A SYSTEMIC EVALUATION OF THE IMPLEMENTATION IMPLICATIONS OF AN INTEGRATED, STANDARD INFORMATION SYSTEM

The SAP Implementation Project as a Viable System

A thesis in partial fulfilment of the requirements for the degree of Master in Industrial Administration, School of Engineering Management, University of Cape Town

HERCULES BOTHMA
November 1996

ABSTRACT

Part 1: Situation

Real-time, on-line, integrated software systems are a part of the latest technologies for large concerns as enablers for viability in an ever increasing competitive business environment.

The SAP (R/3 and R/2) standard software is widely considered as one of the leading solutions and implementation projects have taken the world by storm. The software, which runs on client server systems since 1992, is expensive and takes time to install. Complete systems can run into the tens of millions of dollars and take from one to over three years to implement.

The application of the software spans most of the processes of a business, logistics, finance, workflow and human resources as a real time, on-line and integrated information system enabler. Much of the data capture and some of the control aspects of the business are automated.

Concern

With this sophistication comes a new level of complexity. An initial argument of the thesis is that the success of an investigation into the problems associated with SAP implementations will be dependent on the thorough development of the inquiry system as a framework for appreciating the implications of such projects.

Question

Which management research approach will provide useful knowledge of the situation, with its challenges including variety of human interpretations and interests, the complexity of organisational regulation and the technical options of the software?

Part 2: Answer

A framework was developed by considering three levels for paradigms; philosophy, methodology and the application of the methodology.

As a choice for the philosophical level, phenomenology was chosen with its regard for the importance of the mental models of an observer. Pragmatism, with its basis for attributing meaning on the consequences of holding a belief or assumption, is enabled by a bias towards systems thinking as an adequate way of determining an appropriate level of knowledge of possible consequences of a decision.

The scientific method is the underlying guide for the inquiry process with its abductive, deductive and inductive stages. The base strength of the method, as presented by Peirce (Smith, 1995), was experienced as the rigorous attention to the development and testing of an hypothesis.

Due to the variety and importance of human interpretation regarding purposes and methods of information system implementations, the approach by Soft Systems Methodology was adopted as an enabler for an immersion into the problems of a project. As such it was the basis for the abductive stage of the inquiry. The result of this immersion determined the requirements for the choice of further methodologies.

The application of the SSM inquiry is guided by seven stages of sets of questions, as the 'technical' aspect of the inquiry framework.

Reasoning

Further to the reasons for choosing these approaches as stated above, is the following:

The problem was appreciated as being 'undefined' or 'soft', with its combination of vagueness as to what the actual problem is, and the abundance of world views regarding information and meaning. Soft Systems Methodology accommodates vagueness and world views and has the capacity for the development of a systemic understanding of a situation, with the purpose of defining desirable and feasible action to improve the situation.

Part 3: Evaluation

The application was guided by the three stages of the scientific method, abduction, deduction and induction, each with their arrangement of three elements of reasoning, rule, case and result. A definition for each of the stages follows as a basis for presenting the evaluation:

Abduction: The process of "reasoning from effect to cause". (Smith, 1995: 224)

Result: There exists a variety of successes and failures with respect to SAP implementation projects. The SSM inquiry revealed a need for an adequate project information system to maintain viability, within the challenges of the design and implementation of a standard information system for a large business.

Rule: Management cybernetics has been developed through various models to address the management of complex systems. The Viable Systems Model (VSM) is a developed cybernetic approach for the definition and management of the minimum regulation functions and the communication channels for an organisation to be viable.

Case: VSM is an adequate guide for the definition of the minimum necessary regulation functions that are required for the viability of an SAP project.

The VSM was subjected to a theoretical test involving the definition of SAP as a cybernetic information system, a VSM of a typical project and a Multiple Perspective evaluation, before the final acceptance of the hypothesis.

Deduction: The process of developing predictions as a basis for testing the hypothesis.

Rule: A Viable Systems Diagnosis will reveal the capacity of a project to be viable, by comparing the project attention to the minimum regulation functions as specified in the Viable Systems Model.

Case: Two projects are case studies, each with a distinct different level of success with respect to an SAP implementation.

Result: It is predicted that the success of each project is proportional to the attention to the minimum regulation functions as per the VSM.

Induction: The testing of the hypothesis with the evaluation of the results against the predictions from the deductive phase.

Case: Case A- A project with many failures, including sever cost and time overruns.

Case B- One of the more successful projects of an SAP implementation.

Result: The Viable Systems Diagnosis revealed weaknesses regarding most of the VSM regulation functions in the unsuccessful project, and adequate attention to these functions in the successful project.

Rule: The test supports the hypothesis. The VSM is a useful model for the definition of the minimum regulation functions for the planning and management of a viable SAP project.

Part 4: Reflection

The main contribution of the thesis is the development of an inquiry system for the purposes of management research. An inquiry system (IS), as a purposive tool, determines the quality of the answers and care was taken to investigate the underlying assumptions of the questions.

SAP implementations are intrusive and affect the nature of the personal, organisational and technical issues in one big project. As an enabler for the viability of the business, the software provide a system for real time, on-line information, with the assumption that the information is relevant to the users, and that the users have the authority and ability to make meaningful decisions.

The Viable Systems Model is a valuable mental model for the design of any system involving humans, by defining the basis of the viability system as an enabler for the existence and development of the social system.

Table of Contents

Figures

Tables

Acknowledgements

I would like to acknowledge the guidance and critical feedback given to me by Prof. Tom Ryan, the support of my team and the patience and practical feedback given to me by Michaela Kulbartz, without which this thesis would not have been possible.

Declaration

I, the undersigned, hereby declare that the work contained in this thesis 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: 01 November 1996

Signed by candidate

PART 1: The Situation

1.1 Introduction

Business Re-Engineering (BRE) projects are generally undertaken to optimise the organisation by redesigning the balance between ends and means, taking full advantage of the latest business science and technology.

A large percentage of BRE projects fail, with the blame often awarded to the human factor as the main resistance to change. A more recent view is that the human system may well be an ever present challenge, but another element emerged as a deciding factor in the race for competitiveness.

Lean organisations with decentralised power for decisions require a new quality of information system, which is designed for maximum decision support and readily available throughout the business. The relevant information must be available when it is needed on a real-time basis, which renders the previous approach of batch systems outdated and irrelevant.

One of the most successful software vendors, the German company SAP, has an enterprise wide, standard software solution which is becoming the norm in large organisations faced with the management of a high level of complexity and diversity. There is a need for one common information system throughout the organisation spanning functions, divisions and even countries, which is addressed by the client server based SAP R/3 software and the mainframe based R/2 software. For the purposes of this thesis reference will mostly be made to the SAP software as R/3, but this is mainly for continuity reasons as the challenges associated with both releases are similar (as confirmed by SAP senior consultants and developers).

The development of standard software is iterative, with business schools and industry providing a substantial input to the process. This implies a strong bias to the most recent tried and tested business methodologies as the underlying philosophy of the software solution. With a number of these 'best practice' processes designed for an environment of real-time information systems, it is no surprise to find that companies running on the old batch type software systems find their organisational design incompatible with the SAP methodology. A total Re-Engineering exercise is then often a prerequisite for the successful implementation of the R/3 software.

This poses a major challenge to organisations who are considering an integrated, real-time standard software system as an option: the most appropriate application of the R/3 standard software as an appropriate enabler can only be evaluated effectively once the redesigned organisation is developed with conceptually defined information requirements, compatible with the options offered by SAP. The problem is that it is very difficult to know the constraints of the software and its implications to the business. An appreciation of the impact is often only realised after about one year of using the system.

The implementation project team is faced with complex software, that is highly intrusive and impacts the business on many levels including the dispensation of decision making power, the integration of business processes and often the redefinition of meaningful work.

1.2 What is SAP R/3?

SAP R/3 is a standard software package that provides a management information system, spanning across financials, logistics and human resources. What makes the package special is that it is a real time, on-line and integrated system as a sophisticated enabler for control in organisations. The functionalities include:

- Financial accounting
- Controlling
- Fixed asset management
- Project system
- Human resources
- Plant maintenance
- Quality management
- Production planning
- Materials management
- Sales and Distribution
- Workflow

The R/3 applications reflect a company's operational procedures in the form of conceptualised business processes. These processes form the basis for data and information models in the system in the form of logical operational chains of routines.

At the core of the R/3 system are the applications for accounting, human resources and logistics, that provide comprehensive support for processes from purchasing through production planning and control to warehouse management and sales. Office applications such as word processing and electronic communication services like e-mail enhance the comprehensiveness of the package. A more recent addition is that of workflow, designed to improve the user friendliness of R/3 as well as the automation of work routines.

As an integrated information system, the R/3 software requires single data entries, automatically updating all the functional areas affected by the data entries. For example, by creating a purchase order, the financial and logistics functionalities are adjusted by this action in real time. From a financial perspective, the system is always in balance and reconciled. The organisation is therefore represented in the system as an integrated network of business processes, all affecting each other in real time dynamics.

A strong feature is that of flexibility. Within a wide range of "best business practises" built into the software, the organisation has the relatively large freedom of choice regarding performance indicators and measurements. With the technical side of the system based on an open, client server architecture, the range of choices extend to hardware, operating systems and data bases.

1.3 The implications of standard software

Standard software implies a single, common information system for the organisation and enterprise. The table below summarises the main implications of standard vs. individual application software.

'Individualised software' is a description for any software that is developed for a specific organisation, for a specific application. The table is derived from a cross section of interpretations of consultants and Information Technology managers, all involved in some manner with an implementation or evaluation of SAP software.

Individualised Software Development Project	⇒	**Standard Software Implementation Project**
Concentration usually on one specific area	⇒	Inclusion of the whole company
Mostly a localised effect	⇒	Effect on the whole company
Main work in the development	⇒	Characterised by prototyping with the user department
Progressive methodology	⇒	Iterative methodology

Table 1- Individualised vs. standard software

(Obtained from an SAP presentation by H. Schupp)

The scale of organisational change is largely dependent on the choice of purpose for SAP R/3 as an enabler. One can define three broad categories of an implementation scope:

- Reproducing the existing environment within the SAP system
- Selective optimisation of processes through the application of the software
- Re-engineering of the business processes and structures toward an integrated organisation with the selection of best business practises

Most of the projects involve at least some optimisation of business processes. A basis for optimisation is the range of 'best business practices' that are options within the software. The organisation is therefore faced with changes at many levels, mainly affecting the what and how of the operations and performance measurements of a business.

Research into the R/3 implementation implications has to address the challenge of providing knowledge of the control of the business, an issue that encompasses the complexity of socio-technical systems, politics, business processes and performance measurements.

Developments of management research and inquiry systems include an awareness of the shift in the complexity of businesses and their social systems. Checkland addresses the shift as one from "hard" to "soft" problems (Checkland, 1981). Strümpfer (Strümpfer, 1995) suggests the definition of problems with respect to its characteristics and criteria required for problem solving in a particular context.

1.4 Problem context

The R/3 implementation is presented in the context of systems in a business, each defined by a transformation that is expected or desired.

As the environment of the information system implementation, the context of a system to maintain viability for the organisation is chosen. A definition of viability is given below:

***Viable**: capable of working, functioning or developing adequately/ capable of existence and development as an independent unit (Websters New Collegiate Dictionary, 1973)*

The two essential components of viability of a system are existence and development, which can be accepted as the general critical purposes underpinning businesses. A business chooses products/services for relevance and existence in the marketplace and continuously develop their products and processes to remain relevant as the environment changes.

As a basis for defining a system, the perceived transformation of that system is used. Systems theory will be introduced in more detail in the development of a framework for inquiry, but it is necessary at this stage to know the author's basic assumptions of defining a system. A system is a mental model of reality, that defines boundaries around observations in order to attribute meaning to the perceived reality. The method of binding employed at this stage, is that of defining transformations and the grouping of interdependent components that contribute to these transformations.

A systems representation of the problem context follows:

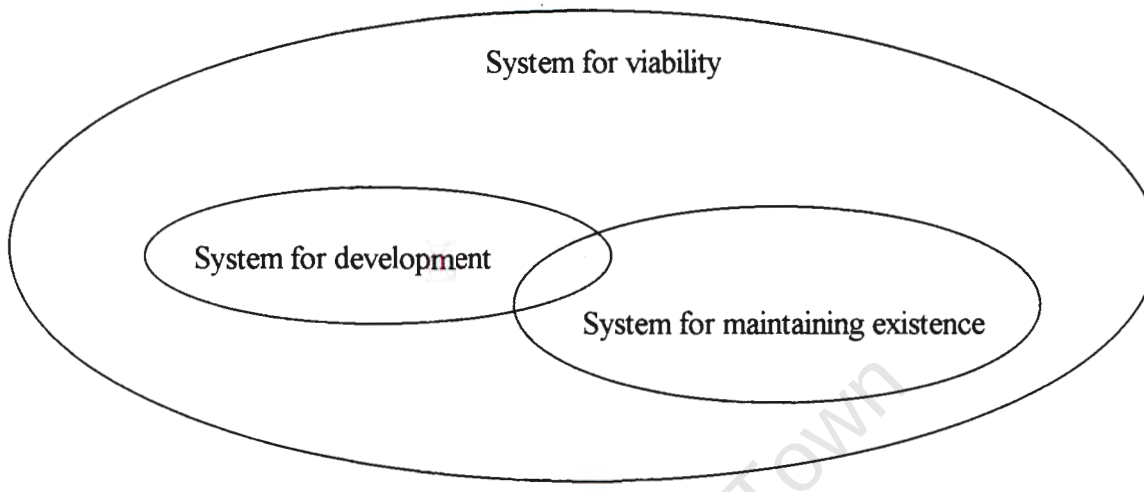


Figure 1- Systems and the problem context

To define the systems, their transformations are stated as:

Viability:	Viability in present environment	⇒	Viability in changed environment
Existence:	Requirements from customers	⇒	Customer requirements adequately met
Development:	Current competitiveness, performance	⇒	Improved competitiveness, performance

With the general definition of the problem context assumed as that of systems to ensure viability, namely systems for existing and developing, one can assess the possible characteristics of the problem.

1.5 Problem characteristics

Strümpfer suggests an exercise involving the rating of the problem/context in terms of being a bounded or unbounded one (Strümpfer, 1995). 'Bounded' refers to a high level of definition to the problem and its context, while 'unbounded' indicates a general lack of definition, even with respect to what the problem is in the first place. The rating is applied to the context of an integrated information system implementation, with its broad impact on the system maintaining viability in the business.

For the purposes of the table below, a purely bounded problem rates 1, and an unbounded one rates 9. Please refer to the table on the following page.

There is a strong indication that the problem appears to be of the unbounded variety. An inquiry system should therefore be appropriate for soft problems to have the potential for meaningful results in the context of R/3 software implementations. Strümpfer (1995) presents a list of qualities that is required for solving unbounded problems. A selection of these qualities follows:

- Soft problems require mindshifts, they cannot be solved at same level that they exist
- Mindshifts require double loop learning, i.e. a reassessment of assumptions and not only a reaction based on an old assumption- a challenge of the current basis of understanding.
- Learning requires an inquiry process
- Implementation requires shared mental models.
- Group learning, participation is therefore required
- Therefore problem solving ought to be shared learning
- Systems methods structure and carry the learning conversation as the underlying mental model or base assumption

These suggestions by Strümpfer form the initial bias for the development of an appropriate framework of an inquiry system.

Bounded/Hard	⇒	**Unbounded/Soft**
Reductionism works 1 2 3 4 5 6 **7**		Holistic view required **8** 9
Problem can be disentangled from its context 1 2 3 4 5 6 7		Cannot be disentangled from context 8 **9**
Solve externally 1 2 3 4 5 6 7		In situ solution required **8** 9
Problem known 1 2 3 4 5 6 **7**		Don't know what problem is 8 9
Information needs clear 1 2 3 4 5 **6** 7		Don't know what needs to be known 8 9
Solution exists and can be recognised 1 2 3 4 5 6 **7**		Solution may not exist/ be recognised 8 9
Objectivity possible 1 2 3 4 5 6 **7**		Subjectivity abounds 8 9
Optimisation possible 1 2 3 4 5 6 **7**		Robust system required 8 9
Time scale limited 1 2 3 4 5 6 **7**		Longer, uncertain time scales 8 9
Priorities clear 1 2 3 4 5 6 **7**		Priorities called into question 8 9
Fewer people involved 1 2 3 4 5 6 7		More people involved **8** 9
Limited impact 1 2 3 4 5 6 7		Implications and impact uncertain, broad **8** 9
Underlying causality 1 2 3 4 5 6 **7**		Causality not understood or not accepted 8 9
Good, proven theory available 1 2 3 4 5 6 **7**		Many competing theories, little proof 8 9
Objective accepted 1 2 3 4 5 **6** 7		Weak, no alignment on ends 8 9
Value system accepted and unquestioned 1 2 3 4 5 6 7		Multiplicity of value systems, questioned 8 **9**

Table 2- Hard and soft problems(Strümpfer, 1995)

1.6 Summary

An R/3 integrated information system implementation displays many of the qualities associated with soft problems. When one influences a control system, power structures are formally and informally influenced. Few aspects of an organisation are as 'unbounded' as the political dynamics, with subtle processes protecting present positions and status. A summary of the challenges of an implementation project is given below:

- An SAP implementation project is complex in the sense that it has a broad impact on the control of the business.
- Control is a critical aspect of the viability of an organisation and any changes to it can affect structures, processes and people.
- Changes to the regulation of an organisation requires the ability to develop a good appreciation of a) the current control system, b) a desired improved system for regulation and c) a way to realise the new system.
- The software is sophisticated in that it has many modules interacting in a network of real-time programmes. This makes it difficult for the implementers to grasp the constraints of the system and often necessitates critical changes during a project.
- The projects are expensive and seemingly small mistakes can result in large cost and time penalties

The inquiry system must therefore be designed to reveal knowledge about structures, processes and how these processes are controlled within the structures by people in the organisation.

The next part of the thesis is concerned with the development of an appropriate framework for an inquiry system.

PART 2: A Framework For Inquiry

2.1 Introduction

The purpose of Part 2 is that of developing a robust framework as a basis for the inquiry system of this half dissertation.

As a basis for the development of the Inquiry System (IS) for this thesis, the interpretation of Gareth Morgan of the use of paradigms is accepted. (Easterby-Smith, Thorpe and Lowe, 1979)

Morgan identified three levels where paradigms exist:

- the philosophical level
- the social level
- the technical level

The philosophical level is where basic beliefs about the world are formulated. These basic beliefs form the mental model of the researcher, which is the basis for developing an understanding of the relevant subject. The 'why' component of the research has its foundations at this level.

The social level contains the methodologies which are employed to address the questions raised by the research. This level addresses the 'how' part of the inquiry process. What specifically should be done, to successfully apply the chosen methodologies, is determined at the technical level.

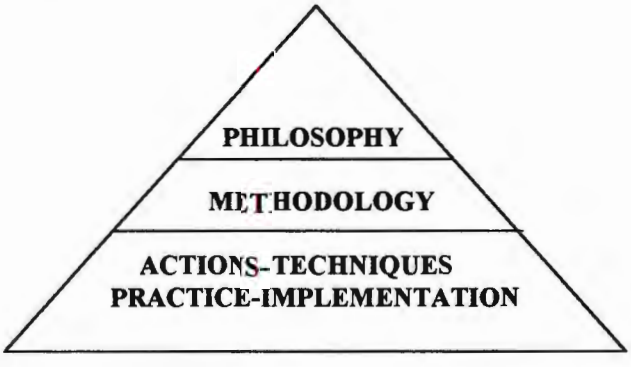


Figure 2- Diagrammatic representation of the levels for paradigms

2.2 THE FOUNDATION

2.2.1 Introduction

Of the three levels introduced in the previous section, the philosophy paradigm was described as a set of basic beliefs about the world. One of the primary purposes of Part 2 is the development of a rigorous process of inquiry to effectively address the complications of the problem situation.

The same rigour is required for the actual design of the inquiry process, which necessitates the clear definition of the assumptions at the philosophical level.

Current world views include two apparent corners within management research with respect to philosophical stances, phenomenology and positivism. (Easterby-Smith, Thorpe and Lowe, 1979)

These stances have distinct differences and cannot be used together in the same reasoning process. It is therefore important to clearly define one of these philosophies as the basis for the inquiry process. The definition of these stances are based on the interpretations of Easterby-Smith, Thorpe and Lowe, 1979, in their book, *Management Research- An Introduction.*

2.2.2 Features of Positivism

A positivist stance implies a belief that reality exist only external to the mind, and that this external world can only be measured by means of external methods, independent of the influence of sensation, reflection or intuition. (Easterby-Smith, Thorpe and Lowe, 1979) Two assumptions are that:

1. Reality is external and objective
2. Knowledge is only significant if it is based on observations of this external reality

There are several implications with respect to the following characteristics due to these two assumptions (Easterby-Smith, Thorpe and Lowe, 1979):

- Independence: the observer is independent of what is being observed
- Value-freedom: the choice of what to study, and how to study it, can be determined by objective criteria rather than by human beliefs and interests.
- Causality: the aim of social sciences should be to identify causal explanations and fundamental laws that explain regularities in human social behaviour.
- Hypothetico-deductive: science proceeds through a process of hypothesising fundamental laws and then deducing what kinds of observations will demonstrate the truth or falsity of these hypotheses.
- Operationalisation: concepts need to be operationalised in a way which enables facts to be measured quantitatively.
- Reductionism: problems as a whole are better understood if they are reduced to the simplest possible elements
- Generalisation: in order to be able to generalise about regularities in human and social behaviour it is necessary to select samples of sufficient size
- Cross-sectional analysis: such regularities can most easily be identified by making comparisons of variations across samples.

Easterby-Smith, Thorpe and Lowe state that the propositions above are a collection of views within the positivist stance, more than a definitive description.

2.2.3 Phenomenology

Phenomenology, or social constructionism, acknowledges the importance of human bias in observations and the meaning of these observations.

Edmund Husserl originated the branch of philosophy called phenomenology. His premise is that it is impossible to examine the world without any preconceived notions about causes or underlying structures. By carefully exploring all the data available to conscious experience, it is possible to arrive at an explanation of essential structures of all phenomena. (Phenomena are the realities perceived by the senses. The word itself means "appearances" and suggests that there is an unperceived reality behind them.). (Easterby-Smith, Thorpe and Lowe, 1979)

2.2.4 Phenomenology vs. Positivism

As a summary of the two stances, a comparison between phenomenology and positivism is done in the context of research.

The basis for the comparison is the three levels of paradigms as introduced in the introduction to part 2: philosophy, methodology and technique.

The table is an interpretation of groups of approaches within each category, and therefore is an attempt to show distinct differences rather than provide absolute definitions.

Easterby-Smith, Thorpe and Lowe presents the following table in their book, Management Research, An Introduction' (1979).

