overall purpose.

15.1 INTRODUCTION

15.1.1 TELKOM SA LTD

Telkom is the South African telecommunications operator which has been allocated a license by the Minister of Posts, Telecommunications and Broadcasting to *"construct maintain and use the Public Switched Telecommunications Network in the republic and to provide Public Switched Telecommunication Services."*⁴¹⁸

The purpose of Telkom can therefore be summarized as to build and operate the Public Telecommunications network. To achieve this purpose, Telkom has been organized into several business units. The basis for dividing Telkom into business units is the telecommunications service provision value chain (see Figure 54).

⁴¹⁷ Subsequent to this chapter being written, significant structural changes have occurred within the centralized functions of the TNBU. The description presented here was valid up until November 1997.

⁴¹⁸ Government gazette , 7 May 1997, pg. 20

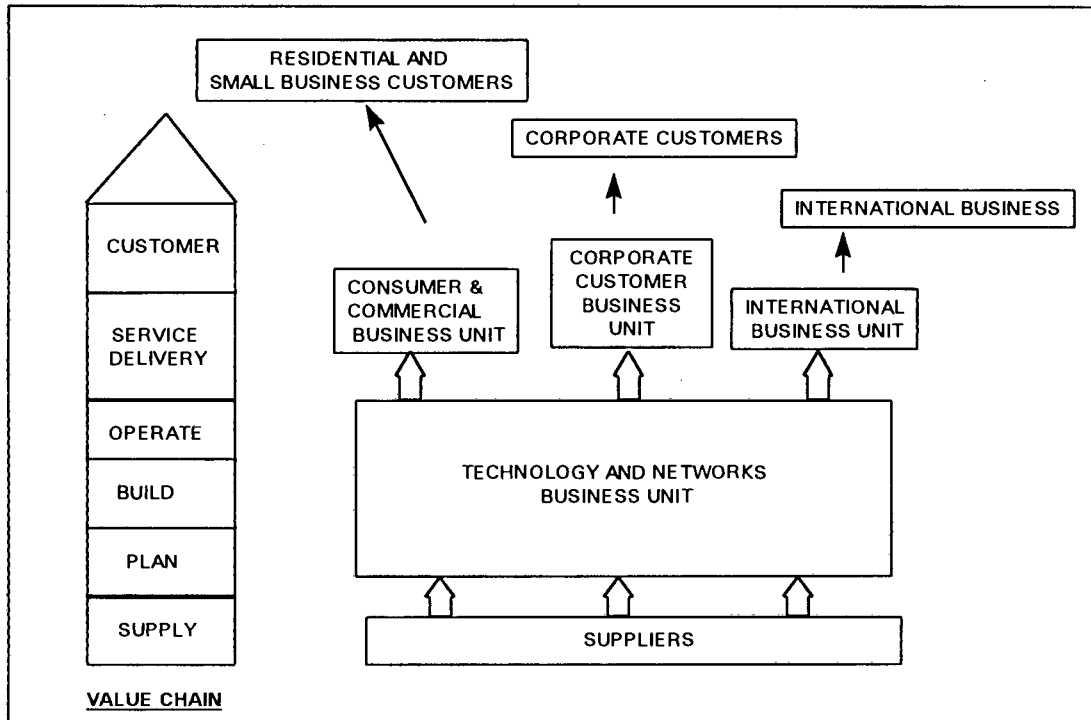


Figure 54 : Telkom value chain and the Telkom Business Units.

Before the purposes of the parts of the TNBU are described a brief overview of a typical telecommunications network and its architecture will be described. This should assist the reader in understanding the rationale for dividing Telkom into the specific business units.

15.1.2 A GENERIC TELECOMMUNICATIONS NETWORK

From a systemic perspective of hierarchy, the public telephony network can be perceived as a system which provides end-to-end inter-connectivity for purposes of communication via electronic systems. This end-to-end inter-connectivity is achieved by inter-linking a number of switching units (telephone exchanges) using a transmission network to transport communication signals between the switching units (see Figure 55).

The access network provides access from the customer premises to a centralised point where the switching units are located. The access network typically consist of underground or overhead copper cables which extend directly into the customers premises.