	Positivist paradigm	**Phenomenological paradigm**
Philosophy (basic beliefs)	The world is external and objective Observer is independent Science is value-free	The world is socially constructed and subjective Observer is part of what is observed Science is driven by human interest
Methodology (guiding)	Focus on facts Look for causality and fundamental laws Reduce phenomena to simplest elements Formulate hypothesis, then test them	Focus on meanings Try to understand what is happening Look at the totality of each situation Develop ideas through induction from data
Techniques	Operationalising concepts so that they can be measured Taking large samples	Using multiple methods to establish different views of phenomena Small samples investigated in depth over time

Table 3- Phenomenology vs. positivism
(Easterby-Smith, Thorpe and Lowe, 1979)

The basis for selecting one of these philosophical stances as the starting point for the development of an inquiry framework, is the problem under investigation.

The characteristics of the problem was described as 'unbounded' in Table 2 of Part 1. This implied the necessity of an holistic view, an in-situ inquiry as opposed to taking the problem away for investigation, a strong subjective nature and a complex, often badly understood causality. There is therefore a definite incompatibility with the implications associated with positivism, which includes the necessity for objectivity, reductionism and the establishment of a clear causality for the basis of an explanation for human social behaviour.

Phenomenology is thus the initial bias for the design of the inquiry system. Developments that are associated with phenomenology include the definition of categories as a basis for appreciating an 'external world'. Kant developed his categories with the understanding that they only exist in the mind as a basis for achieving knowledge, while his pupil, Peirce, interpreted categories as also possible in the external world. He argued that his categories were derived objectively.(Smith, 1995) This aspect of Pierce's philosophy is interpreted by the author as the inclusion of the qualities of objectivity and the reality of an external world to the phenomenological basis. Whether this influence the classification of Peirce as a phenomenologist will require a more extensive inquiry by the author. The question, "Is Peirce a Phenomenologist?" is one of the current topics of the Peirce discussion group on the internet.

A brief introduction to the aspect of the categories follows, as developed by these two Philosophers.

2.2.5 Immanuel Kant

Kant is said to have developed his philosophy in response to the depressing scepticism of Hume. Hume argued that ideas are only the result of impressions from the outside on our senses. Ideas are also only formed from impressions which they exactly represent.

The most challenging statement by Hume for Kant is that about causality; "there is nothing in cause except invariable succession", and further, "that all our reasonings concerning causes and effects are derived from nothing but custom, and that belief is more properly an act of the sensitive, than of the cogitative part of our natures"(Russel 1995, 643 &.644).

Kant's response was the development of 'a priori' as the necessary set of conditions for experience. He argued that sensory impressions are necessary but not sufficient for perception and the resulting knowledge. The most basic requirement is that of ordering the observed matter in space and time, expressed by Kant as intuition. (Russel, 1995)

A systematic categorisation of a priori resulted in twelve categories, divided in four sets as below: (Smith, 1995)

- **Quantity**- unity, plurality, totality
- **Quality**- reality, negation, limitation
- Of **Relation**- substance-and-accident,
  cause-and-effect, reciprocity
- Of **Modality**- possibility, existence, necessity

The types of a priori are analytic and synthetic; analytic is where the predicate is part of the subject (a red apple is an apple), and synthetic that which is not analytic (all the propositions we can know through experience (today is a sunny day).

Empirical propositions, also referred to as a posteriori, are those we can only know through our sense-perception, when our knowledge of their validity depends on observation. It is my understanding that one can consider these a posteriori as those assumptions which will be reconsidered and possibly modified when double loop learning is effected, assumptions with its validity relative to content and context at a specific time or period. Churchman names the a priori "systemic judgements", that guide the inquiry process for the observing agent.

Critical to inquiry are Kant´s questions:

What can I know?
What can I do?
What can I hope?

A criticism of Kant is that there is no clarity on monitoring and testing the "truth" arrived at through the a priori. He strongly addresses the perception part, with no substantial reference to the pragmatic implications of the 'truth'. He does define a categorical imperative, which intends to say that a certain kind of action is objectively necessary: "Act as if the maxim of your action were to become through your will a general natural law" (Russel, 1995:683). This is necessary but not sufficient to test the validity and legitimateness of an action. An important component is that of evaluating the effects of the action, otherwise a fanatic can wish for the indiscriminate killing of those of opposing his belief, justified in his own mind as an appropriate natural law.

These questions and the a priori in the form of distinct categories impressed C.S. Peirce to develop his special version of phenomenology, which is rational and practical to provide a sound base for inquiry. Please not that the main influence as a basis for developing an understanding of Peirce was the full dissertation by Craig Smith, 1995: *Towards A Peircean Framework For Organisational Development. A Teleological Approach.* (Smith, 1995)

2.2.6 Peirce's phenomenology

Peirce expands phenomenology beyond the experienced, to include potential experiences and possible direct or indirect objects of study. He uses the Greek word, phaneron, which is interpreted as the collective total available to the inquirer, tangible and intangible.

The three implied characteristics of phenomenology are qualitative possibility, factual evidence and generalisation. It therefore attempts to include perception, accuracy and generality.

Peirce's phenomenology is therefore the basis for categorising elements of reality, with him choosing triadic logic to develop three categories, Firstness, Secondness and Thirdness. (Smith, 1995) The italics indicate an interpretation of the result of the categories as applied to observation, by the author.

- ***FIRSTNESS***

Firstness indicates potential, the qualitative nature of the total that is available to the inquiring mind. One interpretation is that Peirce, through this category, allows for a situation which is neither true or false. (Smith, 1995) ***Something***

- ***SECONDNESS***

Secondness may be summarised as that which cannot be controlled by our thinking, the hard facts of the external world, i.e. the factors which act as constraints upon our will. Peirce further states that a fact can only consist of two objects interacting. (Smith, 1995)

Without an understanding of limitations, it is impossible to develop a basis for prediction. Secondness concerns itself only with the fact as a constraint, the here and now, while thirdness provides for the past and future related to the fact with respect to some causal relationship. ***Something interacting with something else***

- ***THIRDNESS***

Peirce describes thirdness: "As the process intervening between the causal act and the effect". (Smith, 1995:153)

Thirdness is concerned with the development of understanding, generalisation or law, which can be used for predictions. It reduces the element of surprise present in our experiences.

The three categories may be explained as follows as an interpretation by the author: firstness and secondness are determinate as reactions by the inquirer, with thirdness the indeterminate component, addressing the future and requiring a proactive stance.

Something interacting with something else to give rise to something new, Production, Process, Cause and Effect

These categories are based on triadic logic, of which the author's understanding is: A interacting with B gives rise to C, as a result of A being, B constraining or interacting and C resulting as a product.

It is a belief of the author that an approach for management research is only valid if it has a capacity for some kind of prediction of the possible practical implications of accepting the results of an inquiry. With the implementation implications of an information system as the focus of the inquiry, there must be a basis for evaluating the possible implications to the organisation as one of the critical aspects of the evaluation of the validity of implementation decisions. This implies a bias towards pragmatism as an implementation approach, of which an introduction follows.

2.2.7 Pragmatism

Peirce is considered the founder of pragmatism, or pragmaticism as it was named later for differentiation from the broad meaning associated with 'pragmatism'. Smith states that an understanding of 'thirdness' as the category for the development of law or generality, can use Peirce's pragmatic maxim as a standard of measure:

"Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then our conception of these effects is the whole conception of the object." (Smith, 1995:173)

The American philosopher and psychologist William James was a close friend of Peirce and an important contributor to the development of pragmatism. He stressed that the value of any idea or policy is based entirely on its usefulness and workability.(Reilly, 1970)

In 1884 he published the "James-Lange theory". It set forth James's belief that emotions are organic sensations aroused by bodily expression, that we feel sorry because we cry, and angry because we strike. William James's most important work, 'The Principles of Psychology', was published in 1890. In this book, James advocated the new psychology that acknowledged a kinship with science as well as with philosophy.

In 'Pragmatism' (1907)., he expounded the theory that man knows the true meaning of an idea only when he sees what its effects are.

Other later developments include Neuro-linguistic Programming (NLP), which is a model of the perceptual filters which determines the human's interpretation or 'map' of the external world. (O'Connor and Seymour, 1990)

The description of the interconnectivity between the external world, the mental processes which results in understanding and meaning, and physiology in one mental model is arguably the most important contribution by NLP.

An interpretation of the NLP communication model is presented on the next page. It shows some of the critical filters through which an observation passes before meaning is attributed.

Note: The term 'Meta Programs' (in the model) refer to the preference of the individual to sort information for relevance and value. This could be for example: evaluating information on the basis of similarity, or difference to previous information and/or the authority of the source of the information.

The model originated as the result of the developments by Richard Bandler and John Grinder. One description is that NLP is an applied behavioural psychology, with roots in linguistics, systems thinking and artificial intelligence investigations.

The author attended an NLP Practitioners course and obtained the diagram of the communication model as part of the course notes.

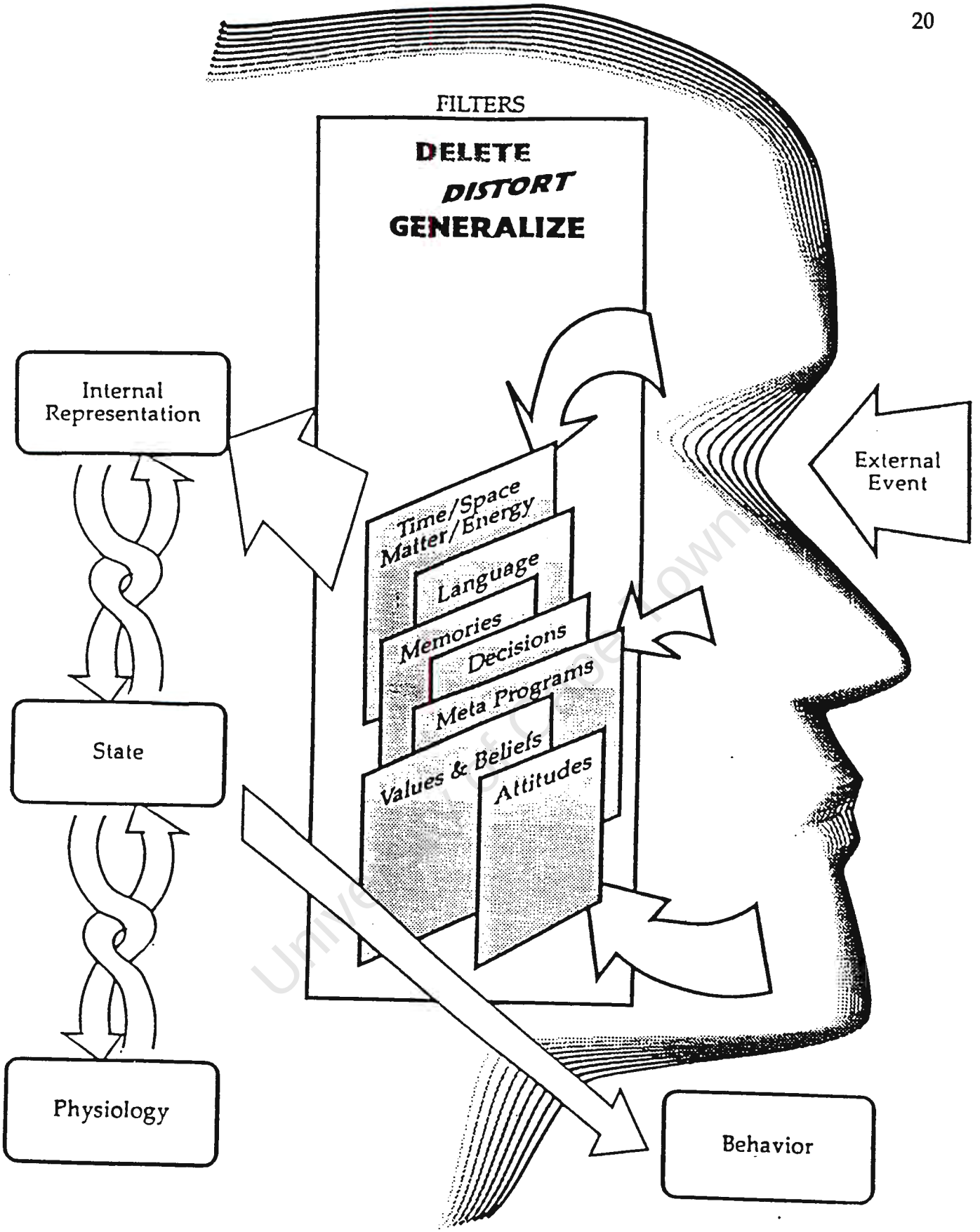


Figure 3: The NLP Communication Model

(Profitability Group, Inc., 1988, 1989 NLP Practitioners Course notes)

There is therefore a strong psychological argument against the possibility of the 'independent observer'. With the assumption that one has a bias that influences the ability to develop an understanding of the world, and that a basic requirement of this understanding must be the ability to have a concept of the consequences of a particular view, it is the author's opinion that a useful bias must be developed to be appropriate for observations of a particular situation.

2.2.8 Descriptions of the world

Three major approaches for describing the world has emerged, the world as a machine, an organism and a social system. (Ackoff, 1994)

The world as a machine includes the following assumptions:

- The world and its parts (people) have no purpose of their own and operate within the purpose of some external power.
- The world can be completely understood
- The understanding can be achieved by analysis, i.e. reductionism
- The environment has little effect on the operations of the world

The world as an organism has the following implications:

- The world has choice of purpose, but not its parts, such as the human body and organs.
- The main purposes are survival and growth
- Control is done through the specification of outputs, with a required level of the parts accepting a production function without opposition.
- Regulation occurs within the constraints of defined outputs

The world as a system implies:

- The system and its parts have choice of purpose.
- The system cannot be divided, parts and system are interdependent
- Synthesis and analysis are both required for an adequate understanding of a system
- Behaviour and production of a system is the result of emergence through interactions

The systems view is the choice of thinking about the world for the purposes of this inquiry, as it is the only approach that acknowledges people as purposeful parts. This is a critical factor regarding the design and implementation of information systems, as information has direct relevance to people as entities with the capacity to choose and attribute meaning.

2.2.9 Systems Thinking

Human systems are more complex than the natural science systems, due to the one additional feature, conscious thinking and appreciation. The author intends to apply the resulting inquiry system to management issues, which involve people. Management situations are mostly indeterminate and a result of interactions between people, rather than the separate components of the situation.

The Systems approach is traditionally accepted as emerging in the 1940s as a response to the failure of mechanistic thinking (where an aggregate of the parts of a 'system' is equal to the sum of its parts) to explain biological phenomena (Flood and Jackson, 1991).

Today, however, the word 'system' has been so overused that it has lost its specific meaning which is intended here (Checkland, 1981). Other names have been suggested, for example, 'holon'. A system or holon is an abstract conceptual model of the real world that is often useful to organise or model our thinking of the real world . Systems Thinking is claimed to be more powerful at tackling real world complex interconnected problems than traditional reductionist thinking. This is especially so where often unpredictable human actors are involved (Checkland, 1981).

2.2.10 Basic systems concepts

The most basic core idea of Systems Thinking is that the complex whole may have properties which refer to the whole and are meaningless in terms of the parts which make up the whole. These are its 'emergent properties'. This is expressed in everyday use by the phrase 'The whole is more than the sum of its parts' (Checkland, 1981). The concept of emergent properties itself implies a view of reality as existing in layers in a hierarchy (in the technical use of the word) (Checkland, 1981). This means that each 'system' is part of a larger 'suprasystem' and itself contains smaller elements of 'subsystems'. If such a hierarchically organised whole has processes of communication and control which would enable it to adapt in response to changes in its environment, it should in principle be able to survive in that changing environment (Beer, 1994).

A system can be identified by its purpose and the transformation that it performs. The transformation process should change the nature of the input, which can be a physical or abstract entity. The general way of approaching systems is then to define a system in focus for that transformation or purpose (Recursion 1). This system will be embedded in an environment or suprasystem (Recursion 0) and have parts or subsystems contained within it (Recursion 2). This defines the boundary of the system, however, the boundary judgements should be handled with care, as they determine most of the thinking that follows that specific inquiry into a phenomena.

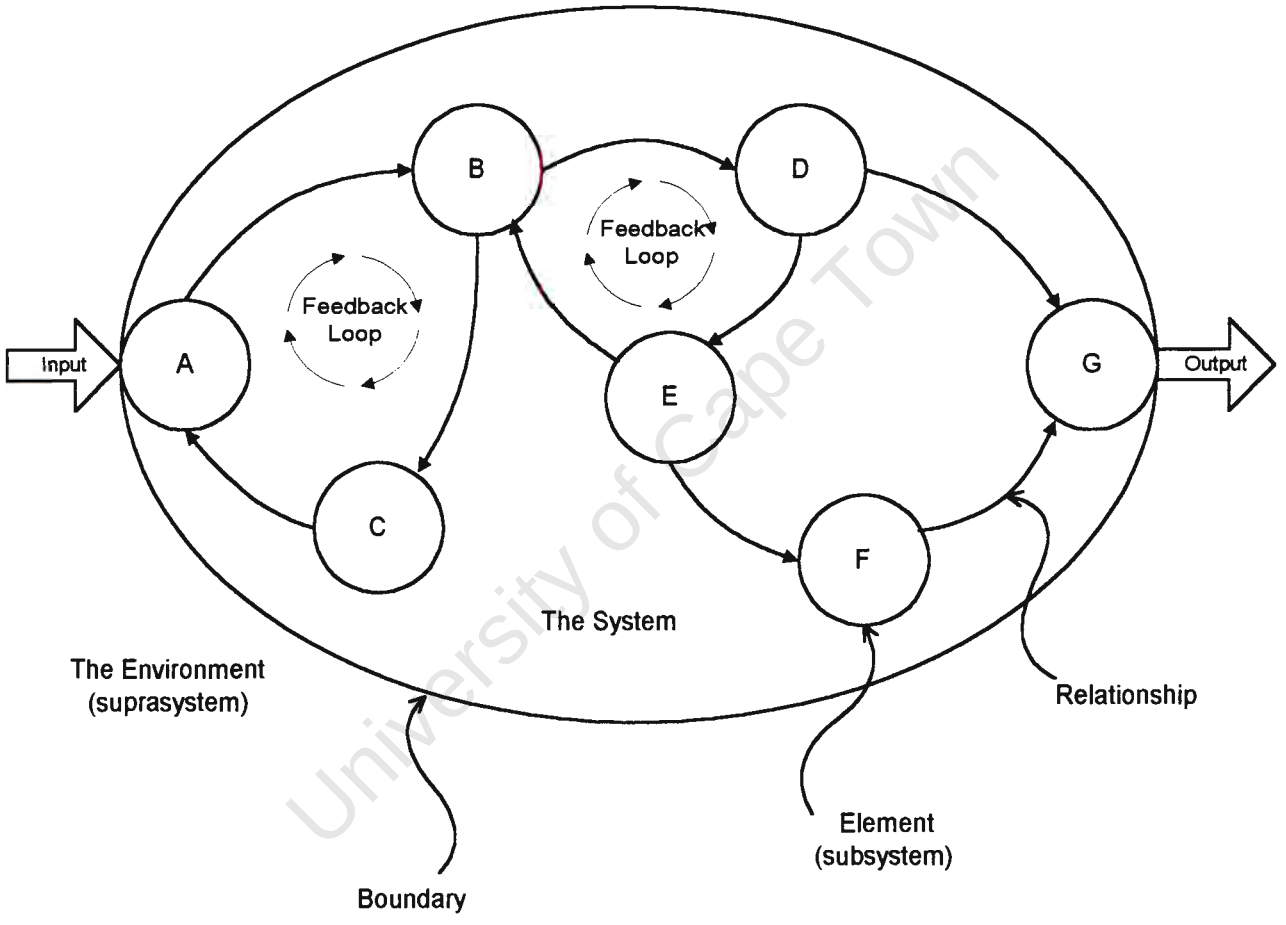


Figure 4- Characteristics of systems

One of the most rigorous definitions of a system is that of Churchman. He suggests nine conditions to define a systemic representation of an observed phenomena. These conditions are in essence steps of binding the situation into a manageable perspective, in the form of a system, **S** (Churchman, The design of inquiring systems, 1971). The nine conditions are included below.

Churchman's nine conditions for the definition of a System, S

1. **S** is teleological, it has a purpose.

2. **S** has a measure of performance, some standard that guides the behaviour of the system.

3. There exists a client whose interests (values) are served by **S** 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 of the measure of performance.

4. **S** has teleological components which co-produce the measure of performance of **S**. These components are purposeful subsystems, interdependent with each other and **S**.

5. **S** has an environment (defined either teleological or ateleologically), which also co-produces the measure of performance of **S**.

6. There exists a decision maker who - via his resources - can produce changes in the measures of performance of **S**'s components and hence change the measure of performance of **S**.

7. There exists a designer, who conceptualises the nature of **S** in such a manner that the designer's concepts potentially produce actions in the decision maker, and hence changes in the measures of performance of **S**'s components and hence change the measure of performance of **S**.

8. The designer's intention is to change S as to maximise **S**'s value to the client.

9. **S** is stable with respect to the designer, in the sense that there is a built in guarantee that the designer's intention is ultimately realisable.

What makes this definition useful is the identification of the owners, designers, experts and those who live within the system. This corresponds to the stakeholders of an information system implementation project.

Information systems essentially perform measurements against some standards as one measure of success for the system, while Churchman' definition expands standards to beyond measurement as a statistical exercise.

2.2.11 Conclusion

An SAP implementation involves the appreciation of what information is relevant to a business and what meaning people would attribute to the information for effective decision making.

A researcher has no basis for absolute definition about information systems within diverse and changing environments and brings his/her world views into the pool of world views of the organisation during inquiry. This is the motivation for choosing a research approach that accommodates and acknowledges the bias of the observer of a system. Phenomenology is an approach that recognises the importance of the involvement of the observer as a part of the system under investigation, rather than an external party.

The choice of Peirce's phenomenology implies an equal recognition of observer appreciation and an external reality. Peirce provides the concept of thirdness, as the basis for developing a prediction of the consequences of holding a certain belief about a situation.

This pragmatism, as applied to information system design and implementation, assumes an ability to adequately understand the components, constraints and production dynamics of social systems. Systems thinking is the basis for developing this understanding as one of the only approaches to accommodate the choice of purpose of the humans in systems.

It is with this basis that the process of inquiry is designed and presented in the following section.

2.3 THE INQUIRY SYSTEM

2.3.1 Introduction

The next aspect of philosophy is that of fixing belief, i.e. the process adopted to establish certainty about the validity of the research process. The author offers an interpretation of truth using the diagram below.

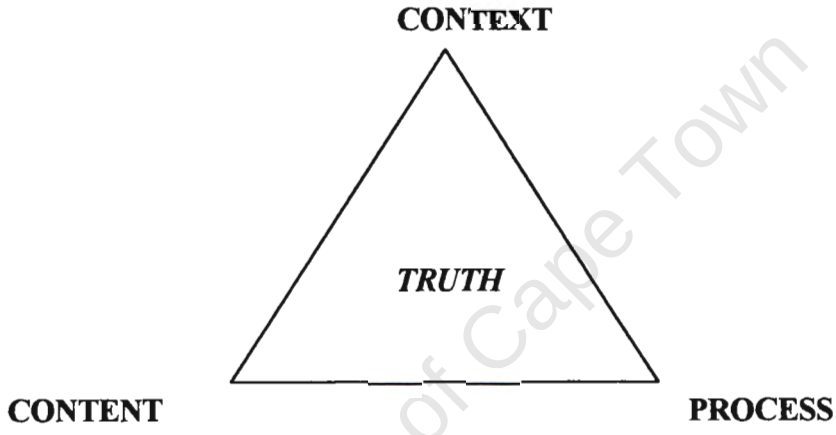


Figure 5- The truth triad

With the phenomenological stance as the foundation, it is postulated that, at a given moment, truth within a specific context is determined by the observer, based on the available content (collective total information) by means of a process of inquiry.

If any of these components change significantly, the 'truth' may have to be re-evaluated.

The context is determined by the choice of a research subject and the content is the collective total information available to the researcher, a priori and observed. However, the process is purposive as a tool, and requires design.

There are two levels to the process, the philosophical and the practical, the why and the how. This section concerns itself with the philosophical component of the inquiry process and will address the method employed to fix belief.

The following summary serves as an introduction to the history of the philosophy of inquiry.

2.3.2 A History Of Inquiry

An introduction to the history of inquiry is presented as a basis for choosing an approach.

C.S. Peirce

Peirce describes science as a living thing continually growing and developing.

He saw science as a pursuit of scientific men who he considered as a peculiar class of man. It was essential to note, that for men of science achievement was not the primary consideration. What he did consider primary was the spirit that guided the work.

The definition of the scientific is someone who was working in the right way to learn something not already known. If someone was not using the correct and effective method he could not be considered a scientific man. It was of no importance in this definition as to how informed the individual is, rather to the fact that correct and effective methods are being used to inquire. Behind these correct methods would reside the spirit that would not rest with existing opinions but would press on to the real truth of nature.

Peirce takes issue with the Cartesian view that one can doubt at will, rather that experience is necessary to give rise to doubt. His concern regarding idle doubt leading to farce is carried through in his attitude toward observation which he describes as not a vacant and passive act, rather a voluntary and attentive experience, often with great effort. The concept of the surprising event that leads to scientific inquiry is clarified by Peirce that "*mere irregularity, where no regularity is expected, creates no surprise nor excites any curiosity*". A more deliberate effort is explained by him: "*Certain experiences build up habits of expectation in the observer, and when this habit is broken in upon by some unexpected event, the mind changes from belief to doubt, and should undertake a process of inquiry to explain the unexpected fact*" (Reilly, 1970).

The chief stages of the method are: observation, abduction and verification.

John Dewey

One of the most notable American philosophers of the 20th century he shares with William James and Charles Sanders Peirce the distinction of founding the movement called pragmatism.

Dewey and his wife started the Laboratory School at the University of Chicago to test his educational theories. Learning by doing was the heart of his method. The children were given freedom to learn in accordance with their needs and experiences. The faculty was able to study child behaviour, a new area of study at the time.

Dewey's pragmatic theories insisted that the way to test ideas was to check them against their consequences, rather than to claim their agreement with supposedly self-evident truth. When faced with a problem, said Dewey, a person must logically examine the options open to him to find the best solution supported by the facts. This method of inquiry and testing should be applied to moral and social questions, as well as to technological and scientific ones.

Karl Popper

Originator of the theory of falsifiability, Karl Popper is best known for his rejection of the inductive method of reasoning in the empirical sciences. In inductive logic a statement of supposed fact, the hypothesis is proven true if repeated observations substantiate it. In opposing this viewpoint, Popper insisted that hypotheses must be testable, and that the right test for a scientific hypothesis is to look for some circumstance for which it does not hold. If no such circumstance can be found, then the hypothesis is true.

In his first book, 'The Logic of Scientific Discovery', published in 1934, he presents his thoughts regarding falsifiability and inductive logic, and outlines his method of distinguishing between sciences and pseudosciences. The theoretical constructs are rejected by Popper as pseudosciences because they failed to pass his test of falsifiability include such fields of study as astrology, Freudian psychoanalysis, metaphysics, and Marxism.

Popper's later works include 'The Open Society and Its Enemies' (1945) and 'The Poverty of Historicism' (1957). In both of these books and with expansion on these ideas in his three-volume 'Postscript to the Logic of Scientific Discovery' (1981-82), he opposes historical determinism, the view held by Plato, Hegel, and Marx that history develops in accordance with inexorable natural laws.

Thomas Kuhn

In 1962 T.S. Kuhn published his 'Structure of scientific revolutions'. Kuhn developed the concept 'paradigm', which can be regarded as a framework or mental model within which the scientist operates.

He describes the revolution of science as follows: a form of science or philosophy is developed by mankind to explain phenomena. This science is accepted until unsolvable problems are encountered, which is when the science or philosophy itself has to be re-evaluated as an explanatory system. This total re-evaluation is the revolution component.

The significant feature of this revolution is that a complete perceptual change needs to occur to develop a new science or "truth".

With the 'why' component of the inquiry process the focus, one way to choose a specific process is to specify a critical purpose requirement.

The challenge is to develop an inquiry system that can address the type of problems existing when large scale software implementations are undertaken, such as the SAP R/3 information system.

2.3.3 The Scientific Method

Peirce's application of the scientific method is accepted as the philosophical approach to determining 'truth'. A general introduction to the method is followed by Peirce's interpretation.

Introduction

Like philosophy, science emphasises the use of logic. In fact, science can be viewed as a scrutinising system of logic. It seeks to answer questions by observing phenomena. The scientific method is the system of logic used by scientists, though some sciences differ in their use of logic. As scientists try to solve a problem, they may use a model based on a logical, plausible connection of events. Like an hypothesis, the model is then tested by making predictions based on the model. If the predictions are proven wrong, then the model is revised. If the model survives the tests, the model becomes the system of logic that describes the theory.

Unlike philosophy, science emphasises the repeatability of results. This means that a given set of circumstances should always produce the same result. Scientific theories are not accepted by the scientific community until the theory has been validated.

Peirce and the Scientific Method

The chief stages of the Peirce's method are: observation, abduction and verification these are described below.

- **The Abductive Phase**

The method contains firstly experience then doubt, which leads to observation and the Formation of the Explanatory Hypothesis. This hypothesis is a conjecture that attempts to explain the phenomena. Abduction is considered by Peirce as a vital function of science. It comprises the mental process by which a hypothesis is formed. Peirce commits strongly to his belief that experience coupled with human intellectual invention and intuition, stimulated by doubt and observation, produces the explanatory hypothesis.(Reilly, 1970)

The hypothesis may start as a weak argument, which needs to be selected on the basis that it is verifiable experimentally, taking into account the practical and economic issues surrounding verification. Peirce emphasises his belief in the power of human intuition to reach an appropriate and simple hypothesis.

'Peirce urges investigators to trust the power of the mind to hit instinctively on the right explanation of observed facts' (Reilly, 1970)

Scientific Verification.

Peirce suggests that science progresses by means of brilliant imaginative leaps of induction coupled with carefully controlled evaluation in the verification phase. He further suggests that every hypothesis should be put to the test by forcing it to make verifiable predictions. In essence, once a theory emerges from the abductive phase, a causal model is required to plan the transition between hypothesis and reality. The verification phase is divided into two steps the deductive(causal model) and the inductive phases.

- **The Deductive Phase**

After a hypothesis has been chosen predictions as to the results of experimentation are deduced. This phase is not an examination of the phenomena rather it is an examination of the hypothesis. Its main function is to prove the hypothesis. The predicted results must be observable, the truth therefore is reached not by reasoning, but by experience. As essentially a causal model between theory and practise, deduction must produce observable predictions and is a valuable tool for the planning of the implementation of the hypothesis.

- **The Inductive Phase**

  Induction is the process used by the scientist, to investigate to see where the predicted observable consequences of the hypothesis actually occur. Whether the results confirm or deny the hypothesis, science has been advanced. During this phase the inquirer must ensure that fair sampling is adhered to. The inductive phase is further broken down into three parts: classification, probation and the sential part.

  Classification is the result of the prediction of the sort of thing to be expected if the hypothesis is true. Probation describes the quantitative and qualitative evaluation of results. The Sential or third part of the inductive phase is an appraisal of the probations, and judgement of the whole result, so that the explanatory hypothesis may be regarded as proved, partially proved, unworthy of further investigation, in need of further modification, etc.

  This process leads to the convergence of the truth, in that persistent use of the inductive method will gradually reduce the incidence of error.

  Peirce evaluates the validity of the method against the potential of alternative methods of fixing belief.

Peirce on fixing belief

Peirce defines the process from doubt to belief as the desideratum of the human mind. In order to define the most effective method for realising this process, he articulated three approaches for fixing belief as alternatives to the scientific method (Smith, 1995)

The three methods are Tenacity, Authority and A Priori. Peirce argues that these methods do not offer a long term sustainability of the fixed belief.

- ***TENACITY***

  Also named the "Ostrich syndrome", this method implies the holding onto beliefs purely because it is the most comfortable alternative. It can possibly be likened to a deliberate ignorance, which is practised to protect an existing belief.

  Peirce reasons that one cannot ignore the environment for a sustained period unless leading a reclusive lifestyle. Man is a social creature and is influenced by other people's opinions. It can therefore only offer short term security to the person employing this method.

In Peirce's words :

"The man who adopts it will find that other men think differently from him, and it will be apt to occur to him, in some saner moment, that their opinions are quite as good as his own, and this will shake his confidence in his belief"(Smith, 1995: 80)

- ***AUTHORITY***

Directly relevant to this method is the concept of control, more specifically, control over the expression of the beliefs of individuals by groups of individuals, using coercive means.

Naom Chomsky expressed the Western civilisation's efforts to fix belief by method of authority as *The Manufacture Of Consent* in his television documentary, which is to him a sophisticated manipulation of the media in order to maintain a specific level of ignorance and acceptance in the individual. This suppresses the tendency to think of alternatives to the belief held by the controlling authority. A challenge of this belief by a daring individual may be discouraged by the prospect of uncomfortable consequences.

Although this approach is still popular when dealing with the governing of countries, the organisation or business may often include many individuals who are above external control, and who are prepared to challenge authority. Peirce argues that no state can regulate the opinion of every subject, which reduces the long-term viability of this method.

- ***A PRIORI***

According to Peirce, the a priori is a more respectable method of fixing belief than the method of authority. Both methods employ coercion, however, the a priori follows a more intellectual path.

A group of intellectuals democratically decide which propositions are acceptable against a set of criteria. Coercion is practised by using esoteric language and intellect to attack those who oppose their propositions.

The basis for the selection of the beliefs is not observed facts, according to Peirce, but rather by the degree by which these propositions support reason.

He states that this method is more acceptable than the other two, by virtue of its more beneficial nature. However, the lack of including observed facts in the determination of beliefs may be interpreted as a lack of a base more stable than the perceived reason of intellectuals. This hampers the potential of this method to support sustainable beliefs.

2.3.4 The Qualities Of The Scientific Method As An Inquiry System

The choice of the Scientific Method was further supported by the following implications, that are considered to be valuable qualities of an inquiry system.

A process for learning

The scientific method follows the steps of a learning cycle. This implies that the process is self-correcting and, according to Peirce, converges on the one universal truth.

When one compares some other approaches to learning to the Scientific Method, one distinguishing feature emerges. The Scientific Method has the deductive phase as a critical requirement for learning. It states that, without defined predictions, how can a rigorous comparison be made to validate the hypothesis? The importance of the prediction stage enhances the rigour and transparency of the Scientific Method as an Inquiry System that can be publicly criticised with its visible logic.

Please find the table of learning cycles below.

Peirce	Revans	Kolb	Handy
Abduction: Experience Doubt Intuition Explanatory hypothesis	**Observe** **Theory**	**Experience** **Reflection** **Generalisation**	 **Question** **Answer**
Deduction: Formulate predictions Define basis for a test			
Induction: Classification Probation(quantify) Sential(evaluate)	**Test** **Compare**	**Test**	**Test** **Reflect**

Table 4-Learning cycles

It constitutes a rigorous process

As a rigorous process, the method has the following qualities:

- **It is independently verifiable**

The strong logical basis for the process provides a transparency which enables an observer to test the reasoning of the inquiring agent on a rational basis. Deductive and inductive reasoning are well known methods and allows the critical external observer with the chance to evaluate the process of inquiry as well as the content.

- **Three reasoning processes**

The three approaches to reasoning, abductive, deductive and inductive provide a multiple perspective to the process, which enhances the refinement of a generally valid belief.

The Reasoning process deals with three entities:

RULE	Belief about how the world is structured
CASE	Observed fact that exists in the world
RESULT	Expected occurrence, given the application of the rule in this case

Where you start in a process will be determined by what you know and influence the choice of reasoning that you use.

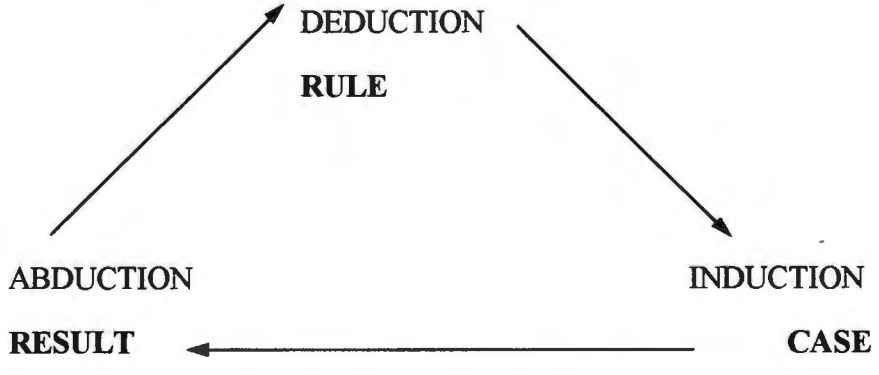


Figure 6: The Reasoning Triad

Deduction:

- Make a statement about a situation that exist in the world
- Make another statement about a related situation that exist in the world at the same time.
- State the implication of these two situations existing in the world at the same time

Rule:	If delivery performance decreases, sales will drop
Case:	Delivery performance has decreased by 20 %
Result:	We expect sales to drop

Induction:

Defines a group of ideas or facts to be the same kind of thing and make a statement about their sameness.

Case:	Delivery performance has decreased by 20 %
Result:	Sales have dropped
Rule:	If delivery performance decreases, sales will drop

Abduction:

Develop a rule through the observation of a result and test the validity of this rule in a specific case.

Result:	Sales are down
Rule:	If delivery performance decreases, sales will drop
Case:	Delivery performance has decreased by 20 % could this have caused the drop in Sales?

- **Clearly defined transformations**

The transformations of the scientific method can be described through the diagram below. Each phase is a system with an input and output, and produces the output as an emergence of the interactions of the parts of the system.

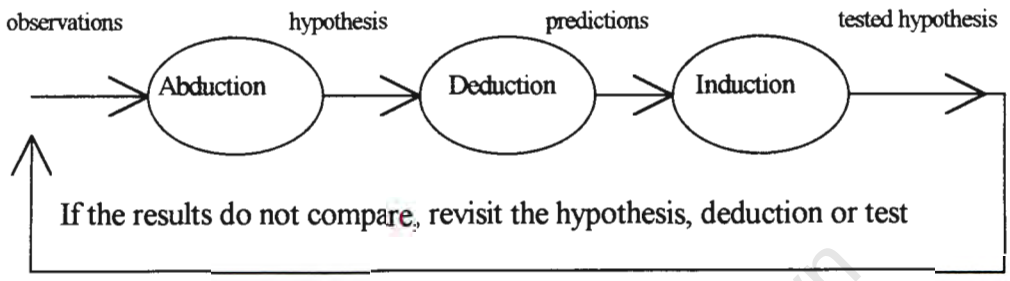


Figure 7- The transformations of the Scientific Method

- **Pragmatic implications**

The importance of the deductive and inductive stages of the scientific method supports a pragmatic approach to inquiry, i.e. the recognition of the consequence of the application of the hypothesis as the ultimate evaluator of its meaning and value. Deduction provides knowledge about the practical aspects of testing the thesis, while induction confirms these predictions through the actual testing in practise, both being important requirements for learning to take place.

A flexible approach

With the scientific method consisting of three distinct phases rather than methodologies, the researcher has total freedom of choice regarding the methods employed in to achieve the required transformations. This is critical especially when observing social systems, where predictability is very low, and the basis for testing may differ substantially from that of a natural system.

As was previously stated, the ultimate purposiveness of the method is that of providing a rigorous process to enable the inquirer to develop the most relevant or useful belief or result. The logic of the process acts as the guarantor for the research in as much as it guarantees a convergence onto a "truth" through a self-critical learning process, substantial in reason and practical verification.

The author intends to apply a collection of systems methods during the inquiry, which will be chosen on the basis of effecting the basic transformation at each phase.

Application To Operations Management

Revans explains that there exists a parallel process between the scientific method and good management practice.

The scientific method consists of five iterative steps:

- Observations from the external world
- The formulation of a theory based on these observations
- The design and conduct of experiments to test the theory
- Comparison of the experimental results with those predicted by the theory

The rejection, modification or confirmation of the theory in accordance with the results of the comparison

He argues that rigorous adherence to this method has allowed science to progress as it forms a self-correcting loop and that this method can be used in industrial administration, simply by substituting a technological product for a scientific theory (or, indeed, a management theory). This appears as follows:

- Determination of what needs exist and what artefacts have already been produced to satisfy these needs (Survey/Intelligence)
- Decisions about what further or different artefacts to produce (Policy)
- The establishment of methods of manufacture (Operations)
- Processes of audit (Inspection)
- Changes in what artefacts should be produced or in the methods of production (Control)

The managerial process thus sets out to test how far the results of its planned actions compare with those forecast by its policy. Inside each step, a similar fivefold structure can also be used.

Management, unlike the scientific process, seeks to fulfil subjective desired aims and values and these should be clear and unambiguous from the outset. A declaration of preferred aims should therefore be formulated from the beginning ,which can be used for comparison with the actual results achieved by the actions taken. Revans acknowledges that the result can only be statistically significant as such situations contain many variables. If deviations are significant and persistent, the theory should be discarded or modified. Also, the high standard of record keeping and statistical knowledge that have made the sciences so powerful, should be applied to the management situation. Finally, the cost of the improvement must not exceed the intended gain.

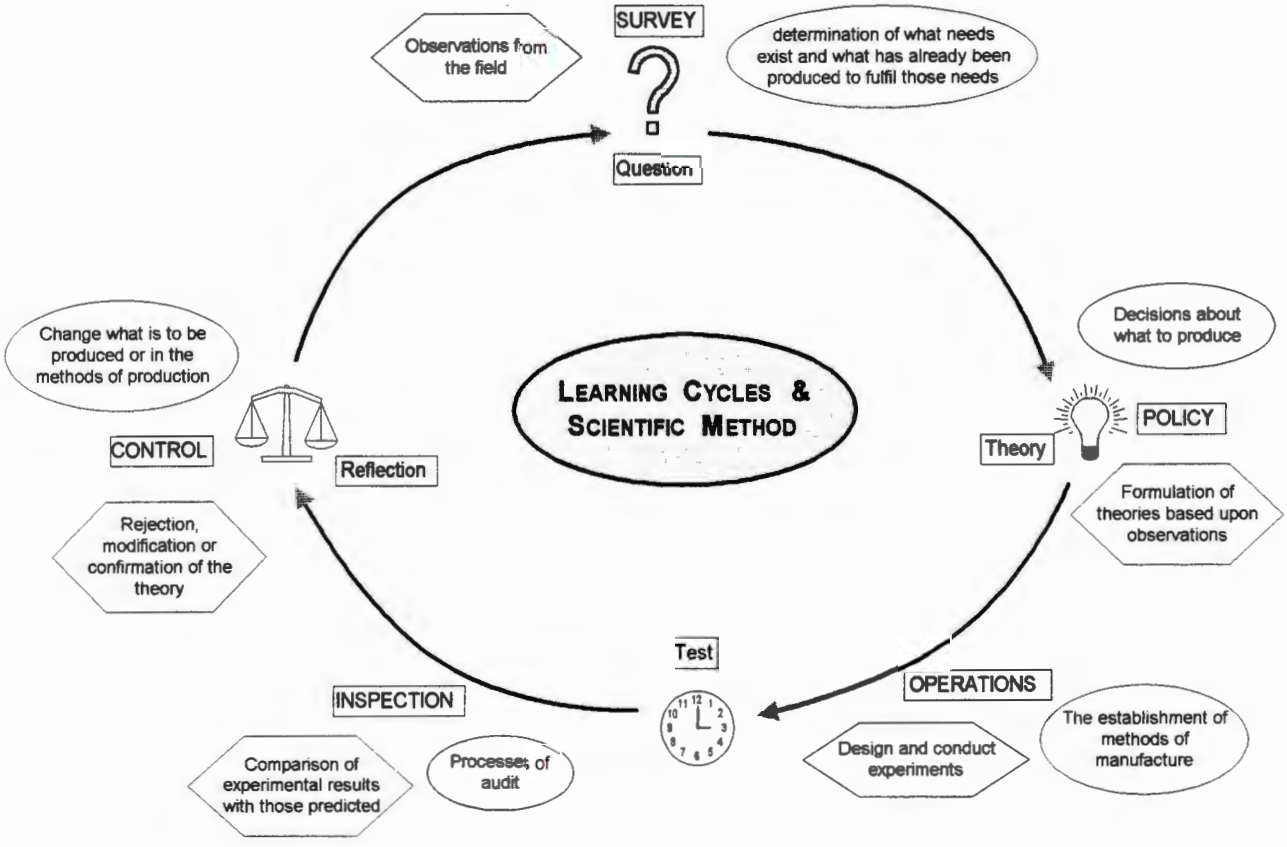


Figure 8: Management and the Scientific Method in a Learning Cycle

2.3.5 Conclusion

One of the most important aspects of an inquiry system is the testability of the findings. Testing implies some pre-defined standard with which the results of an investigation can be compared. This implies a necessity for a prediction of those test results that will confirm or negate the validity of the findings of an inquiry.

Peirce's scientific method is chosen as the underlying framework of the inquiry system. Its purposiveness include a systematic learning cycle for an iterative focusing on an appropriate truth for a situation within a specific context. His phenomenological category "Thirdness" is the basis for prediction within the inquiry, as the critical requirement for a test of an hypothesis. It is chosen as a basic philosophy for inquiry as a self correcting learning cycle, with a strong logical basis.

However, care has to be taken with its application to social systems. Previous applications of the method appear to have been within the reductionist set of paradigms. One can reduce the chances of reductionist thinking by viewing the scientific method as three basic stages of inquiry, not steps, being abduction, deduction and induction.

Each stage contains the application of systemic methods, chosen in the light of the transformation that is required in that stage, relevant to the problem that is investigated. The scientific method then becomes a guide as to the purposiveness of the stages, their methods and techniques.

2.4 THE METHODOLOGY

2.4.1 Introduction

As was stated in the development of the philosophy of this research, systems thinking is used as the underlying perspective for interpreting reality. There are various systems methods which, as systems, have certain ranges of effective purposes with its own limitations. These purposes are relevant with respect to the type of inquiry undertaken, such as system viability, power issues, information systems and flows, optimisation of operations, etc.