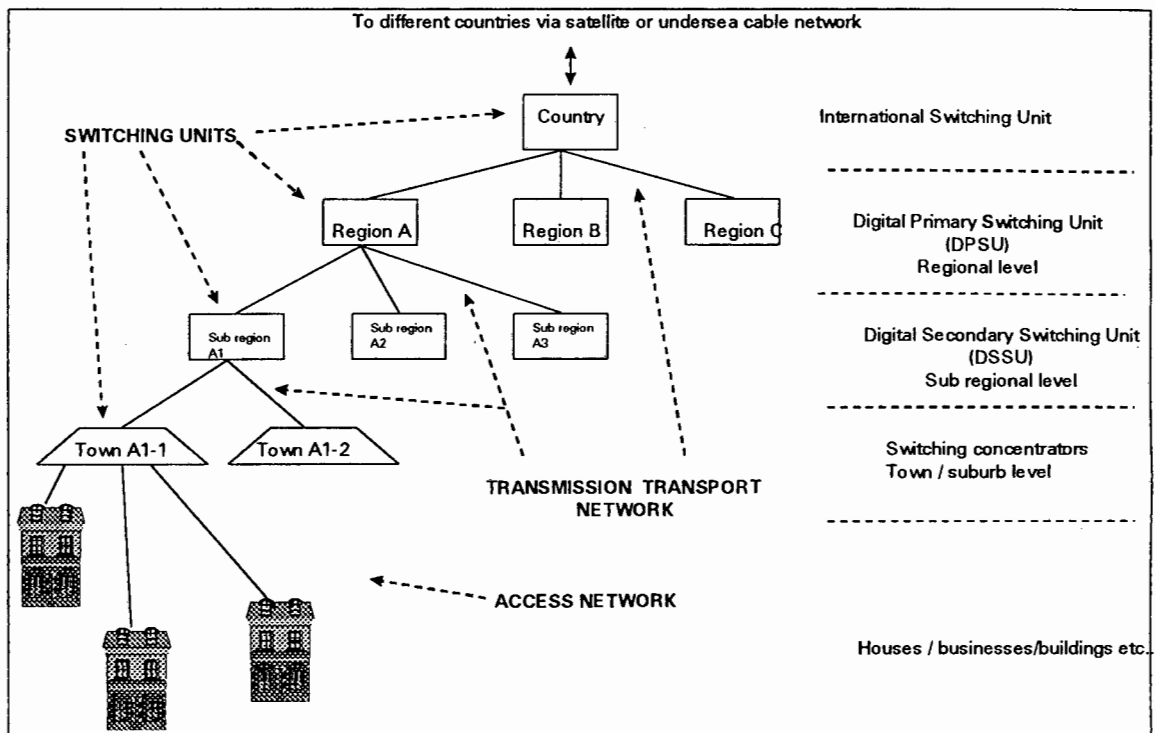


Figure 55 : Telecommunications network hierarchy.

The public telephone network can therefore be perceived as consisting of three parts namely the switching units, transmission transport network and the access network. The point in the telecommunications network which divides the TNBU and the CFBU's is called the local distribution point. The local distribution point is the point at which the telephone installation technician connects a 'drop wire' which extends into the customers home (see Figure 56).

Switching units act as a central point in each geographic region to which telecommunications services are centralised via the access network. It is the switching units which interpret customers requests for a particular destination (e.g. telephone number dialed) and route the call to the required destination via the transmission transport network.

Inter-connectivity between the switching units is provided by means of the transmission transport network. In some cases the transport network is also extended directly into the customers premises via the access network where wide-band services are required (e.g. for inter-linking corporate computer networks; providing capacity to other network operators (e.g. mobile telephone operators)).

The transmission transport network can be perceived as a network of very high capacity pipes with nodes interconnecting the pipes. At each node a lower capacity pipe is 'dropped out' and used to inter-connect the switching units (see Figure 57).