The context for this research is that of information requirements and a basis for utilising information for the management and regulation of a sustainable organisation. Information systems do not have an independent relevance and purposiveness which an automated machine might have, and is interdependent with a human system, who relies on the information system for informed decisions. These decisions are based on the attribution of meaning to the data, manipulated and provided through the information system, by the human user.

As such, the context is one of not only interdependency, but also that of interpretations, variety of choices of purpose and the variety of rapidly changing technologies available.

With respect to the abduction process, the approach of Soft Systems Methodology is adopted as the framework for applying systems methods and techniques. One of the main reasons is the capacity of this method to guide interviews for an effective immersion into a complex situation. The method is introduced by defining the concept of the levels of knowledge that one needs to attain as a basis for intervention in a system.

2.4.2 Levels of knowing

Soft Systems Methodology (SSM) is applied to the SAP R/3 implementation projects to develop knowledge of the current 'project system'.

A useful categorisation of knowledge below by Strümpfer (1995 Systems conference, UCT) underlies the abductive phase.

- Information- Knowledge about how things fit (statically) together
- Insight- Knowledge about the dynamics of a system
- Understanding- Knowledge about the system's external relationships, how it fits into a wider whole
- Wisdom- Knowledge about what keeps things together, relationships

The challenge is therefore to develop these types of knowledge through a process of immersion into the problem situation.. The fitness of SSM for this task is evaluated by an introduction that serves as an indication of the method's purpose and potential.

2.4.3 The emergence of Soft Systems Methodology

Traditionally systems engineering is driven by the requirement to meet a predetermined objective, more specifically the "how" of a process. This application did not normally concern itself with the "what" needs to be done in the first place, and "why".

Peter B. Checkland developed a method of systems thinking as a more effective approach for the management of real life problem situations around human populated, purposeful systems, where the "what" and the "why" of a problem are usually not known or even vaguely apparent to the integruous and respectful problem solver/s.

He named this systemic process Soft Systems Methodology (SSM), which asks question to evaluate interpretations of a problem situation against the real situation.

2.4.4 SSM and systems engineering

Checkland gives the following definition in relation to systems engineering:

"Whereas systems engineering methodology is a system concerned with achieving objectives, SSM is a learning system. The learning is about a complex problematical human situation, and leads to taking purposeful action in the situation aimed at improvement, action which seems sensible to those concerned."(Rosenhead, 1989)

Essentially SSM is a process for managing indeterminate complexities in human populated systems. Management is interpreted by Checkland as a process of achieving organised action, by a manager who tries to organise a continuously changing chaos of interacting events and ideas.

This definition leads to the next assumption, that independent people or groups will have independent basis for the evaluation of a situation, which will lead to different actions to the same situation.

To facilitate understanding of the seemingly interconnected and complex world, it is further assumed that systems theory will be helpful as a perspective.

Each individual has an own "world view", which is that collection of experiences and images in our heads that we use as a basis to make sense of the external or real world. This necessitated SSM to describe the relevant human activity systems with respect to a specific situation, complete with the accompanying world views.

SSM learns by comparing the models of human activity systems with perceptions of what is going on in a real world situation, with the purpose of leading to the most appropriate action.

2.4.5 Application of SSM

The broad components of SSM are positioned around the barrier between the real world and systems thinking about the real world. (see the diagram below) (Checkland, 1981)

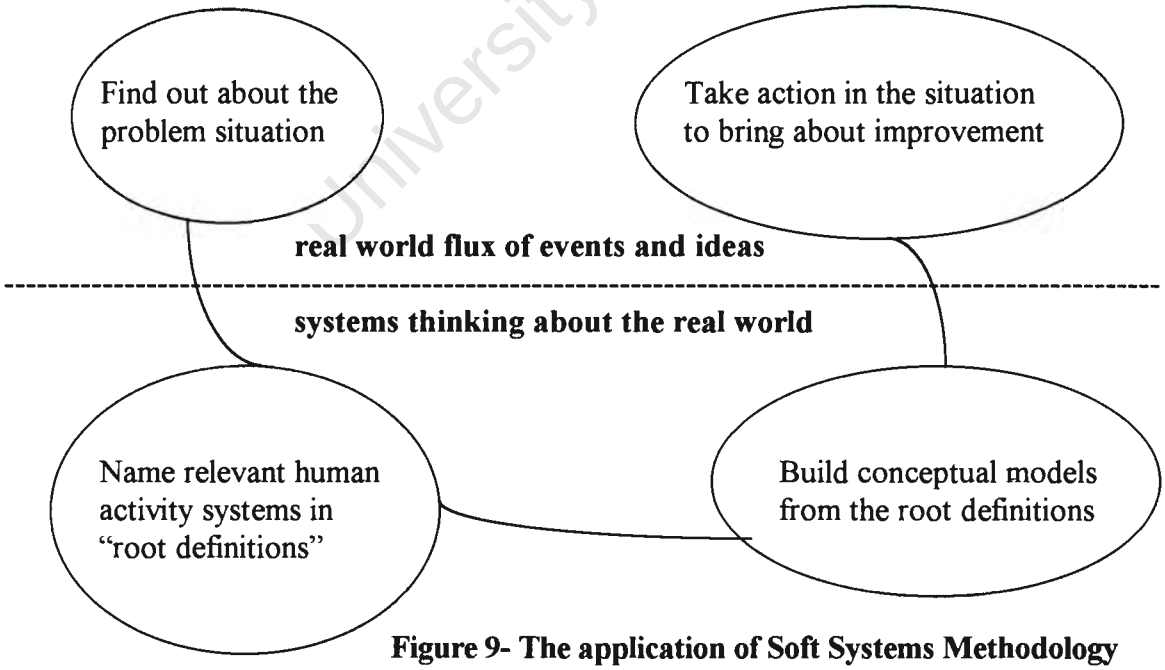


Figure 9- The application of Soft Systems Methodology

(Checkland, 1981)

There are seven stages in the conceptual process as shown above.

Find out about the problem situation

1 Observe the unstructured problematic situation

2 Express the problem situation in terms of relevant systems of purposeful activity

Express the view of each system

3 Formulate root definitions of each relevant system, using the mnemonic:

C - customers (victims, beneficiaries): who are they?

A - actors: who would do the activities?

T - transformation: the inputs and outputs of the system?

W - world view: why is the transformation meaningful?

O - owner: who owns the system?

E - environment: what are the assumed constraints on the system?

Build conceptual models for each system

4 The "verbs" of each relevant system are expressed as an interconnected set of activities required to effect the transformation

Compare the models and reality as a basis for determining appropriate actions to improve the situation

5 The comparison shows differences between the models and perceived reality as a basis for meaningful discussion about the situation

Define changes

6 These differences are evaluated to determine any possible changes which could improve the situation

Take action

7 The changes which are accepted as desirable and feasible are implemented

Notes

- SSM does not try to describe a system, it applies systems thinking to develop an understanding of a complex situation, the critical immersion phase of problem solving.
- The seven stages do not represent a rigid recipe and it is not implied that there is a prescribed chronology to the method. Understanding the situation is the purpose and the stages may be applied in whichever manner yields the understanding.
- All the stages do not have to be applied all the time.
- The guarantor (see below) of the process is the inclusion of a variety of interpretations which is recognised in a rational and thorough manner (full learning cycle) for the planning of appropriate action.
- Of critical importance is the underlying purpose of SSM: A process of inquiry into problem situations involving people and their perspectives, to reach consensus as to the most appropriate actions to be taken, with the expectation of improving the situation. With "action" in the abductive stage defined as the development of an hypothesis, it seems that there is an alignment of purposiveness between the SSM and the transformation intended for the abduction phase.

The SSM is chosen as an approach fit for a process of immersion into the challenges of an SAP R/3 implementation. It offers a rigorous learning process in that equal recognition is given to the 'real world' and 'thinking about the real world'. A critical feature is that of accommodating different world views associated with transformations.

Inquiry, as a purposive tool, does not offer guidance as to the perspective of the inquiry to be adopted. A one sided approach to an inquiry can be prevented by deliberately including some minimum perspectives that are required for an adequately holistic appreciation of a problem.

2.4.6 Perspectives for inquiry

Ian Mitroff and Harold Linstone describes the perspective of "ways of knowing" in their book, The Unbounded Mind (Mitroff and Linstone, 1993). The ways are described on the basis of the "guarantor" of each method for effecting an appropriate knowledge. The role of the guarantor is presented in the figure below.

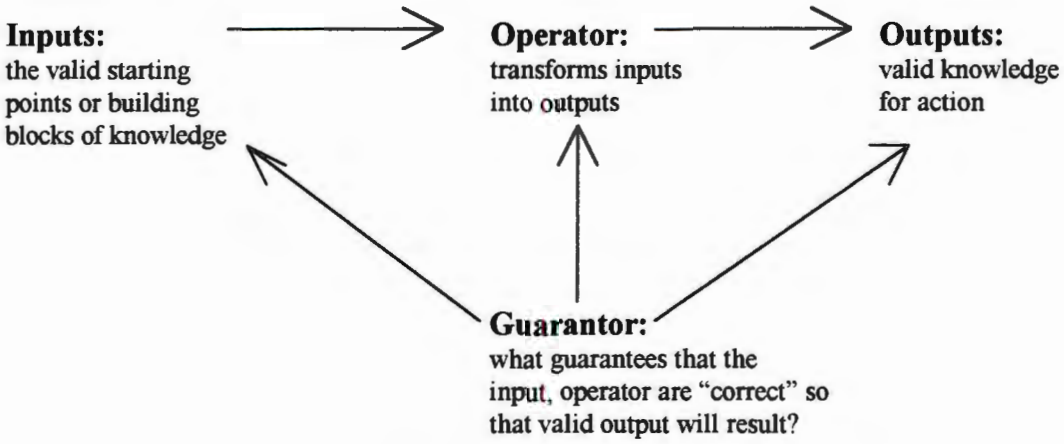


Figure 10- Characteristics of inquiry systems (Mitroff and Linstone, 1993)

The ways of knowing are introduced in the table below, with a more detailed explanation of the Multiple perspective approach. Comparisons are made regarding each basic process and its guarantor, the factor that validates the reliability of the resulting knowledge. As a basis for the table, please refer to the figure below (Mitroff and Linstone, 1993).

Ways of knowing	Guarantor
Agreement	Consensus among a range of judgements, statistical tools
The world as a formula	Intuition for selecting inputs Application of the law of contradiction
Multiple realities	Range of views linked to assumptions, hope Accommodation of interpretive nature of people
Conflict	Conflict, debate, criticism
Unbounded systems thinking: Multiple perspectives	Emergence of insight through the rigour of a systemic evaluation of three perspectives

Table 5- Ways of knowing

2.4.7 Multiple perspectives

The approach relies on the fact that different perspectives yield different understandings of a phenomena, that can provide a richer understanding for the most appropriate actions.

Specifically three perspectives are employed:

T: Technical

O: Organisational, Societal

P: Personal, Individual

These perspective can be summarised as follows:

	Technical	**Organisational**	**Personal**
World view	Science-technology	Social entity	Individuation
Goal	Problem solving, product	Action, stability, process	Power, influence prestige
Ethical basis	Logic, rationality	Fairness, abstract concepts of justice	Individual values morals
Mode of inquiry	Sense-data, modelling analysis	Consensual and adversary	Intuition, learning experience
Systems nature	Purposive	Purposeful- social Purposive- processes	Purposeful

Table 6- A summary of Multiple Perspectives (Mitroff and Linstone, 1993)

For the purposes of this paper, the Multiple perspective framework is applied to determine the core questions of a pragmatic social systems designer:

- What is currently influenced, controlled?
- What can be influenced, controlled?
- What should be influenced, controlled?

These questions have a particular relevance to manage the potential of arrogance and ignorance of the systems designers and decision makers. With implementation as the underlying concern, one needs to have an understanding of what the present state, the desired state and the constraints are for a specific situation. Constraints are defined as those issues that, for all practical purposes, are outside the direct influence of the designers and decision makers.

A belief of the author is that one can only hope to influence relations in a social system. To design controls for politics is impossible with respect to the ability of any control system to reflect even a small portion of the variety of politics and power manifestations. These personal issues also tend to have a fickle nature and can change (and emerge) as a mind can change. Any long term planning may prove to be futile, as the underlying assumptions for planning are almost impossible to determine.

Technology serves activity systems and its choice is largely determined by the requirements of the human activity system. With its pre-defined purpose (purposiveness), the nature of technical systems is that they are used, rather than influenced.

It is a suggestion of this thesis that the only value-adding contribution of business system designers can be made in organisational issues, with a good understanding of the personal issues as the environment of any implementation and the available options regarding technology and techniques.

A design for organisation have a chance for sustainability if the focus is on the state of the system. By state is implied those points of stability as determined by maintained relationships among people with a specific attitude to responding to feedback.

2.4.8 Implementation projects and change

An SAP R/3 implementation is mostly done with the purpose of optimising the management of information. This implies some clarity of purpose in the organisation, that tends to remain intact even after a thorough re-engineering exercise. The following table presents an indication of the levels of IT-enabled business transformations (Collins and Devanna, 1994).

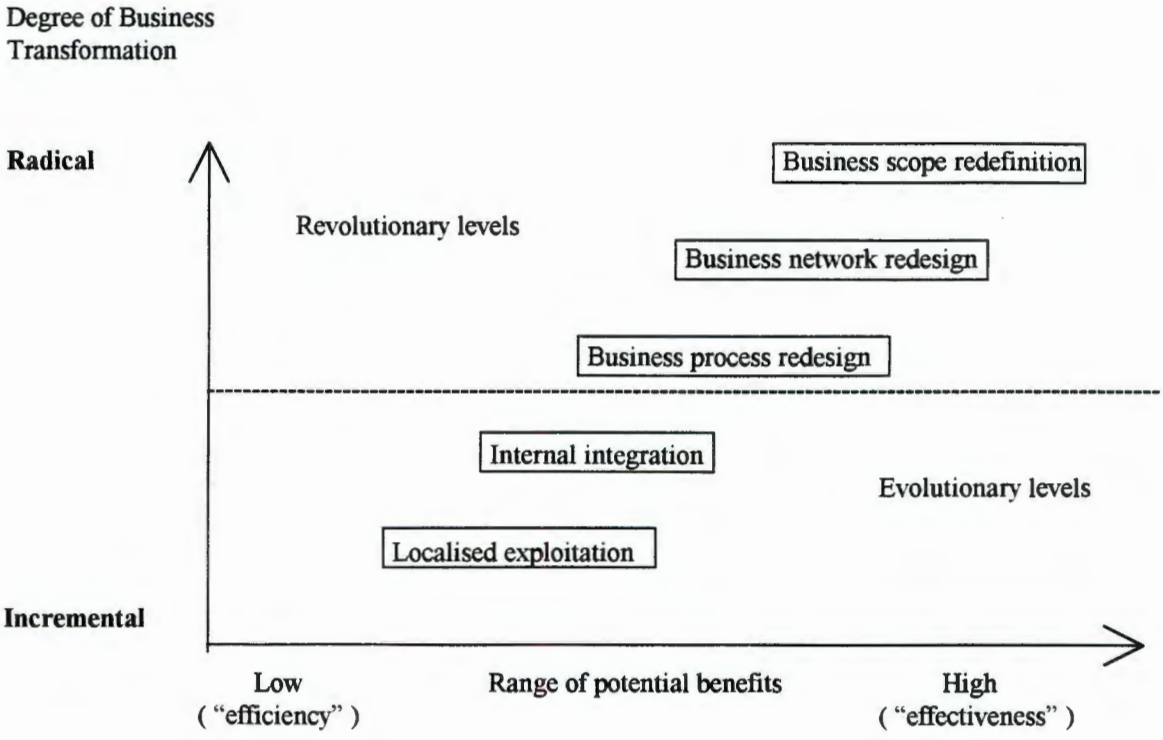


Figure 11- Degrees of business transformations

With the critical systems debate strongly against the "deterministic" nature of the interpretive systems methodologies (Flood and Jackson, 1991), in so much as it promotes the present status quo, it may be important to clarify the constraints of implementable change. This is of particular relevance for the relatively small group of system designers and decision makers which are commissioned by a "sponsor" to do a specific task. With respect to the SAP implementations, the scope of the task rarely exceeds that of Business Process Re-engineering, with the matching of the social system and the technology the primary challenge. This challenge is most often guided by a pre-defined purpose of the business, that resulted in the selection of the R/3 enabler.

Some of the larger projects extend to the redesign of the business network to effect business units with a high degree of independence, co-ordinated through a common information system such as SAP. Even these projects are done to serve a relatively unchanging purpose of the business group, in as much as purpose reflects "the business we are in", what the greater environment considers as valuable in exchange for money. The purposes that can be exercised because of the existence of the business, such as human development and self fulfilment are very much dependent on history, culture, politics, the media influence, the type of business, etc. All these are very much the function of world views, developed by complex relations.

2.4.9 Conclusion

It is with this view that the inquiry proceeds, with the intention of providing the most appropriate environment for the human activity systems. This environment is appropriate if it allows for the greatest variety of purposes for the human system, within the specific constraints. The transformations that make the organisation relevant in the environment are therefore the starting points for systemic inquiries, with the intention of accommodating the purposes of the human activity system as much as possible, within the limitations of ensuring viability.

The Inquiry System (IS) has as its philosophy Peirce's phenomenology and the Scientific Method. Peirce's Thirdness is the basis for enabling the pragmatic nature of the Scientific Method as an approach to predict the consequences of the hypothesis. With respect to assumptions about the world and how it works, systems thinking is chosen as a bias for looking at situations, with its capacity for recognising the purposefulness of the human components of systems.

The multiple perspectives approach introduces three minimum views of a situation, being personal, organisational and technical, each focusing on a different set of systems within a business.

Soft Systems Methodology is initially the only specified systems tool within the method level of paradigms. It is suggested as a useful basis for an immersion into a problem situation, that has little definition of problem or possible solution, and a high content of human interpretations about the problem. The application of SSM is planned at the Abduction level as an enabler for the development of an hypothesis with a chance of being desirable and feasible.

Other systems methods and their application techniques will be introduced where a specific method can address a specific challenge that developed during the process of inquiry.

PART 3- The Application Of The Inquiry Framework

Preface

The Inquiry System is presented below as a learning cycle:

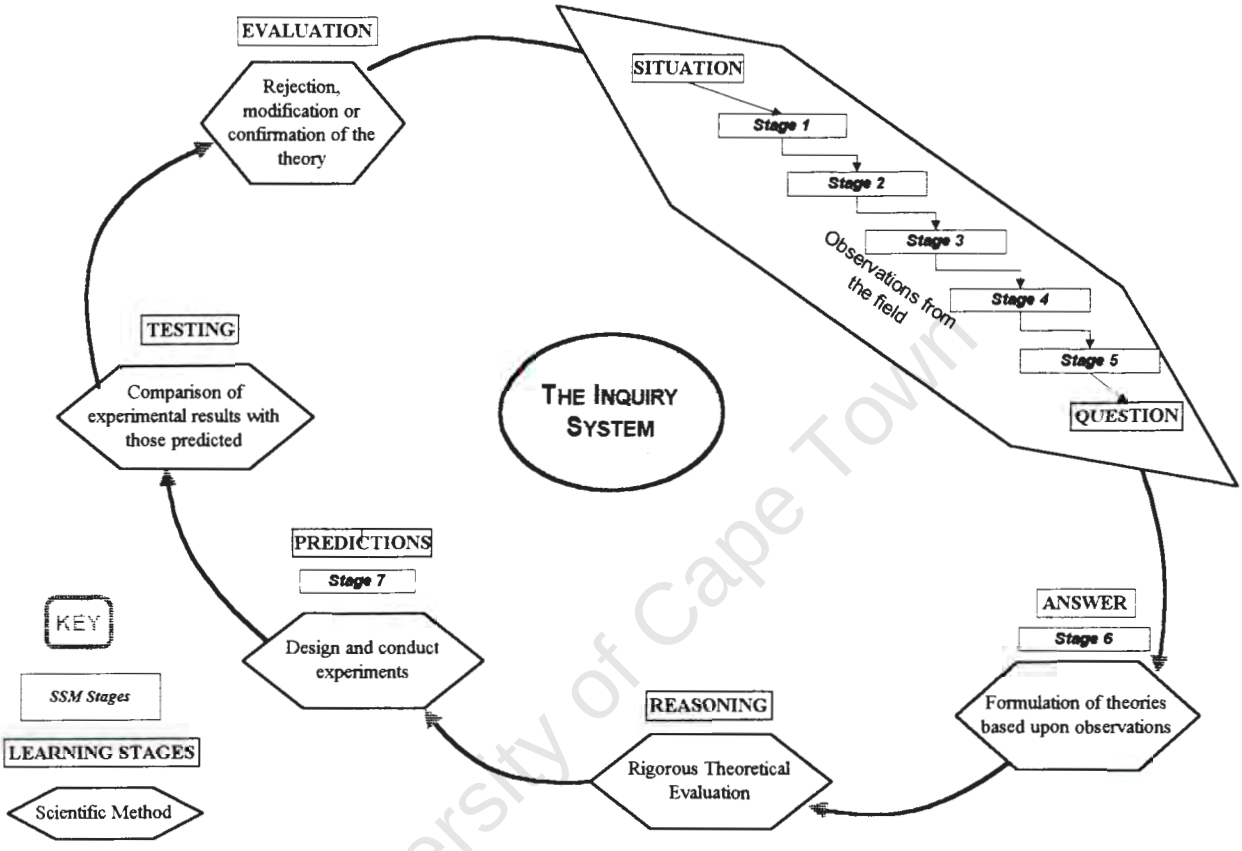


Figure 12: A Diagrammatic Summary of the Inquiry System

Figure 12 is presented as a summary of the Inquiry System and the basis for the structure of Part 3. Below is a comparison between the IS stages and the sections of Part 3.

- Abduction is the process from the Situation to the Answer stages, with the answer being the initial development of the hypothesis- corresponding with sections 3.1.1 to 3.1.4.
- The Reasoning stage encompasses a theoretical test of the strength of the hypothesis- corresponding with sections 3.1.5 to 3.1.12 and the whole of section 3.2.
- Deduction is the Predictions stage of the model- corresponding with section 3.3
- Induction concerns the Testing stage- corresponding to section 3.4.
- The Evaluation stage of the hypothesis is addressed in Part 4, section 4.1.

PART 3- The Application Of The Inquiry Framework

3.1 Abduction

3.1.1 Introduction

Soft Systems Methodology (SSM) is the basis of the inquiry process into the implementation implications of the SAP projects. The main purpose of the process is to select an hypothesis that has the potential of leading to action for the improvement of the current problematic situation.

There exists a large choice of perspectives from which to approach the projects, such as information system strategy, organisational design, systems dynamic modelling for business process and workflow design, social system design and control, etc. This is already an indication of the broad impact of such an integrated software system and confirms the necessity of a systemic approach.

The challenge is therefore first to do some binding of the possible issues to investigate, and then to carry on converging within that choice through the steps of the SSM.

3.1.2 The Soft Systems Inquiry

Stage 1- Observations of the problematic situation.