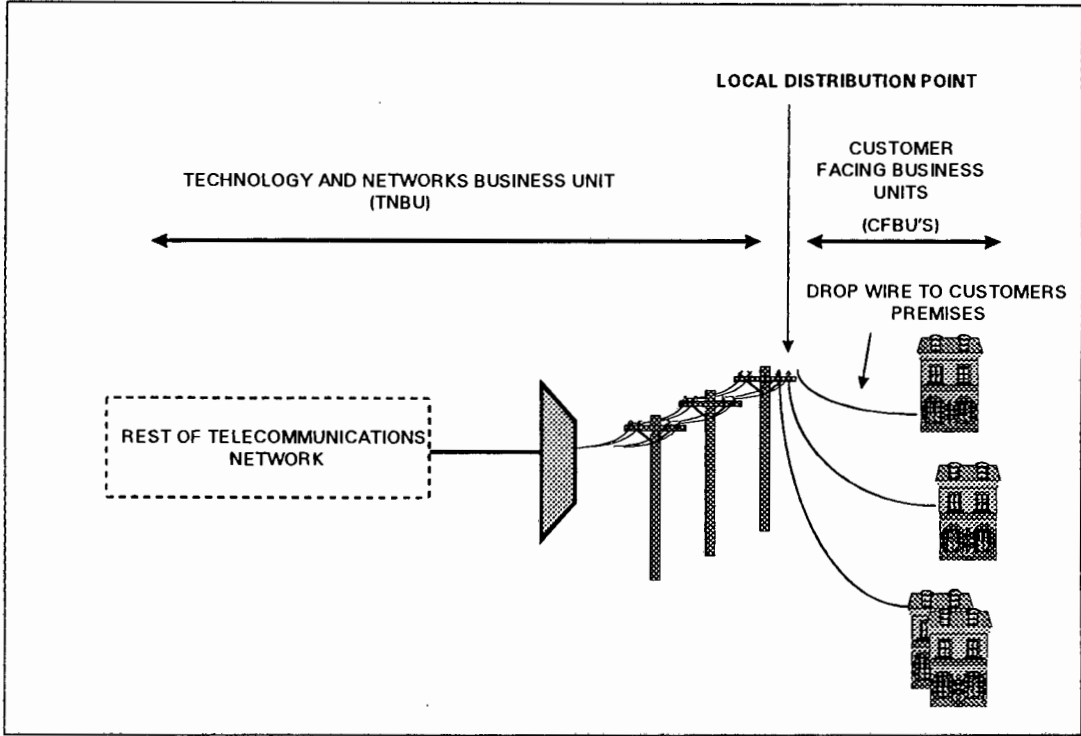


Figure 56 : The dividing line in the network between CFBU's and TNBU.

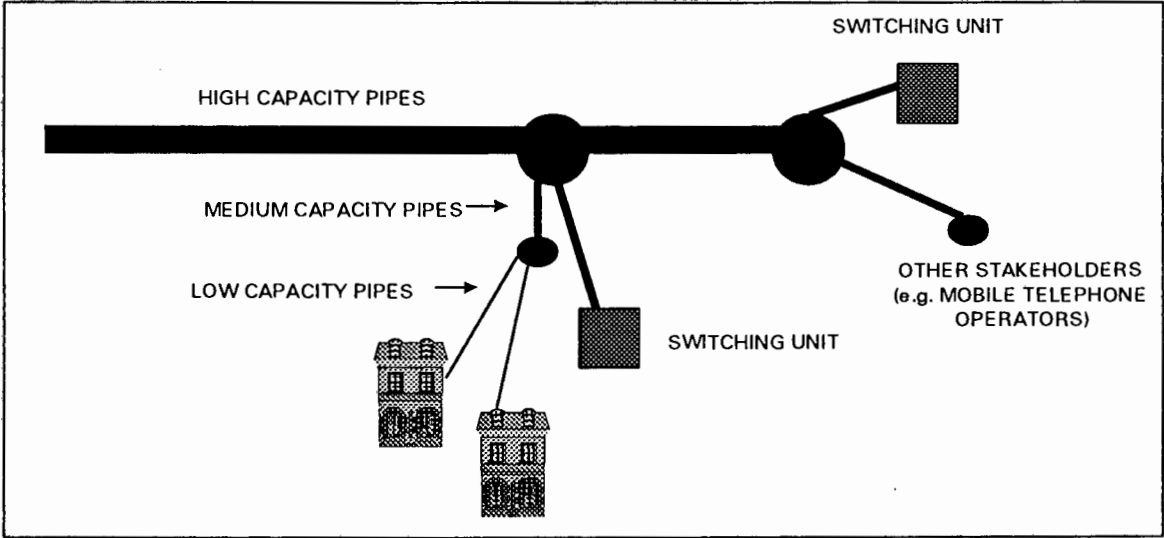


Figure 57 : Transmission transport network.

15.1.3 TELKOM BUSINESS UNITS

15.1.3.1 CUSTOMER FACING BUSINESS UNITS

At the end of the value chain are the customers who are serviced by the Customer Facing Business Units (CFBU's). The basis for the division of the CFBU's are specific market segments :

- Corporate Customers Business Unit - Focuses on providing telecommunications services to a select number of major corporations;
- Consumer and Commercial Business Unit - Focuses on providing telecommunications service to residential and small business;
- International Business Unit : Focuses on providing telecommunications service to international customers.

Functions performed by the CFBU's include :

- Marketing and selling Telkom's telecommunications services;
- Managing the customer billing system and invoicing customer's for services provided on a monthly basis;
- Installing equipment at customers premises;
- Investigating faults reported by customers.

The TNBU is responsible for making network capacity available to the CFBU's.

15.1.3.2 TECHNOLOGY AND NETWORKS BUSINESS UNIT (TNBU)

The TNBU customers are divided into two categories :

- Internal customers (e.g. Customer Facing Business Units);
- External Customers (e.g. other network operators).

Telkom TNBU has a number of external customers with whom it interfaces directly. The reason for this Telkom has the sole right to provide a public telecommunication transport network. Any other telecommunications operators who are allocated licenses (for certain services other than fixed voice and data services) are requires to use Telkom's transmission transport network (see Table 26).

EXTERNAL CUSTOMERS	
Mobile telephone operators	Transport links between mobile switching units and cellular radio base stations.
Paging operators	Transport links to paging radio stations.
Television and radio operators	Transport links to broadcast base stations.
Radio trunking operators	Transport links to radio trunking base stations.
INTERNAL CUSTOMERS	
Corporate Customer Business Unit	Advanced telecommunications infrastructure.
Consumer and Commercial Business Unit	Basic telecommunications services.
International Business Unit	Mix of advanced and basic telecommunications services.