The need for an approach to more accurately evaluate the implementation implications for an organisation has become apparent at SAP user conferences. Presentations with topics such as "Is there life after the consulting phase?", "The agony and the ecstasy" and "Did we create a monster?" could be an indication of the learning demands and understanding of implementing real-time, integrated information systems. These views were expressed at the user presentations at the SAPHILA conference.

Interviews and discussions with some believers, victims, survivors and prospective SAP R/3 system owners reveal awe for the comprehensiveness and sophistication of the software, with a limited high level understanding of the real-time, on-line and, especially, integrated nature of the standard software. Further understanding is usually restricted to the specific functional specialisation of the individual. This phenomena extends to the R/3 functional consultants as well.

Common significant problems occurring in implementation projects include the general lack of understanding the organisation and its regulation. There seems to exist the hope that the new software system and the consultants will solve this issue, as external sources of help. This could indicate a general lack of an understandable approach which could facilitate the planning and decision making processes.

The inquiry focus

Prior to the further application of the SSM process an appropriate choice of what to inquire must be made. As a background, a summary follows of pertinent issues raised during SAP user conferences over the past two years. The issues presented were chosen for an introduction of some general implications of an SAP R/3 implementation project.

An overview of SAP user feedback

The feedback presented is obtained from the national and local SAP user conferences, or SAPHILA. The main human related issues were summarised as follows:

- Integrated, real-time, on-line information systems are different; they require an in depth understanding of the business and its processes.
- A high level of complexity is inherent in the software, and this adds to the difficulty of appreciating application constraints for informed decisions.

- The project is essentially that of business process design and implementation, within the SAP system constraints. This process is guided by the best business practises inherent in the R/3 system, with suggested performance measurement approaches.
- Integration of all the business processes imply the elimination of duplication of data entries and transactions. This results in the redefinition of work for some people in the organisation.
- The project requires a substantial amount of learning, with a generally higher skill level demanded of the users in the resulting more sophisticated system.
- Higher sophistication of technology requires higher levels of attention to the people.
- The issue of authorisations can become problematic if it is not awarded a considerable part of the project time and effort. Such a complex and sophisticated system increases the consequences of fraud for the organisation, especially with so much information at hand combined with electronic funds transfer capabilities.
- There is a general shortage of adequately skilled SAP consultants in South Africa, which lends itself to the risk of organisations becoming the schools for aspiring R/3 junior consultants.
- Information is disseminated throughout the business with a high level of transparency.
- SAP is only a tool.

Some current projects were evaluated through a process of the Soft Systems inquiry to develop a more specific knowledge of the challenges of an R/3 implementation project. A factor in choosing which perspectives could be valuable, was to include the main stakeholders of a typical project. Investigation into several projects yielded the choice of relevant systems for a 'typical' implementation project.

The choice includes views from those involved with the design and decisions as well as those affected by these decisions.

Stage 2- Expressing the problem situation as relevant systems

The following perspectives were developed through the SSM inquiry:

-SAP Partner Consultant

-SAP Senior Consultant

-Key User

-BPR Specialist

-IT Manager

-SAP developer

-Project Manager

-OCM Specialist

Care was taken to ensure that all of the people, who were interviewed to develop the perspectives, were critical to the project with respect to at least a moderate level of power associated with their positions. Power is interpreted in the sense of some practical influence on the course of the project.

Please note: The following abbreviations are used

BPR-	Business Process Re-engineering
BRE-	Business Re-engineering
OCM-	Organisational Change Management
IS-	Information System
MIS-	Management Information System
IT-	Information Technology

The SAP Partner view is included in this section as an example of the SSM application, with the others included in Appendix F.

Stage 3 &4: Develop root definitions and activity models for each system

SAP PARTNER CONSULTANT

SAP partners are usually management consultants specialising in the implementation of the SAP software. After a client made some commitment to purchasing the software, SAP partners are invited to tender for the project, often under the supervision of a senior consultant of the local SAP subsidiary. Some of the main functions of the partners are the SAP compatible design of business processes and their performance measurements, guided by the end users and senior management. Most of the work entails the technical implementation of the designed processes in the R/3 system. Technical tables are maintained and the system is customised to the specifications of the client.

Customers- Organisation
Branch managers: Understand the nature of the business
Middle management: Understand integration, re-define own contribution to organisation
Senior management: Develop an improved understanding of business
dynamics, feedback
Worker: More authority, responsibility and real-time feedback system
Shareholders

Actors- Project team, Sponsor, users
Typical Personalities: Young, interest in computers, SAP seen as a challenge

Transformation-Centralised Control ⇒ Decentralised Control

World view- SAP gives meaningful (accurate and timely) information to the organisation in one information system

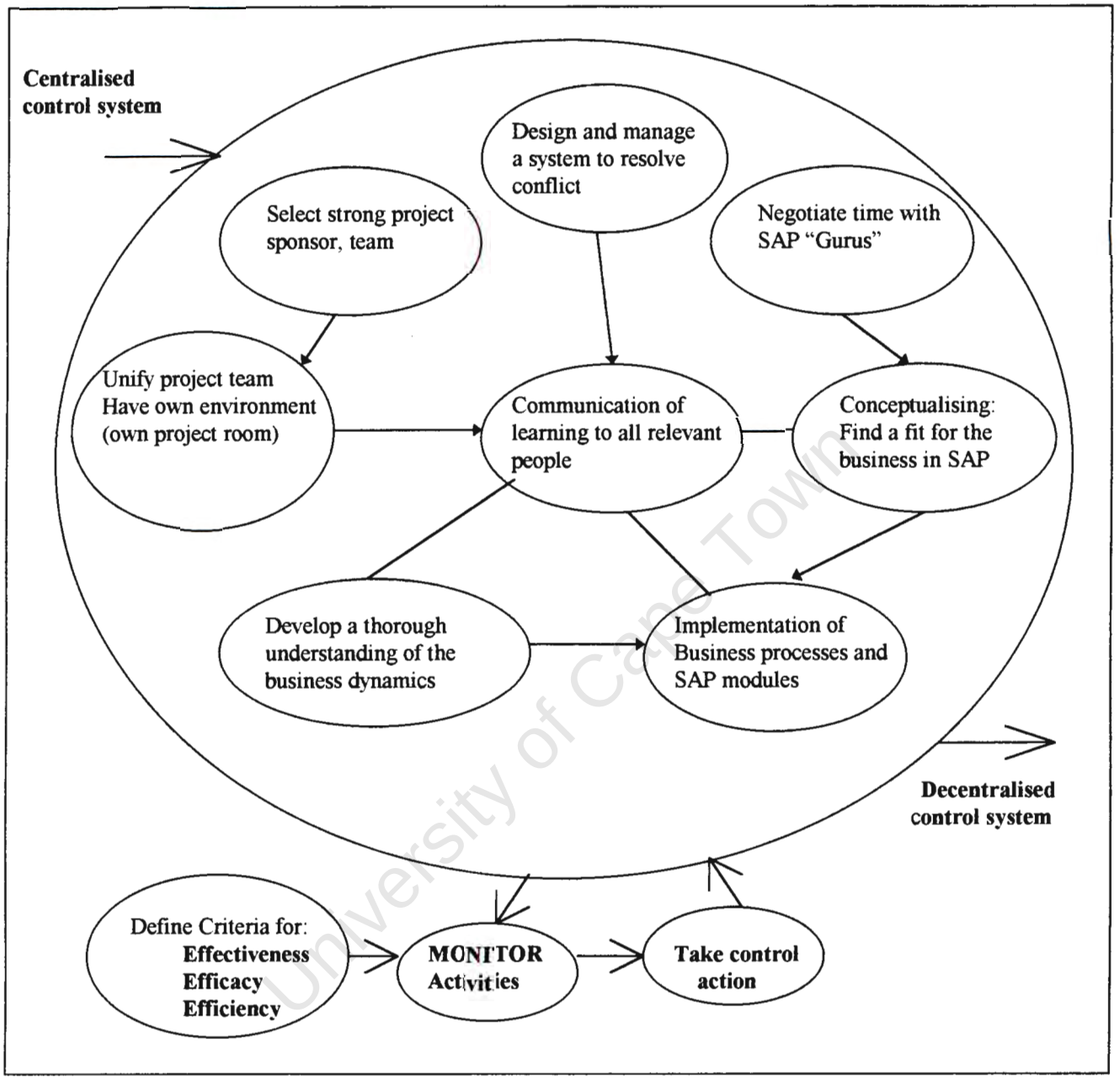
Owner- Project team

Environment- Budget, Arrogance of SAP Head Office (Germany), Some existing business measurements have to be accepted, Software functionality and releases

ROOT DEFINITION

The SAP implementation is a system to add value to the organisation and its shareholders by providing a single information system to effect accurate and timely information for the effective transformation of centralised to decentralised control, through the actions and control of a project team and the approval of the project sponsor. The process requires an overall improvement of the understanding of business dynamics and decision making for management, and the constraints imposed by the budget, general arrogance of the SAP Head Office and the software functionality.

SAP PARTNER CONSULTANT Activity System



Stage 5: Compare the activity model with actual activities

The comparison between the suggested and the actual activities follows as a basis for defining actions most likely improve the current situation, as well as learning valuable for further investigation.

SAP PARTNER CONSULTANT

*Please note that this input was given on two projects

ACTIVITY PLANNED	**ACTIVITY ACTUAL** ***(how well was it done?)***	**Suggestions for value-adding actions, possible improvements**
Select strong project team, sponsor	1. Very well 2. Strong project manager, some gaps in the teams. Some positions were filled with people who did not make an effort	1. None that are critical 2. Positions were unchangeable after selection, the introduction of a probation period for team members could have prevented some stresses
Unify project team	1. Well overall 2. Well with one exception	1. Committed young team used opportunity for personal development 2. The suggestion for the activity above applies here as well
Design and manage a system to resolve conflict	1. Good 2. Very well A group of 9 external people met every second week to clear policy issues.	1. Project sponsor handled policy issues, but with poor communication 2. The decisions were held on a web site, a recommendation for future projects
Communicate all learning to all the relevant people	1. Well, with some problems w.r.t. the expectations created by SAP sales literature. 2. Improved with time and user training, documentation	1. Inform the client up front of the potential size of an R/3 project 2. The skills and motivation issue in the first mentioned activity affected the communication success
Negotiate time with SAP "gurus"	1. Not well 2. OK for one module where expert consulting was required Cannot comment on other modules	1. Plan a minimum of one day every two weeks with a senior SAP person. Have it approved in the budget 2. As above
Develop a thorough understanding of the business dynamics	1. Common sense and gut feel prevailed 2. As above	1. Could be helpful for a project manager to have a background in this area, especially with respect to human dynamics
Conceptualise (fit processes and SAP)	1 &2. SAP offers a wide range of choices for processes, thus little constraint on the fit. New functionality released late in both projects caused some delay	1&2. Care has to be taken to manage the perceptions created by the SAP sales people and some consultants. The client can only benefit from an honest appraisal of R/3 complexities
Implement software with business processes	1&2. Some problems while uploading software, causing delays	1&2. Ensure that a technically knowledgeable (SAP and computer technology) is present when uploads take place

Stage 6: Define changes to be made, based on learning from stage 5

As applied in the thesis, this stage constitutes the consolidation of the learning as a result of a deliberate process of immersion into the problem situation. A suggestion is that the challenge during this stage is not only to react to the stated information, but to look for what is not said. What are the project members focusing on and what are they perhaps neglecting?

3.1.3 A Summary Of The Activities Of An Implementation

As suggested in the development of a framework for inquiry, three minimum perspectives are considered of the challenges of an SAP implementation, the Technical, Organisational and Personal views.

The choice of transformation, world view and activities encourages the interviewed to state their bias, not only regarding their activity system choice, but also with respect to what or who was criticised. These perspectives are used to evaluate the results of the SSM process.

Personal

- Power dispensation in the project, political issues
- Decentralisation of control, dissemination of information to lower levels for decision making empowerment
- Manage relationships with experts, consultants, sponsor, management, users
- Raise the skill levels of management and the users
- Identify key users for centres of influence
- Manage the change to the individual due to the information system
- Select personalities for the project team, young, eager to learn, see project as challenge, ability and inclination to contribute to the success of the project
- Manage perceptions and expectations of the stakeholders, especially the client

Organisational

- Define roles, responsibilities, tasks and communications requirements for each member
- Unify the team
- Develop a communication system for the project
- Manage the project, control, establish performance measures for project members
- Develop an understanding of organisational structure, processes, performance measurements
- Develop an understanding of human dynamics, espoused processes and processes in use

Technical

- Design business processes
- Conceptualisation, detailed design of processes, events and transactions
- Implement hardware, software
- Represent business processes in SAP functional modules
- Do integration testing
- Define gaps between old information system and integrated, standard system
- Customise software, maintain technical tables

The summary above is an indication of the broad range of activities to be managed in an SAP implementation project.

3.1.4 Learning from the SSM inquiry

A basis for a more specific definition of the problem, as developed through the SSM inquiry process, can be made by using the 'truth' triad as presented in Part 2.

The triad stated that, for a situation with a specific content, within a specific context, a process of inquiry determines the truth applicable for that context and content. Another way to use the triad is to view the implementation project as a process with defined outputs, within a specific context and relating to a specific content.

A successful application of the process will depend on the adequacy of the implementer's appreciation of the content and context, i.e. there is a need for a mental model that has the potential to enable an adequate appreciation of the organisation and the information system in order to result in a system design for a socio-technical symbiosis. An illustration of the definitions of the components of the triad is given below:

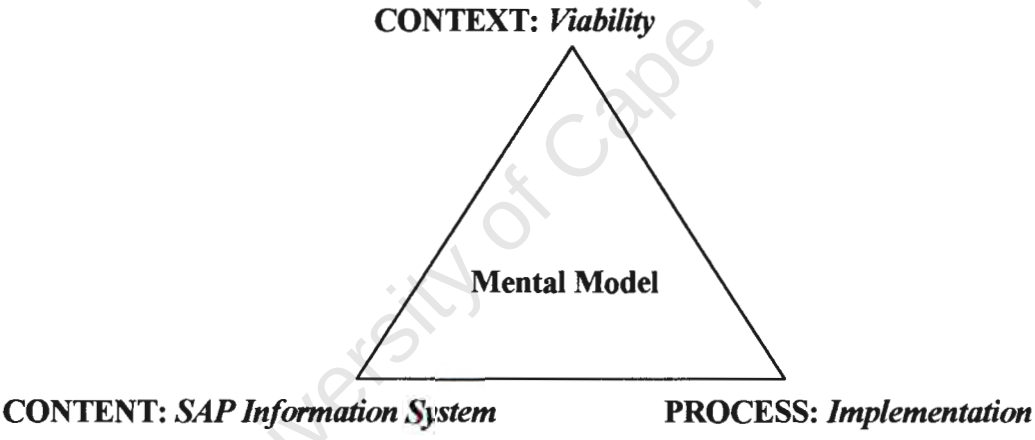


Figure 13- Mental Model Triad

The adequacy of this mental model is a critical part of the implementation. Of the projects investigated, one of the most common problems was the lack of a coherent and shared understanding of the project, its content and its context.

The high level of sophistication of the software with respect to its comprehensiveness and range of options, as well as the diversity of interests indicate the need for an effective variety management. The qualities of a mental model that will be an appropriate enabler for an SAP implementation project should include the following:

- A common language for the project, understood by all stakeholders
- Facilitate knowledge of control, regulation
- Applicable to the management of complexity, variety
- Compatible with the assumptions of the SAP software and its process orientation
- Support the concept of integration
- Acceptable to BPR, OCM and Technical specialists, users, management
- Support the definition of roles, responsibilities and tasks.
- Be the basis for communication flows in the project

The field of management cybernetics has as one of its main purposes the management of complex systems, complex with respect to variety and quantity. Of the models that were designed within the cybernetic approach, the Viable Systems Model by Stafford Beer has the longest development and application history (Beer, 1994), with Work Systems and Human Performance Technology later developments.

The process of introducing management cybernetics starts with a comparison of SAP software with the characteristics of a typical cybernetic information system.

For a further substantiation of the comparison, an introduction to management cybernetics and the models it inspired follows.

3.1.5 SAP as a cybernetic information system

Cybernetic management is based on assumptions with respect to the information needs of an organisation. An evaluation of these assumptions in relation to what the SAP R/3 software offers is required to determine the validity of the comparison.

During his description of the requirements of a cybernetic information system, Clemson continuously refers to the Cyberstride software as a prime example. Of specific importance is the capacity of this software for the automatic statistical process evaluations as the basis for alerting the user to the importance of the measurements. (Clemson, 1984)

The set of characteristics of a cybernetic information system is suggested by Clemson (Clemson, 1984))

CYBERNETICS	SAP R/3
Units and sub-units must be clearly defined.	A complete model of the organisation and its processes is fundamental to the system.
Each unit and sub-unit must be modelled w.r.t. production dynamics	Detailed routings are required for each cost centre
Variables must be selected for the effective monitoring of stability and performance.	The definition of variables is driven by the organisation for optimal monitoring.
The data processing must include planned vs. actual as ratios and store them as time series.	It is standard practice in R/3 to report planned vs. actual as a ratio and use time series.
If any of the time series change significantly, the relevant managers must be alerted.	The system uses advanced statistical process control methods to alert the user of any significant deviations.
Operations, data collection and the recording of the data should be one continuous process.	SAP is a Real-time, On-line Integrated information system The results are recorded as they happen.
A shared understanding of the practises, procedures and processes is required for effective management	Once the organisation is represented in the system, it becomes a map for the operations. R/3 provides for standard processes and practices on an enterprises level.

Table 7- SAP And The Requirements Of A Cybernetic Information System

The R/3 standard software includes applications of the most recently developed statistical process control methods as a basis for initiating action. Workflow takes this further by the automatic monitoring of tasks, with the capacity for evaluating the development of bottlenecks and to alarm a manager in advance.

Further confirmation of the appropriateness of labelling SAP as a cybernetic software was obtained through interviews with management consultants and SAP developers as to the structure and basis of the reporting tools of the software. The organisation is represented in the system as processes, built around the core operations. With the broadness of the applications of the software, it provides a common basis for the practises and procedures of the business. Many of the monitoring and control tasks of the organisation are at least partially automated, with the result that the emphasis is shifted from the capture of data to the interpretation of the reports for decisions relating to the tasks in the business processes.

There is therefore enough support to assume a strong cybernetic bias, as defined by Clemson, in the R/3 standard software.

The following is a brief introduction to the mental models within the cybernetic framework: These models are introduced more explicitly in the appendices.

3.1.6 Cybernetics

Stafford Beer describes cybernetics as the science of effective organisation. (Beer, 1985)

For the author, it provides a useful frame of mind when doing your best to interpret and manage complex systems, such as the socio-technical system of an organisation. The field of management cybernetics were strongly influenced by Ashby, with his concept of the residual variety factor.

The three basic laws of cybernetics are:

Law 1 - Self organising systems law: complex systems organise themselves; the characteristic structural and behavioural patterns in a complex system are primarily a result of the interactions among the system parts.

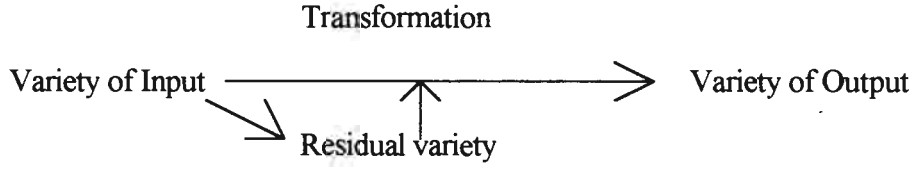
The behaviour of an organisation could therefore be explained as the result of the basis of the interactions among the people. Aspects which could influence the system behaviour are culture, policy, practices and procedures, the physical layout of the workplace, etc.

Law 2 - Feedback law: The output of a complex system is dominated by the feedback, and within wide variations the input is irrelevant.

If performance is measured on a cost, quality, time basis in a manner which has direct consequences to the workers, one could expect efficient outputs as a regular occurrence. The use of different tools could have little effect on the system performance, until the feedback with respect to the outputs change.

Law 3 - Law of 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.

The variety of any organisation far outweighs the variety capacity of the management of that organisation. Managers therefore will never have the control they might desire. The challenge is to follow the 80/20 rule and choose the 20% of variables to manage which affects 80% of the organisation. This concept of residual variety is introduced below as an adaptation of Ashby's definition of residual variety (Espejo, 1989):



The variety of the regulators within the transformation determines how much variety of the inputs to the system can be absorbed, and the unabsorbed variety is then transferred to the transformation process. The higher the capacity of the regulators to absorb variety, the more consistent the output with a variable input.

An important component of the inquiry process of the cybernetician is a set of 7 questions which enhances an understanding of the system in question. A more detailed version of these questions are in Appendix C.

1. What is the system? What are the boundaries? What is the relevant environment.?
2. What is the real purpose of the system?
3. What are the constraints on the system, real or perceived?
4. What language is used for thinking about the system?
5. How does the system work, what causes what else, how do the parts interact?
6. What are the outputs required of the system by the environment?
7. What self-organising tendencies does the system have? In particular, what sort of personal goals, values and aspirations do the people of the organisation hold as individuals?

The choice of cybernetics was based on several factors including:

- It provides a comprehensive frame of thinking for the interpretation of complex, dynamic systems without the arrogance (or ignorance) of claiming to be right.
- The strong systemic nature ensures an approach supporting holistic thinking when evaluating a problem or opportunity within the operations of the business.
- Cybernetics can be presented in a manner which can be equally acceptable to people with a social or technical bias. Even though it is a strong challenge for unsystemic thinking, it is not as radical a concept as Soft Systems Methodology can be to a technician, or Systems Dynamics Modelling to a human resources manager.
- It is a useful bias for the investigation of a system for a knowledge of regulation, what keeps it together, or as Strümpfer suggests, the wisdom level of knowledge.

Some of the neuro-cybernetic inspired models are introduced as suggested useful systems approaches for an application in the Organisational perspective of the Multiple Perspectives evaluation.

3.1.7 The Viable Systems Model (VSM)

For a conceptual introduction to the VSM, a summary of the philosophy of Viable Systems Model precedes a diagram of the model.

The rising complexity of organisational, technological and informational issues require new approaches to deal with these complexities. Stafford Beer suggests a scientific model based on cybernetic principles, which contains the principles of management science.

With the focus being on control, the analogy used for the model is that of the human brain and the central nervous system. One of the main purposes of the model is thus the regulation of a complex system.

The elements of the VSM do not prescribe a structure, but rather the essential functions which have to be performed to regulate a system. A diagrammatic representation of the model with the functional elements is shown in figure 12 on the next page.

Notes on the model

The elements are numbered S1 to S5 (System 1 to System 5) For the purposes of this diagram, only one S1 is shown, but all the primary processes in the organisation, product line or service specific, are Systems 1. The environment, local and external, is shown on the left of the diagram.

A brief description of each function follows:

SYSTEM 1 - The systems which transform inputs from customers (internal and external) to the required outputs. This is where viability is determined, i.e. where the work is done for which the organisation gets paid for by customers. All the other systems represent functions supporting the viable systems.

SYSTEM 2 - This is where practices, procedures and planning are used to facilitate shared meaning through common mental models. The focus is on the management of oscillations between the parts in S1, to reduce variety of understanding the way work is done.