Table 26 : TNBU Internal and External Customers.

15.2 DESCRIPTION OF THE TNBU PARTS

The TNBU has been organized into a number of functional divisions. Figure 58 illustrates the functional division of the TNBU.

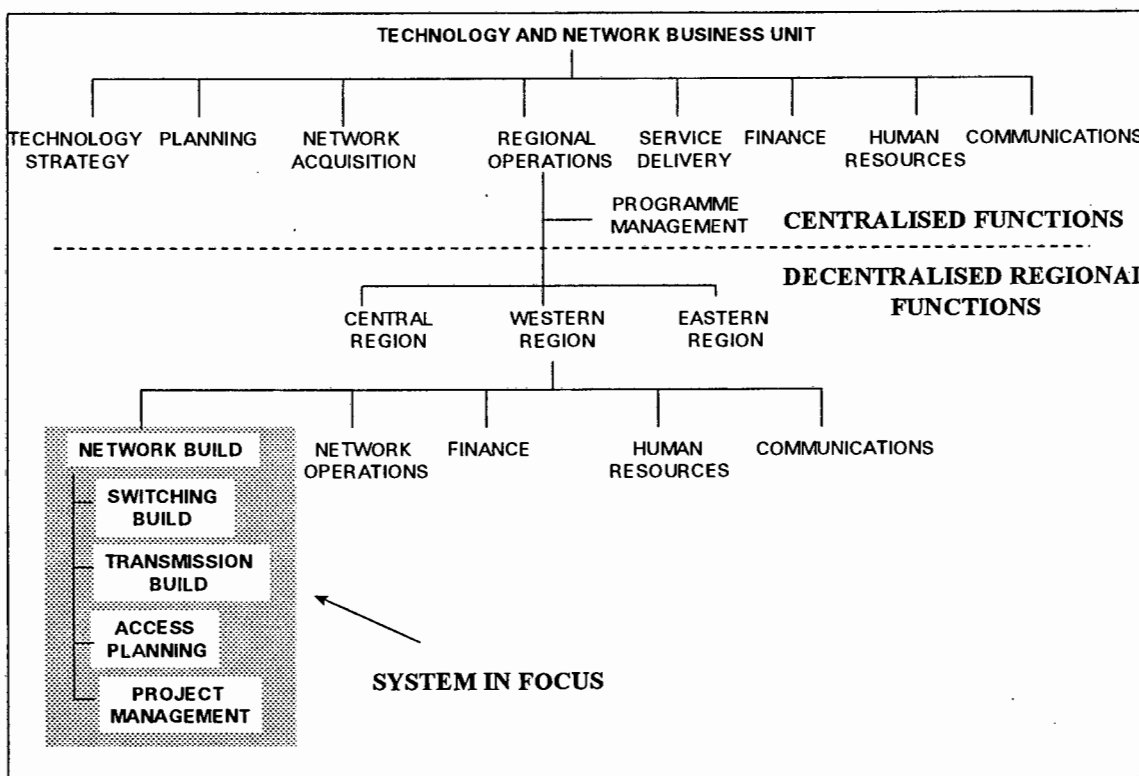


Figure 58 : Functional divisions of the TNBU.

All the centralised functions are located at Telkom Head Quarters in Pretoria. The decentralised 'operations' divisions are distributed geographically in the various regions of South Africa.

15.2.1 TECHNOLOGY STRATEGY

Technology is a major component of the TNBU operations. Rapid advances in communication, particularly in the field of telecommunications makes it critical that Telkom is able to leverage communications technology so that it can provide advanced, state of the art services to customers in a reliable and effective manner.

The Technology Strategy division is responsible for developing long term technology strategies (i.e. what the future architecture of the network will be and what services will be available) and developing technology policies which can be used as a guideline by network planners.

15.2.2 PLANNING

The hierarchic nature of the telecommunications network necessitates certain parts of the network to be planned centrally. Planning from the DSSU level of the network hierarchy and upwards (refer to Figure 55) is therefore centralised at a national level to ensure that all regional elements are taken cognisance of (The writer believes that this is systemically sound approach - issues concerning several geographic regions can only be resolved at the next level of the hierarchy).

It should be noted that there is a high degree of co-ordination and communication required between the regional planning functions in the Operations division (refer to section 15.3) and this centralised Planning division.

The centralised Planning division is responsible for developing master plans for the national network. These master plans are used as guidelines for Planning by the regional planning functions.

15.2.3 NETWORK ACQUISITION

The Network Acquisition division is responsible for sourcing technologies and entering supply contracts with telecommunication equipment suppliers. The basis for the choice in which technologies are sourced is the Technology Strategy division's recommendations.

The Network Acquisition division is responsible for maintaining a 'technology toolbox'. Equipment in this 'tool box' may be ordered from the suppliers by the centralised and regional Planning divisions via the Network Acquisition division.