SYSTEM 3 - The control function which maintains internal stability. The policy of the organisation is implemented through this function. Issues such as resource allocation, legal requirements and accountability are addressed here. The focus is on the here and now. Audits are undertaken by the S3* function for an improved understanding of the processes and the detection of patterns of results.

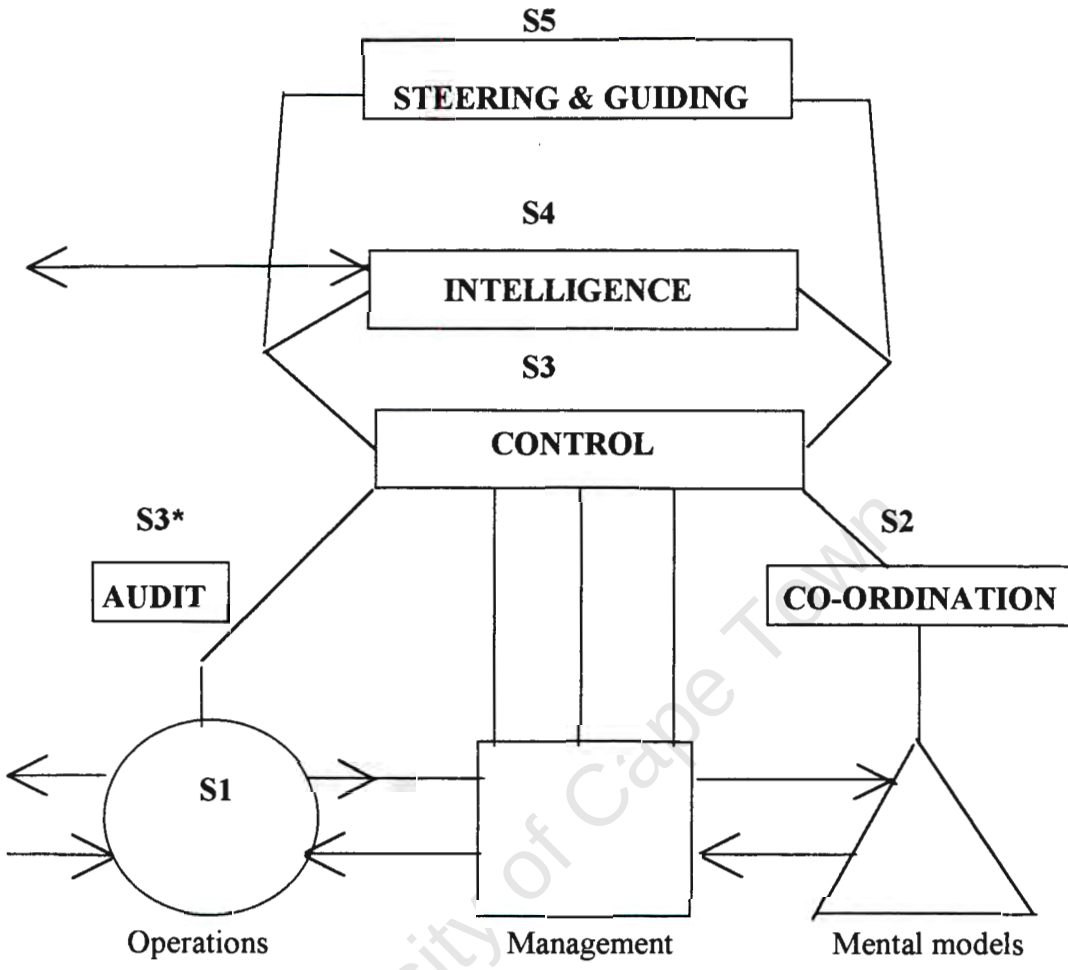


Figure 14- The Viable Systems Model

SYSTEM 4 - An intelligence gathering and reporting function. There is a strong future focus, driven by a purpose to learn and develop by modelling the organisation for an understanding of its relevance in the environment. Information from S1, S2 and S3 is relayed to S5 through the intelligence function.

SYSTEM 5 - Essentially the integrator of the organisation. The internal and external interests of S3 and S4 are balanced by S5. This steering function responds to significant information from the filters at S1, S2, S3 and S4. The organisation is represented by S5 in the environment.

The concept of recursion is an essential characteristic of the VSM. Each of the S1 systems is autonomous in its own right. It is therefore implied that each System 1 must contain all the functions of the viable system itself, i.e. S1 through to S5. This is a requirement for the regulation of the subsystems in S1 and is revealed when drilling down into the detailed levels of the organisation.

It is important to notice that only the Systems 1 and System 4 are directly concerned with the environment. S1 interacts with the customers and S4 gathers information in the environment.

The main reason for the use of this model is the emphasis on the regulation of the organisation. This model provides the insight needed to effectively determine the minimum information requirements of a complex system. The underlying cybernetics with the 3 basic laws provide the support for the design of an efficient and relevant information system for the optimal regulation of complexity.

Using the analogy of the human brain and central nervous system enhances the understanding of how it works. It therefore can be presented to the people in the organisation as something familiar, rare in the increasingly complex world of business and management science.

3.1.8 Work Systems

Whereas the VSM is concerned with the regulation of the organisation, the Work Systems Model (WSM) addresses task related issues such as performance and production. The developer of Work Systems is Luc Hoebeke. (Hoebeke, Making Work Systems Better-a practitioner's reflections, 1994)

The WSM is influenced by the Human Activity System as defined by Peter Checkland, the Viable Systems Model as described by Stafford Beer and the concept of time perspectives as developed by Elliott Jacques.

Work Systems use four levels of recursion related to time levels, being the added-value domain, the innovative domain, the value-systems domain and the spiritual domain as per the diagram below. For the purpose of this project, the added-value domain with its three process levels will be addressed.

In this domain the basic process is that of transforming requirements of clients into outputs meeting those requirements. The process is essentially that of value-adding as a basis for maintaining relevance to the customers, actors and the owners.

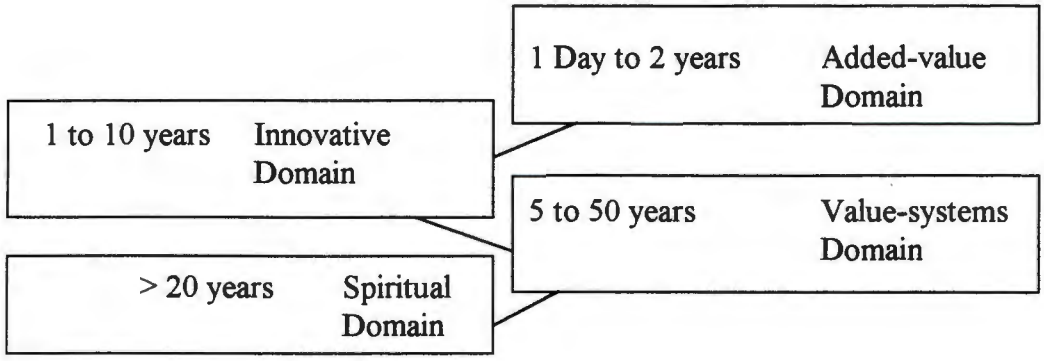


Figure 15- The domains of work systems

Process levels are determined on the basis of time span and the creation of conditions for the next lower level. The time span is the time needed to materialise the results of the activities deployed. Please see the diagram below.

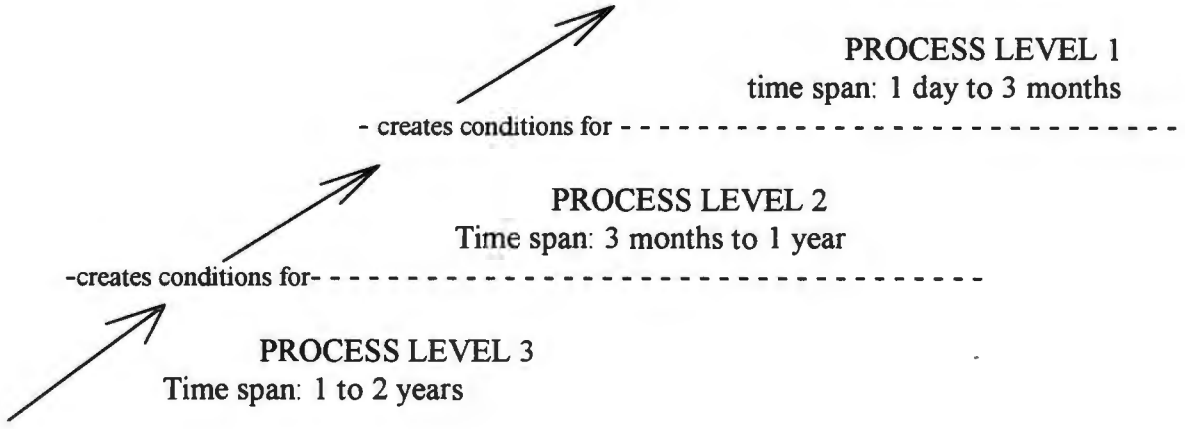


Figure 16- Process levels

Each level has three essential **information processes** as shown below. Hoebeke uses the terms Control, Audit and Strategic information processes. Interviews with project members resulted in the use of the word Co-ordination, instead of Strategic, due to the persistent interpretation of strategic as pertaining to long term planning and policy. After all, the concept refers to a shared understanding as an enabler for efficient work, and is used for that purpose in the VSM. It also serves the co-ordination function by providing a consistency between the VSM and Work Systems.

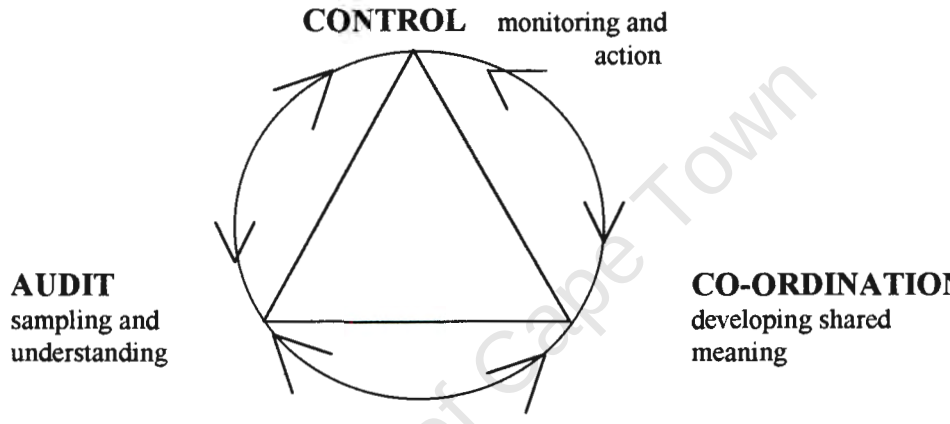


Figure 17- The Information Cycle Of Process Levels

These processes are directly related to the same processes in the Viable Systems Model. However, more specific requirements of the information processes on each process level are expressed in this model.

The basic definitions of the three information processes follow:

Co-ordination information processes - Shared meaning of the processes to be managed. Luc Hoebeke suggests that debate between people resulting from a necessary conflict is the only basis for a useful co-ordination information process.

Co-ordination information processes require an enabling and mediator stance.

Control information processes - Corrective regulative action by the actors of the transformation processes. The basis for regulation is a corrective feedback loop. The management of variety is achieved through a monitoring process which provide information by exception.

Control information processes require a participative stance.

Audit information processes - An understanding of why the processes are carried out, what they do, what means they require and how the means are used. This is an important filter for the manager as it shows the development of patterns of results on a time-series basis.

Audit information processes require an observer stance. For this reason it is undertaken at the next higher level than the process observed.

These descriptions provide a much more task oriented and practical approach of the information requirements with clearly defined specifications at each process level. Furthermore, a definition of the generic transformation process, the basic strategic dilemma and suggested development activities form the rest of the elements at each level.

Task related systems have specific outputs associated with each process. The attributes of the outputs of the work system are essentially:

Throughput time : the time it takes from the specification of the requirements of the client until the requirements are successfully met

Volume : The quantity of the product or service which is seen as relevant by the customer.

Intrinsic Quality : That quality in which the customer places an appreciation of the product or service.

Price : The price that a customer is prepared to pay for a product or service is directly related to the level of appreciation of the product or service.

An introduction of each process level in the added-value domain is given in Appendix A.

Work Systems is a practical model which translates cybernetics and Viable Systems Modelling into specific requirements relating to the task aspects of an organisation.

A generally neglected aspect of a Re-Engineering project is the human performer and his/her complexities and requirements. This is often due to a bias toward Business Process Re-Engineering issues. A relevant addition to the research included Human Performance Technology (HPT) and Work Structuring. A summary of the human performance system as described in the Handbook of Human Performance Technology is included in Appendix B, which also includes critical factors affecting human performance in the workplace and the HPT approach to intervention.

3.1.9 Human Performance Technology (HPT)

The HPT approach for intervention has a similar three level approach to the Work Systems model. The levels are:

- The Organisation Level
- The Process level
- The job/performer level

Questions at the levels could include the following:

ORGANISATION LEVEL: What changes are required in the variables at this level to improve performance? Which of the cross-functional processes should be examined further?

PROCESS LEVEL: What changes are required to the processes under scrutiny? Which jobs are key to effective performance in these processes and should be examined further?

JOB/PERFORMER LEVEL: What job outputs of which critical jobs should be improved for the processes to work effectively? What actions should be taken?

3.1.10 Notes on the Models

Each of the models introduced have a different focus which can improve the completeness of organisation:

Cybernetics provide the basic laws of complex systems: Self organising systems law, Feedback law and Law of requisite variety

The seven questions of the cybernetician is the basis of a systemic process of inquiry. ***Cybernetics provide an insight into information in complex organisations***.

Viable Systems Modelling introduces the 5 minimum functions required for the regulation of a complex system. The model uses the analogy of the human brain and the central nervous system. The information needs for each function are clearly defined and the model supports the basic cybernetic laws.

The VSM is essentially regulation focused.

Work Systems focus on the task related aspects of the organisation. Three process levels are introduced with related time spans. Information requirements are more defined in this model and each level includes a generic transformation and the strategic dilemma to be addressed.

The WSM is essentially process focused.

Human Performance Technology provides a model for the evaluation of performance from a human system perspective. This model also includes three levels, the organisation level, the process level and the job/performer level.

The HPT model is essentially job/performer focused.

The VSM, Work Systems Model and Human Performance Technology are summarised in a model for an illustration of the coherence of the neuro-cybernetic concepts.

3.1.11 A summary of management cybernetics models

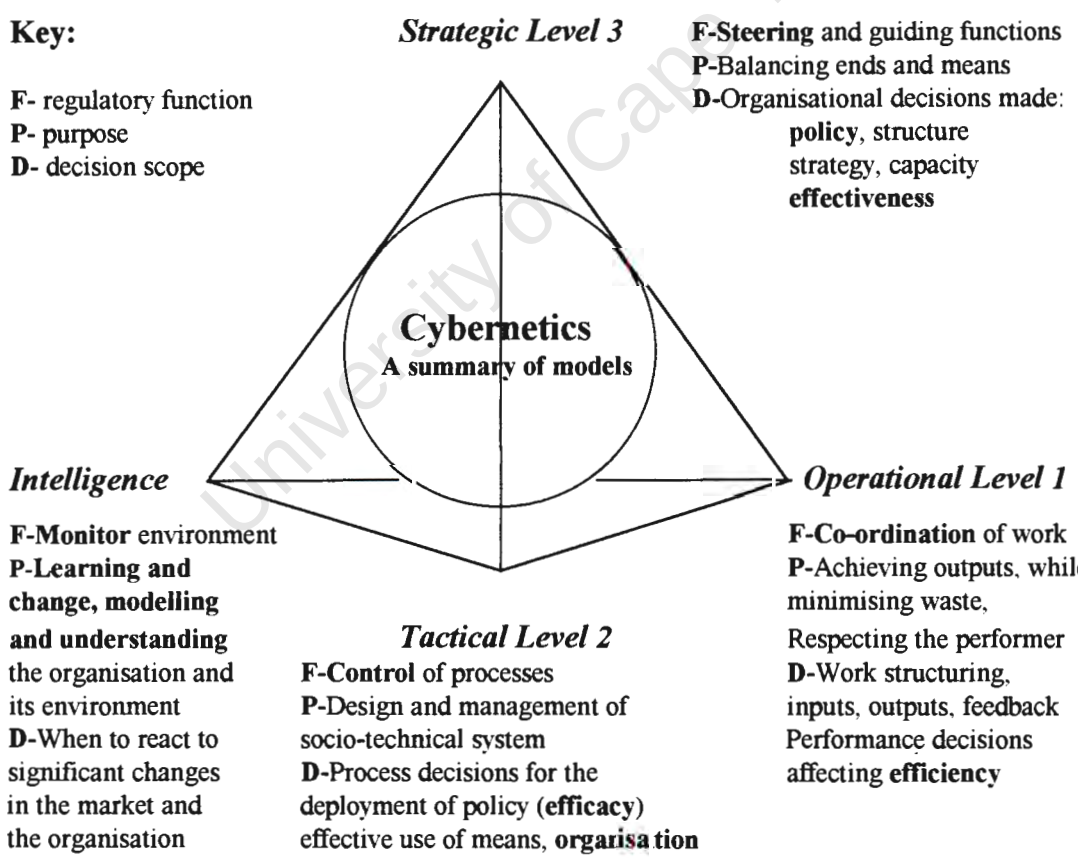


Figure 18- A summary of the cybernetic models

With variety management one of the critical challenges in the organisation, the following diagram suggests a perspective of the process levels and feedback.

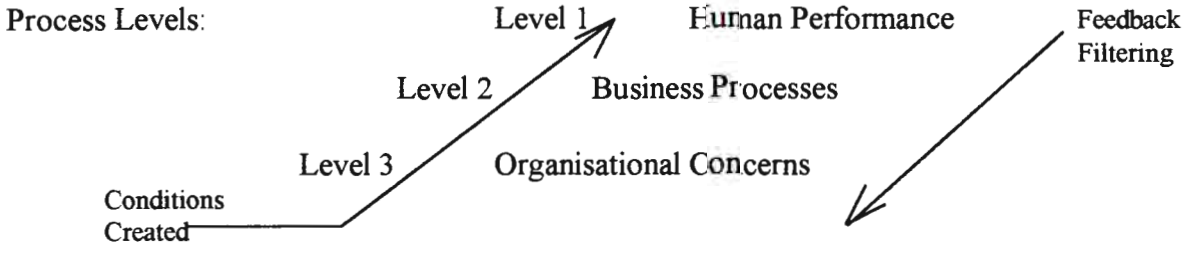


Figure 19- Process levels and feedback

Suggested conceptual feedback loops are in Appendix D.

Regarding the summary, please note:

- The Intelligence function requires an external stance and its functioning spans across all the levels, with decisions effected at the strategic level.
- Generic names are given to the three process levels to express the concepts in frequently used business terms. The labels strategic, tactical and operational appear regularly in information systems and general business books and should provide a common language for people from different disciplines in the organisation..
- Suggested essential characteristic words at all the nodes are in bold.

Market research resulted in the identification of the organisations where the implementation of the total R/3 software where achieved in the shortest time with the least amount of external consulting required. The research is by no means definitive, but has been supported by further investigations at SAP user conferences.

Two SAP clients who emerged healthy after the an R/3 implementation project include companies with a strong bias towards an organisational design around the viable systems. The support systems are designed for the maximum use of technology as an enabler, with the philosophy that the introduction of sophisticated technology demands a higher level of attention to the human and work system.

3.1.12 Conclusion

Management cybernetics have been developed to address the regulation, process design and job specifications of a business. With the general focus of cybernetics on the organisation of a system for equilibrium and cohesion, the models will be applicable to the organisational perspective of the Multiple perspective evaluation.

SAP, as an information system, contains most of the requirements of a cybernetic information system as described by Clemson. This can have several implications to the design and implementation of the software:

- SAP imposes a cybernetic metaphor onto the organisation with respect to the control system
- Management cybernetics can be a useful model for a prediction of the implications of the R/3 software to the regulation options of the organisation.
- The cybernetic models are relevant for the development of a common mental model for the implementation project

Ulrich's critique of the implementation of a cybernetic information system in Chile is a motivation for the inclusion of critical heuristics (Ulrich, 1983), for an introduction to an evaluation of the personal perspective of the implications of SAP as the environment for a system for viability.

The problem context was defined in Part 1 as a system for viability in the organisation. The output of this system serves the purposes of the organisation and the people. While the focus of this thesis is on the aspect of control of the implementation project, it is important to have an adequate appreciation of the environment of the system in focus, as supported by systems thinking.

3.2 A Multiple Perspective evaluation

3.2.1 Introduction

An implementation approach for aspiring system designers is suggested as previously argued in Part 2: A project team needs to develop a good O perspective for knowledge about the dynamics and regulation of the system to be influenced. O knowledge is the best basis for the choice of tools/processes that is one of the prime issues in the T perspective. The implementation success is ultimately determined by how well it serves the people in the system, of who knowledge is developed through the P perspective. The approach can be expressed as systems, with purposes guided by the containing systems as per the figure below.

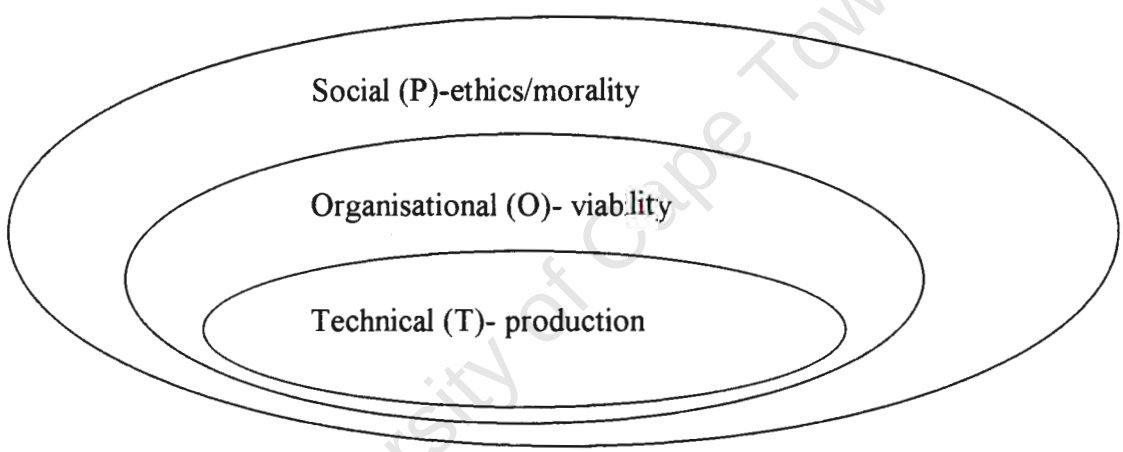


Figure 20- A system of perspectives

The T perspective will not be addressed, as there exists an array of technical tools and approaches, regularly changed and updated, for the implementation of SAP. The challenge is rather assumed as defining the O perspective as a basis for defining the purposes of these tools and approaches. This is followed by an appreciation of the personal issues of an R/3 project in the P perspective.