15.2.4 SERVICE DELIVERY

The Service Delivery division is responsible for providing high level expert support to the Regional Operations divisions . This support is provided by means of several specialist High Level Support divisions which have expert employees who have detailed understanding of the network technologies utilized.

In addition to providing high level support, the division also tests and approves equipment for use in the telecommunications network before the network acquisition division agrees to enter a supply contract for new equipment.

15.2.5 REGIONAL OPERATIONS

The Regional Operations division is the largest of the TNBU divisions. The division is sub-divided geographically according to the Telkom geographic regions. The operations division is responsible for planning, installing and maintaining the regional telecommunication network.

The Regional Operations each consists of the following divisions :

- Network Build : Responsible for planning and installation of all regional telecommunications infrastructure from the DSSU level of the network to the local distribution point;
- Network Operations : Responsible for maintaining the infrastructure which is planned and installed by the Network Build division;
- Support functions namely finance, human resources and communications.

A centralised Programme Management division has also been established which is responsible for driving the network build initiative (refer to section 8.1.2). The purpose of the division is to ensure that the targets set by the Telecommunications Act and the Telkom network master plan's are achieved. The division acts as a co-ordination function and interfaces to the geographic regions via the regional Project Management divisions.

15.3 DESCRIPTION OF THE 'SYSTEM IN FOCUS' - THE REGIONAL NETWORK BUILD DIVISION

The above description has focused on providing an introductory overview of the TNBU. The purpose of this section is to describe the organization of the regional Network Build division. The Network Build division is responsible for planning and installing all regional telecommunications network infrastructure.

The regional Planning divisions within the Network Build division are responsible for:

- Planning new infrastructure to areas where there is not adequate capacity in the network to satisfy the demand for telecommunication services;
- Upgrading existing network infrastructure based on obsolete technology;

- Providing regional specific information to the centralised planning function.

The regional Installation divisions perform the physical work of installing and commissioning equipment planned by the regional planning divisions. The regional installation divisions are responsible for installing equipment which has been planned by either the regional or centralised Planning divisions.

The existing organization of the Network Build division may be described as a mechanistic hierarchy. At each level in the hierarchy there is different rationale for dividing labour. At the highest level of the hierarchy the Network Build division is divided using the traditional telecommunications network as a basis :

- Switching Build;
- Transmission Build;
- Access Network Planning;
- Project Management.

Construction Services is a Telkom owned subsidiary which performs all the civil construction work in the network. A large proportion of the work performed by Construction Service is the laying of cables planned by the Access Network Planning division.

Each of the function divisions have a functional line manager allocated to that unit. The line managers are responsible for all aspects of the operation of the unit and have several line supervisors reporting to them (see Figure 59).

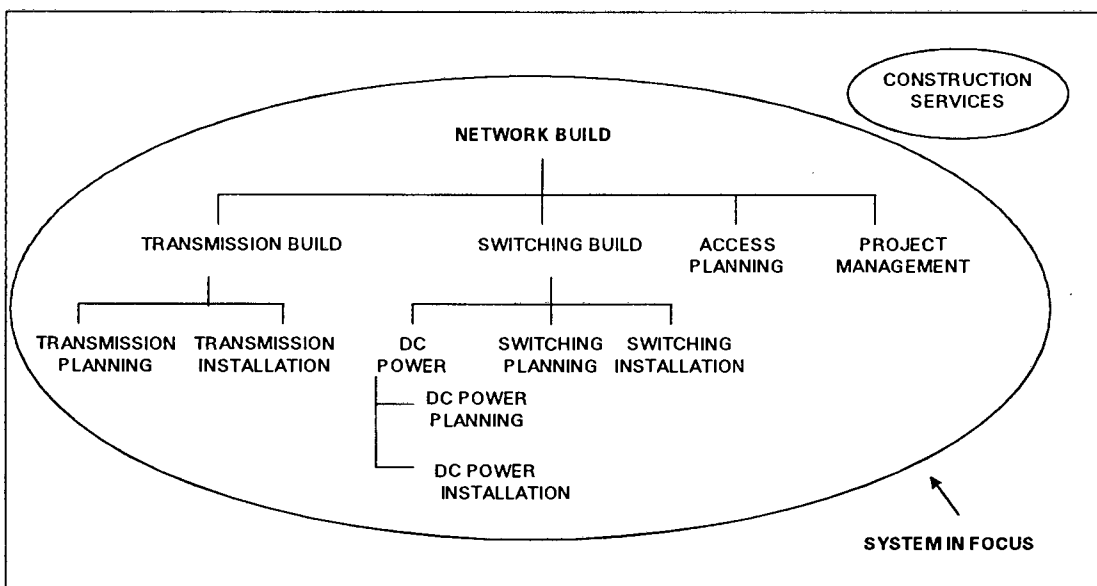


Figure 59 : Regional Network Build division.

15.3.1 ACCESS PLANNING

The Access Planning division is responsible for planning the access network portion of the network. The portion of the network from the local distribution point to the customer's premises is the responsibility of the CFBU's.

To achieve this purpose, the division is divided into geographic regions. Within each geographic region there are several 'main job functions performed' (see Figure 60):

- Access Network Planning: Responsible for planning the access network which will enable sufficient capacity for a connection to be made from the switching unit to the local distribution point. The division is also responsible for general cable planning of optic fiber cables used in the transport network. Request for this planning are received from the Transmission Planning division;
- Access Network Records: Responsible for keeping and updating access network records. To achieve this purpose the division must keep records of the access network infrastructure (i.e. utilized versus spare capacity);
- Access Network Drawing Offices: Responsible for drawing plans and updating maps which illustrate the access network configuration.

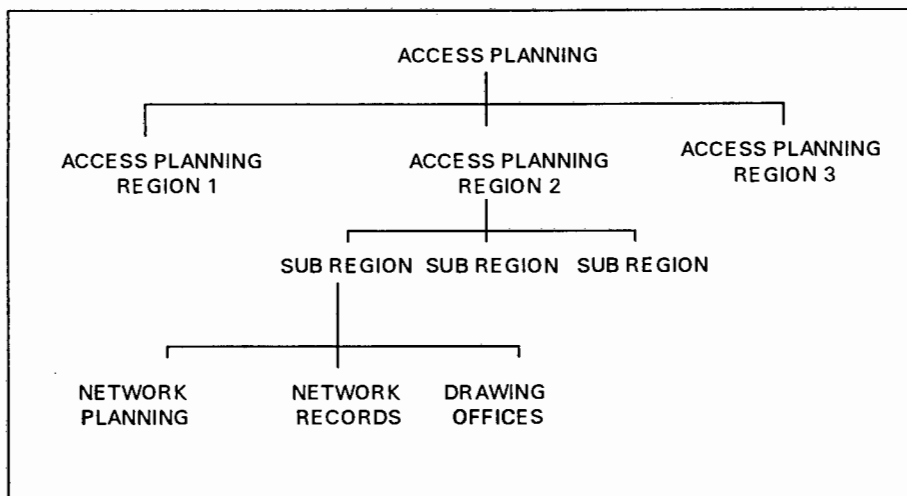


Figure 60 : Access Planning division.

15.3.2 CONSTRUCTION SERVICES

Construction Services is a 'stand alone' unit which is responsible for performing all civil construction work for Telkom. This includes trenching, laying pipes and hauling cables through the pipes. The majority of work performed by the Construction Services division is cable related work which is planned by the Access Planning divisions.

The reason for Construction Services being a stand alone unit is that a strategic decision was taken that the functions performed by Construction Services are not considered core-business. Construction Services will be expected to compete with other external companies after a five year period in which it could organize itself into a competitive enterprise unit.

15.3.3 TRANSMISSION BUILD

Transmission Build can also be described in terms of a mechanistic hierarchy. The division is divided functionally using the installation and planning phases as a basis for dividing labour (see Figure 61).

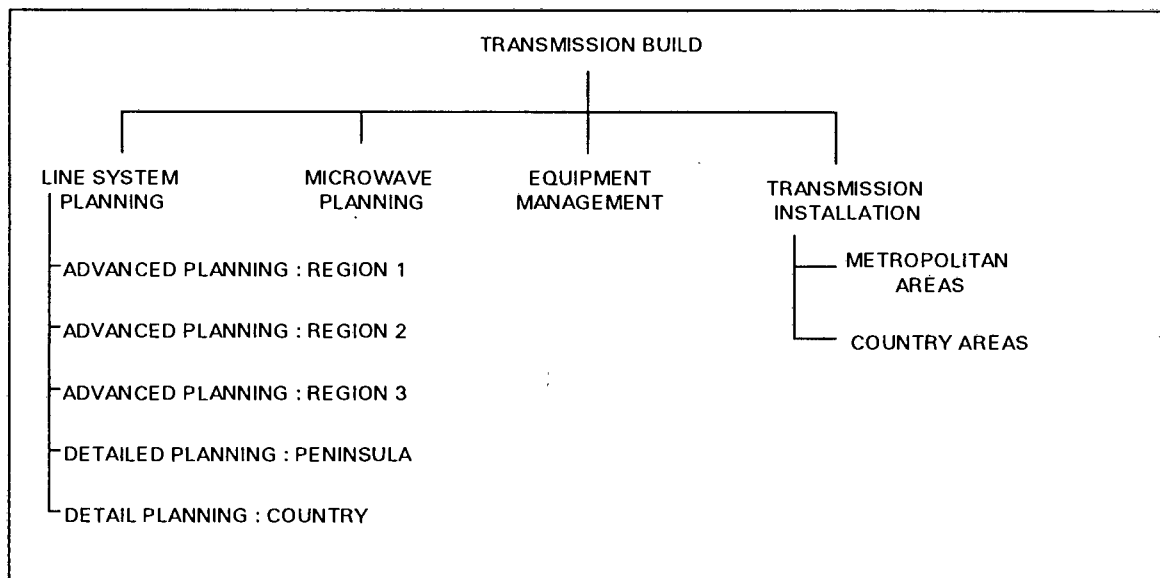


Figure 61 : Transmission Build division.