3.2.2 The Organisational Perspective

With regulation an essential component of the viability of a business or project, it is suggested to develop an appreciation of the minimum regulatory functions of a typical implementation project as a viable system.

Beer developed his appreciation of a viable organisation by observing the qualities of the human brain and the central nervous system, hence Morgan's use (Morgan, 1986) of the Brain metaphor for an appreciation of the organisation challenges of a system.

The project as a VSM

A typical project team with its functional groups is represented below as a viable system. The structure is similar to that of a current SAP project. The system in focus is the implementation project, within the containing system, that of organisation, as a system to maintain viability. The project VSM is not an indication of the project structure, but shows the regulation functions and the people who would be the most likely main contributors to these functions. R1 is the system in focus, R2 the subsystems and R0 the containing system.

The vertical representation of the regulation functions and the core processes are done in this manner due to the restrictions of a two dimensional representation. It does not indicate rank. With the project teams relatively small, the focus will be on this recursion, with the understanding that each of the viable systems S1 contains the same functions S1 to S5. The method of regulation is consistent for all recursions and is guided by the requirements set by the higher recursion. Therefore a policy function in recursion R1 needs to acknowledge the policy requirements of R0 in order to develop an effective policy for R1.

- **Notes on the project VSM**

S5: The project is represented to the organisation at this level. The representation includes tasks such as the validation of changes to the business and its performance measurements. Communication with the Executive committee of the business is one of the most critical functions of the steering committee and the project sponsor, as Excom relays the information to the business owners, such as the directors and shareholders, who have a direct interest in the value of their investment in the new system.

Care has to be taken to refrain from interfering at the control level and to concentrate on the development of critical specifications that can guide the operations of the project.

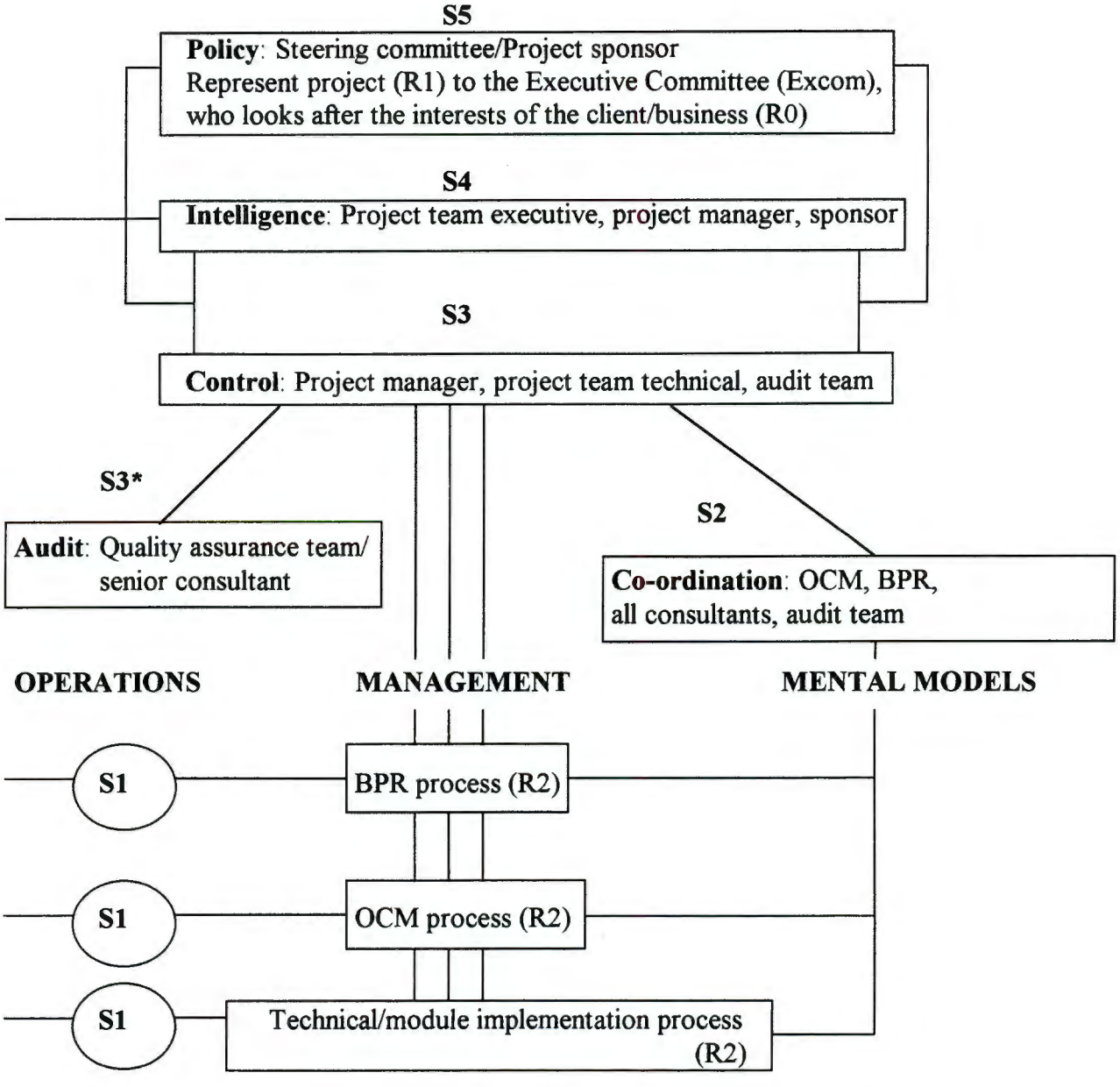


Figure 21- The project as a Viable System

S4: This function often does not enjoy an adequate status in the project. With much pressure on production, little time is awarded for reflection on the why of specifications for the project, especially after the scoping phase. With so much complexity in the software, it is inevitable that a considerable amount of learning will happen. The challenge is to evaluate what learning justifies changes to the project assumptions. Any change affects many other parties within the interdependent network of the project system and needs to be well qualified. It is suggested that systems methods such as SSM is employed to determine justified changes.

The executive team of project management consists of senior consultants and project members, with the ability to understand technology and its effects on the organisation. Activities at S4 would include the attendance of SAP user conferences and interactions with other R/3 clients.

S3: The project manager and technical team contribute to control issues such as resource allocation, satisfying legal requirements and the monitoring of accountabilities and contributions. The scoping document is the main guide for this team, with its project specifications, resource plans and time map. Any changes to the scope must be contested in order to maintain production as much as possible. This ensures a rigorous evaluation of proposed alterations.

One of the main tasks is that of monitoring the budget, usually a sensitive matter in these expensive projects. Care must be taken not to bias the value of major decisions purely on the costs incurred, but to maintain an awareness of other critical implications to the measures of success of the information system as a long term enabler.

The external and internal auditors define the legal requirements of the financial modules and develop authorisation levels for the effective planning for risk. With so much information available in real time, combined with Electronic Funds Transfer functionalities, the potential for fraud is big. This task is very often underestimated in the project and has caused many a crisis towards the final stages of an implementation. The SSM inquiry resulted in the mentioning of the need for early attention to authorisation levels.

S3*: Audits in the VSM refer to the detection of patterns in the performance of the viable systems that can facilitate an understanding of the operations and specifications. This function attempts to establish which variations, that are observed over time, are meaningful and not just 'white noise'. It does not seem that this function is as visible in an SAP project as in a manufacturing business, but the non statistical issues can be useful as indicators of trends in relationships and performance patterns. It might be noticed that some people end up working longer hours due to an incorrect allocation of responsibility, or that the consultants do not communicate technical knowledge to the BPR team for validation and often has to redo tasks. An evaluation of the critical specifications and performance measurements of the project with the guidance of the time-series observations is one of the tasks at this regulation system.

Attention to this level should greatly reduce the need for constant crisis management and provide a basis for understanding and predicting project performance. Measures of performance include time and functional specifications and as important, standards for teamwork, communication, behaviour in meetings, etc. Covey names the shift in attention as

a move from quadrant 1 to quadrant 4 management, where quadrant 1 is a type of crisis management mainly focused on reaction to the complexity of daily events, and quadrant 4 is a focus on the design of a system for long term viability and the capacity to absorb much of the variation of events (Covey, 1994)

S2: The scoping document is usually the common basis for the co-ordination of the project. Further key documents include the conceptual and detail design reports with a guide to the co-ordination of the numerous tasks and where they fit into the critical path/s of the project.

Throughout the interviews with project members the importance of documentation is stressed as an often neglected issue. Some of the potential benefits of a thorough and regular documentation include:

- A basis for measuring the consultants - a hard copy can be brutally honest.
- The prevention of repeating a process - efforts to solve problems are investments if recorded for future reference such as implementations in other areas of the organisation.
- A basis for problem solving - with the integrated nature of the software, a change in one module can cause all kinds of trouble in other modules, that can be difficult and time consuming to trace without a detailed record of changes.
- It provides information for the upgrade to new releases, regarding specific modifications.

What has been found very useful in one of the current projects; is the introduction of a decision form. All decisions that can affect the scope of the project in any way has to be thoroughly argued and validated by all the relevant senior personnel. In the one project, it has reduced the propensity for unproductive political play considerably, as well as providing a powerful tracking device of critical decisions.

Communication and the development of mental models are primary tasks at this level. It includes the creation of standard operating procedures, practises and programmes. In SAP terms there is an 'audit' team who is responsible for the definition of authorisation codes. Potential risks of fraud must be planned for and co-ordinated with the BPR, OCM and SAP technical teams.

Change management presents SAP to the users and the rest of the business and the acceptance of this presentation is a key issue for the success of an R/3 project.

One of the best attenuators of variety in work methods is the choice of computer based implementation tools, such as the previously mentioned Aris Toolset. Other tools include MS Projects, Excel, MS Word and so forth. Standardisation of these tools reduces the variety of the format of the information available in the project.

An argument of the dissertation is the suggestion of the use of the VSM and other cybernetic models as a powerful way to reduce the variety of interpretations of project issues. VSM can also be a common model for most implementation issues including the decentralisation of control, BPR, planning for change management, purposes for the application of technical tools, etc. Examples of applications of the VSM to design the new information system include the following:

- BPR can use the model to define the core processes as viable systems, with a basic structure for the required information flows in the organisation.
- OCM can use the VSM as a framework for the prediction of changes in the organisation. SAP automates many of the control processes, especially when combined with workflow. Many of the people who managed these processes before the implementation will be redundant if new work and skills are not developed for the new system.
- With one information system that represents the business and all its processes, the R/3 system is one of the most powerful variety limiters. SAP systems often span international enterprises and provide information in the same format world-wide. To that effect it fulfils a considerable portion of the S2 function of the VSM.

S1: Some experienced project managers defined only the implementation of the SAP modules as viable processes, but that restricts the transformation to the change from an old to an R/3 system. The transformations regarding the business processes and the way work is affected are co-producers of the new information system and should be viewed as viable systems, not only co-ordination issues. However, it depends on the agreed transformation for the implementation project. Some projects involve the direct mapping of the existing business processes into SAP, while others include a full re-engineering exercise. The chosen S1 processes were a product of accommodating the transformations specified in the SSM inquiry.

The Cybernetic Principles and the VSM

The VSM is underpinned by the cybernetic principles (See the introduction to cybernetics). Self organisation within the project is guided by a structure of communication functions, with a feedback system maintaining the equilibrium associated with a set of critical specifications for viability.

The principle of requisite variety implies the maximum absorption of variety at the source, with only the excess (requisite) variety filtered to the next level, and so forth. The functional consultants, OCM and BPR teams manage their tasks and the immediate environmental disturbances of the viable processes S1, and filter information to the control system S3 that could be useful for that function. This filtering process attempts to expose decision makers only to information that enables their contribution to regulation, within their capacity for managing variety.

With the VSM approach as a basis for the regulation requirements of a viable system and a powerful way for the management of variety, Work Systems and Human Performance Technology supports the design of processes and tasks.

Work Systems(WS) and Human Performance Technology (HPT)

Besides the applications of these cybernetic tools to the final definition of work, it can be an effective basis for one critical aspect of an SAP project, that of risk management. In an integrated system, any change to a component has the potential to have many unpredictable and often disastrous effects on the whole system with its complex net of circular causalities.

Intrinsic control within a project team therefore has to be carefully evaluated within decision scopes and associated risks. Not many of the people interviewed had clarity of which decisions carry what risks to the project. As a result a self organising method of variety management emerges as the reluctance of allowing for most of the decision making at the source. Autocracy can be seen as a lack of trust or a lack of an understanding of risk.

Work systems offer a useful perspective of process levels for the design of tasks on the basis of the transformation time associated with these tasks. It has the potential to be as useful for the evaluation of decisions with respect to the potential time period that decision can impact the project or organisation. The closer the decision comes to base changes of the project, the higher the risk and the closer it comes to being addressed by the policy function, and the

shorter the potential impact, the better the basis for the empowerment of level S1 for full power of decision making without a serious threat to the viability of the implementation.

At the job/performer level in HPT, a deliberate mention is made of the consequences of the quality of performance to the individual and the organisation. Whereas this focus often gives an insight as to the difference between espoused theories of performance and actuals for an appreciation of motivation, it can be developed to review the risks to the organisation with respect to the poor performance of a specific job. As important as a critical path for project planning is the identification of critical jobs and performers.

3.2.3 The Personal Perspective

Introduction

With information technology doing so much of the "thinking" in today's business world, one has to be extra critical of the implications of IT to choice. On the one hand it supposedly gives more information for more informed choices, but who determines what information is the best for a decision?

A system such as the SAP R/3 has a quasi intelligence that allows the automation of many processes involving the evaluation of information. It is intelligent in the sense that information can be checked against a network of interacting standards, and to 'act' by alerting the human operator to take action due to a computer evaluation of the 'meaning' of the checked measurements.

Ulrich makes the distinction between the "intelligence" of the computer based system as purely statistical, with the human 'intelligence' that of statistics **and** the interpretation of the value and meaning associated with information. Even so, an information system is essentially a process of measuring performance or behaviour against some standards. These standards become a long term basis for work relevance and success and have a strong influence on the choices of people, often unchallenged.

Naom Chomsky states in his television documentary, Manufacturing Consent, the power of selecting what information is given to people through the media. Information and its presentation influence world views and should not be underestimated. A disturbing example is that of a country preparing for war; without a considerable change to most people's models about the world, not many would be stupid enough to expose themselves to the real danger of death because of the inability of politicians to resolve conflict. This change is often facilitated by the use of the media, especially television.

In an organisation, a comprehensive information system such as R/3, with its internal structure of performance standards, can have a big influence on the world views of the people in the work system.

How then can one at least challenge the assumptions underpinning the design of the information system as a control tool?

The purpose of the P perspective is interpreted by the author as an attempt to confuse the implementation concerns at a deeper level. As an introduction to the personal perspective, the use of a categorisation of people implicated in a system design project may be useful (Ulrich, 1983). He suggests that two groups exist, the involved and the affected. The involved are those who directly influence the design and the affected are those who do not contribute directly, but have to live with the system anyway. This is particularly useful when evaluating the ethical and moral assumptions for the design.

Systems and their design

One of the most rigorous definitions of a system is that of Churchman. He suggests nine conditions to define a systemic representation of an observed phenomena. These conditions are in essence steps of binding the situation into a manageable perspective, in the form of a system, S (Churchman, 1971). The conditions were given on page 29 of Part 2.

These conditions are accepted as a useful bias towards system design. A discussion of the meanings associated with the nine points has the potential of being a topic of a separate thesis. For the purposes of this perspective it provides a language and concepts helpful to develop a knowledge of social systems.

Planning for a project such as the SAP R/3 implementation involves many assumptions or boundary judgements, as named by Churchman and Ulrich. This binding process can be facilitated through the rigorous application of questions. Questions limit the range of answers and care has to be taken to be aware of the underlying bias of the questions employed to inquire about a situation.

Ulrich developed a set of questions to define boundaries for knowledge about the values and norms underpinning the design of a system for people. The questions cover four categories of purposeful sources within systems design:

- Sources of motivation
- Sources of control
- Sources of expertise
- Sources of legitimisation

Each of these source categories have three questions for inquiry, resulting in a set of twelve questions to guide the normative appreciation of a design.

Ulrich's checklist of boundary questions.

1. Who ought to be the client (beneficiary of the system S to be designed or improved)?
2. What ought to be the purpose of S; i.e. what goal states ought S be able to achieve so as to serve the client?
3. What ought to be S's measure of success, MOS(or improvement)?
4. Who ought to be the decision taker, that is , have the power to change S's MOS?
5. What components (resources and constraints) ought to be controlled by the decision taker?
6. What resources and conditions ought to be part of S's environment, i.e. should not be controlled by S's decision taker?
7. Who ought to be involved as designer of S?
8. What kind of expertise ought to flow into the design of S; i.e. who ought to be considered an expert and what should be his role?
9. Who ought to be the guarantor of S; i.e. where ought the designer seek the guarantee that his design will be implemented and prove successful, judged by S's MOS?
10. Who ought to belong to the witnesses representing the concerns of the citizens that will or might be affected by the design of ? That is to say, who among the affected ought to get involved?
11. To what degree and in what way ought the affected be given the chance of emancipation from the premises and promises of the involved?
12. Upon what world-views of either the involved or the affected ought S's design be based?

The rigorous application of these questions makes some of the critical assumptions and values of the implementation team transparent and constitutes a process of critical evaluation of the norms underpinning the design or improvement of a system. The "wisdom" level of knowing (Strümpfer, 1994), is enhanced by these answers in as much as it addresses the why of a social system; why is everybody there and on what basis?

With SAP having similar qualities to that of a cybernetic information system, the critique by Ulrich of an implementation of such an information system in Chile (Ulrich, 1983) guides a critical evaluation of an SAP enabled system and its implications to the social system of the business. With the general purpose of this thesis the development of a useful bias for an R/3 implementation, the sources of purpose within the project system is discussed in more detail.

Sources of motivation

A key challenge is to identify the client of the information system. This definition guides just about all the critical decisions regarding the design and implementation of a system, S.

The end user is often mentioned as the client, but this is often an espoused utterance for the achievement of 'buy in' of the new system. A natural reaction in our capitalistic society is to view the client as that person or people who pay or approve funds. With the final approval of changes to performance measurements at the level of senior management, the satisfaction of requirements at this high level can dominate other needs to some degree. It requires quite a mindshift in contemporary companies to view its employees as the client.

A perspective of the dilemma facing senior decision makers is that of the interests of the internal and external client.

One interpretation of this challenge is to develop the viability within the guidance of an appreciation of the needs of the internal social system, by carefully evaluating the potential constraining effect of production decisions on the choices of purpose. The extreme result of neglecting the purposes of the people is perhaps summarised by Morgan in his reference to the metaphor of the organisation as a Psychic Prison, void of choice (Morgan, 1986).

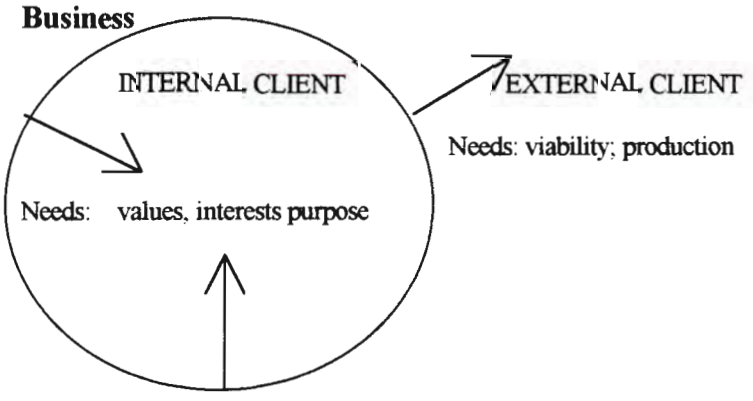


Figure 22- The Internal/External Client

A further complication is that information system designers are often sophisticated technicians in the sense that most of the critical decisions regarding the purpose and critical performance measures are already made, and almost part of the set of constraints on the system.

Who controls who and what is the focus of the nquiry into sources of control.

Sources of control

As an introduction to control issues, the use of the Political Metaphor by Gareth Morgan (Morgan, 1986) can improve an understanding of the power issues inherent in an R/3 implementation project.

Morgan presents 14 sources of power that are important in an organisation.

Morgan's sources of power

1. Formal authority
2. Control of scarce resources
3. Use of organisational structure, rules and regulation
4. Control of decision processes
5. Control of knowledge and information
6. Control of boundaries
7. Ability to cope with uncertainty
8. Control of technology

9. Interpersonal alliances, networks and control of "informal organisation"

10. Control of counter organisations

11. Symbolism and the management of meaning

12. Gender and the management of gender relations.

13. Structural factors that define the stages of action

14. The power one already has.

The questions raised during the development of the inquiry framework about control are of particular relevance to the power to influence other's purposes within S:

- Who controls what at present?
- What can be controlled?
- What should be controlled?

Especially the second question demands some sense of reality for managers as decision takers. There exists the belief in many that people can be controlled. A personal bias is that control is defined as the ability to deliberately influence the choices of someone or something, in a pre-determinate manner. This implies an element of predictability of the behaviour of who/what is controlled. In human systems, the only reliable points of stability, and thus with some predictability, are around some base relationships, as dynamic entities with a tendency for equilibrium over some time.

An evaluation of the scope of control of decision takers should therefore include an appreciation of the relationships that could be affected. A strong bias towards the interpretive and critical systems approaches is not a bad basis for an inquiry into control, in the sense that its assumptions minimise the potential for harm to people.

Regarding the question, what should be controlled?, the concept of the VSM can be useful as an identification of the minimum required regulatory functions that should ensure viability for an organisation. More control can then be challenged with the strong logical basis of cybernetics.

Sources of expertise

With the technical complexity associated with the software, this kind of project has an almost genetic dependence on experts for the success of an implementation. This dependence is reflected in the incredible international marketability of a person with good SAP skills. With R/3 expertise expensive and relatively scarce, particular care should be taken with the definition of a measure of performance for the consultants on the project.

Besides the productivity issue, the matter of ensuring the alignment of the expertise contribution to the benefit of the whole project and the business, with its clients, was raised during the SSM interviews.

Sources of legitimisation

The involvement of the users in the design is often a softening of forcing a pre-defined design through the process called 'buy-in'. However, there are some factors working against the humane designer regarding the 'involvement' of the affected:

- The increase in variety by the inclusion of more interpretations and interests in the project
- Assumptions regarding the ability of users to appreciate complex technical constraints
- The reluctance of people to be honest in case it backfires in the form of added responsibility, a change in power, etc.
- Once some of the affected are chosen as representatives, they tend to adopt the world views of the involved, and are no longer true representatives of the affected.

Arguably, one of the few approaches that has the potential as a practical method for ensuring an adequate power for the affected, is that of rational discourse, as suggested by Habermas (Flood and Jackson, 1991). It entails a basis for a discussion with the purpose of revealing the boundary judgements of the involved and its potential implications to the affected. A strength of the approach is that it cuts through the deceiving rationality of technical speak.

Conclusion

The introduction of the challenges of the Personal perspective of an information system implementation project was done to maintain a systems view of the viability of an organisation. The system for viability of the organisation has been identified as the context of an SAP implementation.