15.3.3.1 TRANSMISSION PLANNING

The Transmission Planning division is responsible for planning infrastructure for external customers (short term focus) and planning the transmission network for internal usage (long term focus) :

- Links for the Switching Build division (internal);
- Links for television, radio and other broadcast circuits for other network operators (external);
- Links for mobile telephone network operators (external);
- Links to corporate customers for inter-connection of wide area data networks (external).

The division must ensure that there is as much transmission spectrum available for use by the above mentioned stakeholders and that capacity can be provided on an on demand basis.

To achieve this purpose the Transmission Planning division has been divided into the following parts :

- **Advanced Planning** : Responsible for conceptual planning of the network and allocation of existing transmission spectrum to stakeholders. This allocation may require the planning of additional capacity using new transmission infrastructure;
- **Detailed Planning** : Responsible for transforming the conceptual planning of the advanced planning division into detailed work instructions which are handed over to the installation divisions;
- **Equipment Management** : Responsible for ordering transmission equipment and monitoring its delivery.
- **Microwave Planning** : Responsible for provision of transmission infrastructure using radio technology. This division is separated because it has a specialized function of managing the frequency spectrum and also requires special radio planning expertise which is significantly different to the expertise in the detailed and fundamental planning divisions.

All applications for transmission infrastructure are received by the supervisor of the Transmission Planning division. If the application is a low capacity link and can make use of existing infrastructure then the work is handed to the detail planning division who prepare the plans.

If the work requires new infrastructure or is medium capacity link then the work is referred to the Advanced Planning division. The Advanced Planning division consult their network records and if existing infrastructure is available it is allocated on the record system and handed over to the detailed planning division. If the application requires new infrastructure, a conceptual plan is put in place to provide the infrastructure and this conceptual plan is then handed over to the detailed planning division.

If the conceptual planning requires a radio link then, instead of being sent to the detailed planning section, the request is sent to the microwave planning section who perform detailed microwave planning.

15.3.3.2 TRANSMISSION INSTALLATION

Historically, the Transmission Installation division has been responsible for installing transmission equipment which has been planned by the Transmission Planning division. However, as a result of various transmission technologies now being utilized in the access network, installation work is also performed for the Access Planning divisions.

To achieve this purpose, Transmission Installation is divided into parts using geography and technology as its basis. The rationale for dividing geographically is that the nature of the transmission work is significantly different in the metropolitan and country areas. In the country areas extensive use is made of radio technologies as well as different technologies to those used in metropolitan areas.

15.3.4 SWITCHING BUILD

Switching Build consists of Switching Installation, Switching Planning and DC Power divisions (see Figure 62).

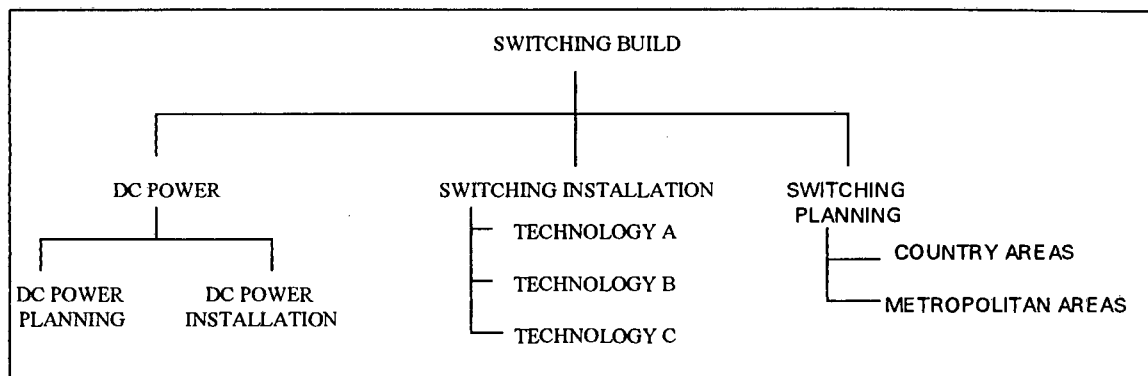


Figure 62 : Switching Build division.

15.3.4.1 SWITCHING PLANNING

Switching Planning is responsible for providing adequate switching unit capacity. To achieve this purpose it has been divide using geography as the basis. The rationale for this is that different technologies are used in the metropolitan and country areas. These technologies are sophisticated and require specialized planning expertise.

15.3.4.2 SWITCHING INSTALLATION

Switching Installation is responsible for installing switching units which have been planned by the Switching Planning division. This includes the physical installation of the equipment as well as the commissioning and testing of the equipment to ensure that it is operating adequately. The division has been divided using technology as a basis. The rationale for this is that specialist skills are required to install and commission the equipment.

15.3.4.3 DC POWER BUILD

The DC Power build division is responsible for planning and installing DC power equipment.

The rationale for DC Power being located in the Switching Build division is historic. Previously DC power was only used in building where switching units were installed and it appeared logical that they should report to the Switching Build head for purposes of communication and control (authoritarian mode of organization).

15.3.5 PROJECT MANAGEMENT

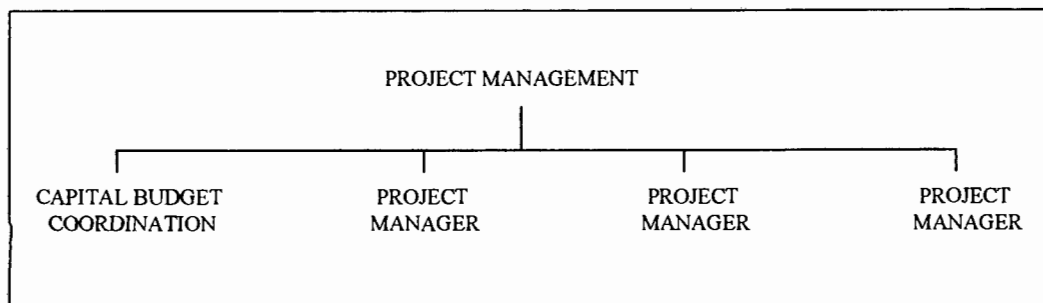


Figure 63 : Project Management Division

The purpose of the Project Management division is to provide a centralised co-ordination function. The Project Management division operates on a matrix reporting basis with the functional line divisions. The division is responsible for driving the project process from project planning to project completion.

To achieve this objective, the Project Management divisions consists of a Capital Budget Co-ordination division and a number of Project Managers.

The Capital Budget Co-ordination division is responsible for ensuring that the budget allocated to the region by the centralised Telkom Executive Committee is managed within the region to ensure that customer demands and internal operational requirements are achieved (see Figure 64).

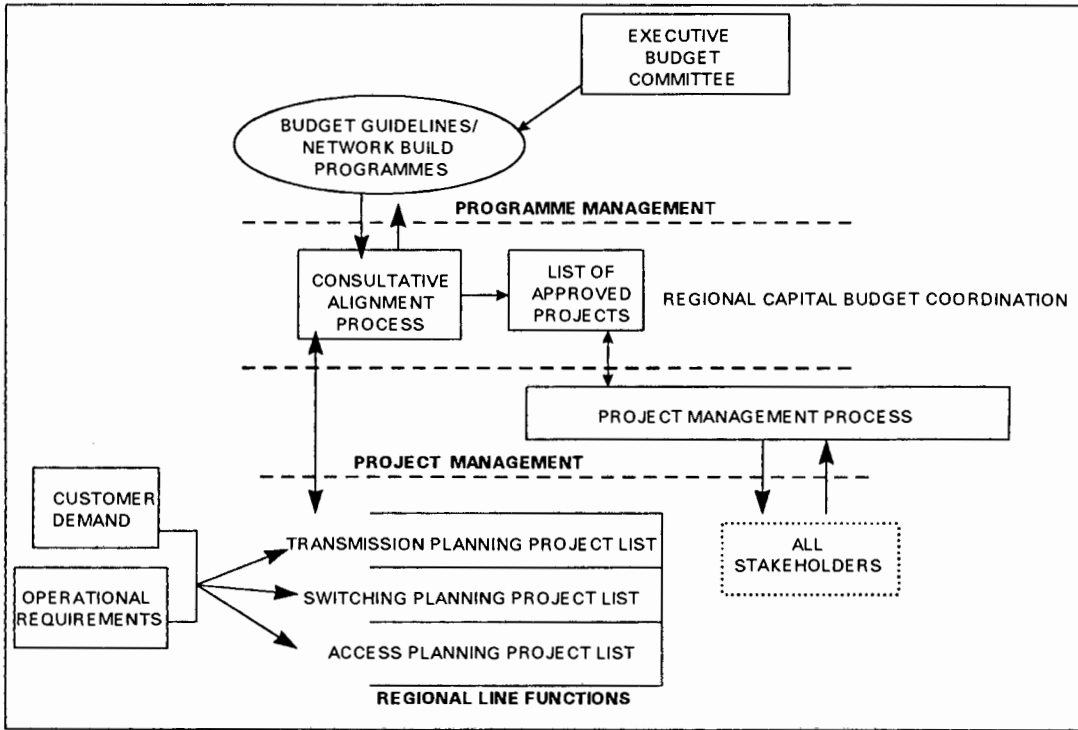


Figure 64 :Capital Budgeting system.

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