Defining the project as a viable system was an initial theoretical test of the probability of an argument that the success of an implementation project can be enhanced by the adoption of the Viable Systems Model (VSM) as the main mental model for the organisation of the project. It was also suggested that the organisational system determine the basis for choosing the purposiveness of production and processes, as the containing system of the technical system. Work Systems and Human Performance Technology show potential for useful applications, but its applications are more focused on tasks and the job/performer level. The VSM is chosen as a model for the development of an information system for an SAP project.

With a systems view of project organisation and its social environment, the hypothesis can be developed. The abduction phase is summarised by referring to the result, rule and case elements of abductive reasoning:

Result: SAP implementation projects are complex with respect to the many technical options available, the variety of interests and interpretations to be managed and the broadness of the impact on the people in the business. SAP projects are generally experienced in the industry as problematic with many new challenges for designers, decision takers and managers.

Rule: The Viable Systems Model (VSM) as defined by Stafford Beer (Beer, 1985) is one of the more developed cybernetic based approaches to the regulation of complex systems.

Case: The VSM is an adequate approach for the definition of the minimum regulation functions for a successful SAP implementation project.

3.2.4 The Hypothesis

The argument of the thesis is that the Viable Systems Model is an effective approach for the definition of the minimum regulation functions that are required for successful SAP implementation projects.

Information system design and implementation require an adequate appreciation of the control aspects of an organisation and the chosen software constraints, to effect a successful implementation. The VSM is suggested as an adequate mental model for the development of knowledge about the project organisational dynamics and regulation, within a wide range of

purposes for an implementation project. As such it does not restrict the purposefulness of the designer, rather, it enhances the capacity of the design process for success.

With the argument that the VSM does indeed define the minimum regulation functions, is the assumption that a project without these defined regulation functions and an appropriate management thereof, will not have a high probability for success.

Project success is defined as the achievement of the objectives planned in the strategy, scoping and detail design documents.

3.3 Deduction

Deduction is the transformation of the hypothesis definition into a testable argument (Smith, 1995). The definition of this basis for a test is effected through the reasoning process as defined on page 35 of Part 2. The reasoning involves the recognition of a rule, a case and the result of applying the rule to the case. These three elements are the basis for the development of the test.

3.3.1 The Rule

The hypothesis, that the VSM is a necessary guide to an implementation project for the planning and management of the minimum regulation functions for survival and development, implies several assumptions. One of the main assumptions is that the VSM does indeed contain the minimum regulation functions, and, as a consequence, that an organisation without adequate attention to all these functions will suffer with respect to its viability in some noticeable manner.

Viable Systems Diagnosis (VSD) is the evaluation of an organisation with respect to its attention to the minimum functions as specified in the VSM. An application of the VSD reveals strengths and weaknesses regarding the viability potential and is as such potentially useful for the focusing on particular areas of concern regarding the regulation system.

3.3.2 The Case

Several SAP implementation projects were considered as case studies for the application of the Viable Systems Diagnosis. Two cases showed distinct differences with respect to project success and were chosen as the context for the test of the hypothesis. The two projects were chosen to represent a broad spectrum of industries, project and organisation sizes. One of these projects have publicly presented their costly learning process, however, the arrangement was to maintain the anonymity of all the cases in exchange for honest information.

Case A is a large business, that was one of the first big SAP implementation projects in South Africa. At user conferences, several presentations have already been made to provide an insight into the failure of the implementation project with respect to major cost and time overruns. Further problems included an unstable technical system after the commissioning, with a resulting of an initially poor performance of the SAP enabled information system.

The problems of project A included:

- Many modifications to the software, without the initial appreciation of the consequences of these changes to the performance of the information system.
- An apparent general lack of client ownership of the project.
- The consultants were given a substantial amount of power, that often resulted in the project being more of a place for learning than contribution.
- Little understanding of the implementation of SAP on such a large scale.
- Substantial cost and time overruns.

Case B is a project in smaller concern, that has commissioned its first phase of an SAP implementation with a high level of success with respect to the planned and actual project. Phase one appears to have satisfied the cost, delivery and quality expectations as per the scoping document. Further indications of success are:

- The smoothness of the commissioning stage, or 'going live' as it is commonly referred to.
- The final cost was below the planned budget.
- The generally high levels of commitment and contributions of the project members.
- Only one aspect of the initial scoping document was changed during the course of the implementation, as an indication of the success of the planning and management of the critical specifications of the project.

The main problem that was stated during an investigation, was that of a level of autocracy with respect to the general project control. Some members experienced this as an inhibition to the level of contribution by the non-management individuals in the project team.

3.3.3 The Predicted Result

It is predicted that the application of the Viable Systems Diagnosis to the cases will show a considerable deviation from the principles of the VSM in the unsuccessful Case A, and a high level of congruence with the VSM in Case B.

More specific predictions relating to the principles of the VSM can be made as follows for each case study.

Case A:

- Strong negligence of the policy and intelligence regulation functions.
- Due to the lack of critical specifications being defined at these S5 (policy) and S4 (intelligence) functions, too much variation has to be managed at the control and co-ordination functions.

These predictions are based on the problem statements as per the above section 3.3.2, as well as interviews with some Case A project members.

Case B:

- The autocracy can result in the collapse of the S5 (policy) function into the S3 (control) function, which means that the steering committee and/or the project sponsor interferes at the project execution and control level.
- This can cause the inhibition of project member contributions, as they are not allowed to manage most of the variety of their tasks without approval of those responsible for the S5 function. The variety that is filtered to the policy function is therefore not attenuated enough to be manageable at the S5 function.
- With the overall success of the project, it seems that the stated tendency towards autocratic management was not a major inhibition to the effective regulation of the project. It is therefore predicted that the S1 to S5 functions were all addressed in a deliberate and adequate manner in Case B.

Within the context of the SAP implementation projects, the predictions can mostly be made regarding the project relationships, the basis for communication and the definition of responsibilities and contributions. One does not only have the complexity of a social system, but also the relative newness of the SAP software as an integrated information system enabler as factors contributing to a high level of unpredictability with respect to such implementations.

If the VSD reveals substantial shortcomings in the problematic project, and fewer in those with moderate concerns, it would support confirmation of the strength of the hypothesis, as a valid test within the time constraints of the half dissertation.

A suggestion for the next cycle of inquiry is the actual application of the VSM for the design and management of several SAP projects, with a deliberate monitoring of the differences of these projects as compared to non-VSM based projects. This will imply a minimum time period of one to two years.

This case study based confirmation of the hypothesis is a valid motivation for further efforts towards a more in depth evaluation of such projects as viable systems, with more detailed regulation functions that can be specifically developed for the challenges of an SAP implementation project.

The validity of the selection and accuracy of the case studies for the VSD is based on interviews with project members, developers and clients, as well as an attendance at the SAP Southern Africa user conference, SAPHILA 1995.

3.4 Induction

3.4.1 Introduction

The industries of the cases include fossil oil and petroleum, and fresh and processed food, with the approximate project sizes ranging between 160 and 800 information system end users.

The intention to give an indication as to which regulation functions, as subsystems of the viable system, appear to have been neglected and in what way.

Please refer to the examples of the Viable Systems Model on pages 67 and 78 for an introduction to the regulation subsystems **S1** to **S5**.

The basis for the induction phase is again the three elements as per page 35, the Case, the Result and the inferred Rule. The author's understanding of the use of induction is the observation of cases and produced results, and the challenge of inferring, or as a phase of the Scientific Method, confirming the result as an indication of the validity of the abduction.

3.4.2 CASE A

Introduction

This case represents one of the larger projects, with an estimated end user number of 800. Considerable cost and time overruns of the project were indications that there were critical problems with the design and/or the management of the implementation.

These problems followed the project until after going live with the system, with disruptions due to the information system's non-performance during the first few months of commissioning.

The Result: Viable Systems Diagnosis

S5: Policy

A general lack of senior management support resulted in a negligence of the policy function of the project. There were several changes of project sponsor, that resulted in a limited project sponsor presence and functioning.

At this level, the system is represented to its client, usually by the project sponsor and the steering committee as the validators of significant changes to performance measurement indicators, decentralisation of control and information policy issues.

Feedback from various stakeholders support the opinion that the project was left to the consultants. The management consultant group that were involved with the project did most of the critical decision making, with little validation or apparent interest from the senior management of the organisation.

S4: Intelligence

At the time of implementation, there was little known about the SAP software. Feedback from the interviews suggest that there was no formal user group in South Africa, as well as a general newness of integrated information systems in businesses.

There were however several international implementations at that time. When one considers the large scale underestimation of the implementation implications, as mentioned in S3, it does not appear that much investigation into the implementation concerns were done, or that information obtained were not translated into practical guidelines for the project. Some senior consultants confirmed a general lack of appreciation of the software and its constraints.

S3: Control

Most of the decision making was done at this level and lower. Resource allocation was strongly biased towards management consultants and Information Technology personnel, with very little user representation.

One of the main results of 'policy' decisions left at S3 without adequate support from S5, was the general lack of decisions about business process changes. Instead, the software was modified substantially to fit the previous process configurations of the business, even if it meant several changes to the actual programming of the software. The reproduction of the old processes reduced the benefit of the new technology as it maintained most of the old relationships and their related performance measurements.

With an integrated software programme, small changes to one part have consequences throughout the system with an often low level of predictability. The performance of the information system was hampered by many of these changes. At the end several of these changes had to be undone to restore stability and performance to the information system.

There is a big difference between modifications and customising. Modification implies a change to the programming of the software, while customising is the process of selecting options that are within the constraints of the software. There is usually a compromise between the design of the business processes of the organisation and the options for processes in the software. A general rule for smoother implementations and future maintenance of the SAP system is that the system should be as standard as possible, with no modifications.

The other implication of leaving the decision making in the hands of the IT people and the management consultants, is that the 'client' is not really the owner of the system. Decisions are made that are based on the assumptions of mainly technical experts, within their field of specialisation. The client, with little understanding of the system, will also remain dependent on consultants for minor future changes and upgrades.

S3*: Audit

Not much information was obtained about the effectiveness of an audit function. With the problem of a lack of senior management involvement persisting for a large portion of the project without any visible corrective action, it does not seem that the audit function was done with success.

S2: Co-ordination

Co-ordination as a function for the development of shared understandings, plans, practises and procedures was neglected. The bias of decision making towards the technical project members, with little user representation, had a strong influence on the co-ordination of the project.

The management consultants on the project were relatively inexperienced with SAP systems at the time, and there was poor support from the SAP head office in Germany. The general level of understanding of the system and its implications was therefore low. IT people focused mainly on technical matters with little concern or understanding of the consequences of decisions on the organisation as a whole.

S1: Viable Operations

The three viable operations are assumed as SAP module implementations, BPR and Organisational Change Management. Each is briefly discussed below:

SAP module implementations: Too much variety was absorbed at this level without relevant information being filtered to the control and policy functions. Day to day activities require short term thinking, which was reflected in the design of the system. Decisions affected at the operational level were not evaluated for its implications to the effectiveness and performance of the whole system.

BPR: Business processes were designed without recognising the constraints of the software with its depository of 'best practises' for business processes. Best practises may be a contentious issue, as a best process for one business may not be a best process for the next, but the software was designed to accommodate the integration of the standard process options. With the software changed to fit these non-standard SAP processes, the integration of the system was affected, with a general reduction of system performance as a result.

Organisational Change Management: A big bang approach was adopted for this project. This implied the implementation of all the modules of the software in the whole organisation at the same time. Change management was particularly challenged with the co-ordination and delivery of training for all the users, who were more than 800.

Case study A is therefore a project where there was little regard for viability. A lack of senior management support resulted in a general lack of client ownership. Decisions were left to be made mostly by people who did not have to live with their designs. The affected were not given much representation and power for the legitimisation of the design, in relation to the experts. The experts were also the main decision takers. (See Ulrich's boundary checklist, page 85)

The finding in Case A therefore support the predictions of the deduction.

3.4.3 CASE B

Introduction

This project was considered as one of the more successful implementations with respect to its adherence to the project time and budget as set in the scoping document. In fact, there was only one minor change to the original scope of the project until the system went live for phase one, with some budget savings realised during the implementation.

One concern of the project was about the management style. This did not seem to affect the project performance as a whole, but it was mentioned by many of the interviewed as an area for improvement for the rest of the phases of the project.

The Result: Viable Systems Diagnosis

S5: Policy

The project was very well represented to the rest of the organisation, with a committed steering committee and project sponsor. The sponsor had the executive powers of the company directors and could affect most of the high level decisions associated with the project.

This commitment of the project sponsor was also the cause of concern for some project members, as the sponsor had an autocratic style of management and was involved with many S3 functions. The executive position of the sponsor within the company as well as the project, allowed for effective policy decisions within the project, but also restricted project member contributions at the meetings. Most members stated that they were less outspoken in the more autocratic project environment.

S4: Intelligence

The project sponsor and the Management Information System team were committed to the gathering of information regarding SAP implementation project challenges. SAP user conferences were attended and the learning was applied in the project scope definition.

A deliberate and thorough effort seems to have been made to understand the implementation and its implications to the organisation.

S3: Control

Regular project management meetings were held, but with some of the power for control decisions assumed by the project sponsor.

A further challenge to the project manager was a lack of technical skills. This inhibited this person's ability to decide what technical information was important for further distribution as a contribution to the S2 function.

Resource allocation was good with respect to time commitment, as the whole project team was 100% committed to the implementation for the duration of the project. Regarding the appropriateness of the resource allocation, concern was expresses about the selection of some of the key users. In general, the project team was committed to the project, with time and effort.

S3*: Audit

The regular presence of a senior SAP consultant ensured that quality problems were detected early and corrected. The project meetings included this consultant and the implications of changes to specifications, with respect to the software constraints and best practise options in the system, could be resolved without delay.

S2: Co-ordination

The general feeling was that communication in the project could be improved. Information was filtered through a hierarchical structure, with the end users at the bottom receiving little valuable information.

Key users were meant to communicate their learning to their respective departments, but the interview results suggest that they were not generally successful. A further factor was that users were not presses to acquire SAP knowledge. A 'play' system was made available for the users to practise on, but the process was not managed as a priority for knowledge development.

Decision forms were used for the rational presentation and authorisation of any changes to the scope of the project. This was a useful method of reducing coercion with its requirements for signatures and motivations from all the parties affected by the decision, as well as a thorough basis for the documentation of the history of changes in the project.

Training was considered as generally good, but with timing problems. With such new skills, a just in time approach to training is often advised, to ensure that knowledge and skills do not fade during the period between training and application.

S1: Viable Operations

SAP Module Implementation: An approach was taken to view the planned time of implementation as one of the most important constraints. This resulted in a decisiveness with respect to business process design and other critical change issues. Late changes to the system design was discourage and the information system went live on time, within budget.

BPR: The business process design was mostly done during the implementation project with a recognition of the software constraints. One criticism was that not enough was made of the opportunity to improve the current processes, with too many performance measurements remaining unchanged in the new system.

Organisational Change Management: With the project opting for a roll-out implementation, the implications to the organisation is that a manageable portion of the business is converted to the SAP information system.

The developed expertise and learning from this implementation phase are then transferred to the next phase and section of the organisation. The intention is that the process is self-correcting as the implementation is rolled out in the organisation. Mistakes affect smaller sections of the business and therefore pose less of a risk to the project.

This project achieved its targets with respect to time, cost and quality as planned during the scoping phase of the project. Even with some political stresses, all the regulation functions for viability were addressed in at least a reasonable manner. Some feedback from the project members suggest that the tendency towards autocratic management was countered through self organisation, especially by the members with the least amount of seniority. The informal system included going outside the project to senior managers, who then addressed the member's concerns with the senior management of the project, with the appropriate level of authority. This did not happen too often, which can be an indication that the level of autocracy was not a threat to the success of the project.

Comments were made that the communication in the project should be improved, with a recognition that there were at least defined existing communication lines as a basis for improvement.

3.4.4 Conclusion

The hypothesis stated that the Viable Systems Model is an effective approach for the definition of the minimum regulation functions that are required for successful SAP implementations.

Through the process of deduction, the prediction was made that the success of an implementation project will be proportional to the level that the minimum regulation functions, as per the VSM, were effectively addressed.

Case A, an example of a problematic implementation project, showed a general disregard for the minimum functions for viability in an organisation. Case B, while seeming to have had its share of tensions, addressed all of the regulation functions with at least a moderate degree of success, and emerged as one of the least problematic implementations in South Africa.

The predictions have thereby been confirmed by the results of the application of the Viable Systems Diagnosis. With the assumption that the predictions of the deduction are valid, the results of the induction therefore supports the strength of the hypothesis.

Part 4 contains an evaluation of the hypothesis and a summary of the learning as a result of the inquiry process.

PART 4- Reflection

4.1 An Evaluation Of The Hypothesis

4.1.1 Rationality

The Viable Systems Model can be an enabling mental model for most of the activities specified within the organisational issues. As an internal information system, the VSM is valuable for the implementation project with its requirements for flexibility and a steep learning curve. Reporting and other internal communications planning can benefit by the logic and economy of the minimum regulation functions of a viable system.

Compatibility between the SAP software characteristics and a cybernetic information system is a further boost for the validity of the VSM as a common mental model for the project, whether it is to explain an SAP concept to a user or to determine the level of intrinsic control that could be achieved. The possibility is there to make a quick assessment of the implications of the R/3 system to control in an organisation simply by checking how well the business maps onto the VSM. The author has found the VSM very useful as a basis for formulating questions about the applications of an SAP module, especially as a relatively lay person regarding the technical details of the software.

A substantial portion of the Multiple Perspective evaluation was spent on issues concerning the personal view. Due to the non-deterministic nature of people issues, the more open ended questions one can ask, the better. Questions in this perspective seek more to challenge assumptions than to give definite answers. The boundary checklist of questions as developed by Ulrich is a short list with the potential for a long discussion. Very few assumptions of system designers will remain totally hidden if these questions are rigorously pursued, as they challenge the core of rational arguments. This is especially important when facing the rational eloquence of management consultants and other experts.

The personal perspective was developed to maintain a systems view of the human system as the environment of the organisational issues of viability.

Perspectives, seen as systems, imply that each developed view has a purpose and a Measure of Success (MOS). The author has found this introduction of multiple measures of success in planning probably the most critical value. One affects the basis for performance towards the norms and assumptions of the defined MOS's of a project. With multiple perspectives as the framework for project planning, the definition of MOS's for respecting people, ensuring stability and production, are deliberately done as the required outputs of the personal, organisational and technical perspectives as purposive systems.

Personally the author has found an substantial improvement in understanding SAP projects through the application of the framework, even after a previously diligent pursuit of anything to do with the software over the past two years. The VSM has been effective to cut through the technical complexity to reveal control concepts and also as a useful basis to explain the strategic implications of the implementation of R/3.

One of the most important aspects of the hypothesis is the consequences it may have. Adherence to the minimum regulation functions for viability, with little prescription as to the choices of purpose of the system, can provide a basis for the minimum control in a social system, while ensuring survival and the capacity for development.

4.1.2 Reality

The presentation of an abbreviated version of the Multiple Perspectives evaluation to senior project members has supported the initial acceptance of the approach as an improved bias towards an SAP implementation. Some of the members have been around on complex projects, but found especially the potential of the VSM as a basis for communicating SAP to an organisation useful.

For those in a position to participate in the selection of a project team and its goals, the sources of purpose and the twelve questions were refreshing enough to start a discussion about their current project and roles, contributions, power and the involved and affected. The framework seems to have the potential to challenge existing experienced views into a broader thinking without an observed resistance to the approach as a threat to any of their personal agendas.

Perhaps the newness of the concept to most of the interviewed played a role, but the initial reaction was certainly supportive of the Viable Systems Model as an adequate mental model for the appreciation of a project that influences technical, organisational and personal issues in a business, such as an information implementation project.

4.2 The Learning

Learning is assumed as the process of adjusting one's world views based on experience and knowledge. Much have probably been learnt in all kinds of subtle ways, but there were those issues that made a more forceful impression on the author's appreciation of social systems.

4.2.1 The challenge of confusion and paradox

While these two issues are seen as an integral part of life for the Buddhists, it took an in-depth investigation into the realms of phenomenology and its implications to truths in order to develop an appreciation of the relevance of these concepts. Without assumptions about the world, one is not far from madness, so it is rather a better option to choose assumptions, as a priori, that can be of value to life.

Pragmatism is one of those assumptions, that an evaluation of the meaning of a belief lies in the practical bearings of holding that belief. It reduces much of the propensity of rationality and logic to be merely a basis for justifying a personal judgement, by providing some form of tangibility to a test of the belief.

The Scientific Method, as a philosophy, strongly supports pragmatism through the rigour of testing any hypothesis with respect to its practical implications.

Pragmatism assumes that one has an adequate basis for the evaluation of the potential effect of a belief or decision, as a critical requirement. To this end, systems thinking in the broader sense is a useful enabler for the practising of pragmatism. It provides an adequate basis for predictions in complex social and ecological systems.

4.2.2 Triads and tetrahedrons

An introduction to the power of triadic relationships as the smallest component of relations, and the tetrahedron as the most geometrically stable structure, resulted in the development of a personal appreciative framework of just about anything in the form of these shapes.

An interpretation of the addition of a fourth dimension of the triad developed. With the 'truth triad' as suggested in the development of an inquiry framework in Part 2, the minimum requirements of truth are Content, Context and Process. Within the acceptance of uncertainty as the certainty of life, changes to any of these three requirements will affect the present version of truth. The fourth element for the development of a 'truth tetrahedron' is that of a constant challenge to the relevance and adequacy of the appreciation of any of the three requirements. It can be represented as follows:

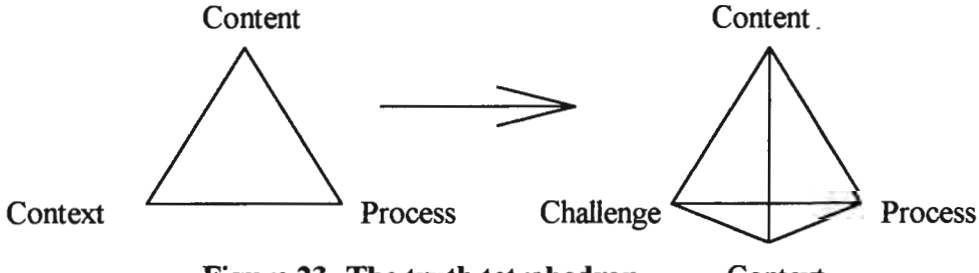


Figure 23- The truth tetrahedron

This structure can be a useful framework for most of the issues under investigation in this thesis and a list of tetrahedrons are included in the Appendix E.

Peirce developed the phenomenology of Firstness, Secondness and Thirdness and argued that the Scientific Method is a pragmatic inquiry philosophy, that tends towards his version of the truth of all truths. The fact that a final truth is probably unattainable is not the crux, it is the intention for continuous learning and improvement.

4.2.3 Rational discourse

Vickers, Churchman and Ulrich have a passion for ecology and ethics. Ulrich developed a practical approach for the development of ethics in projects involving the design of social systems. By allowing the affected of a project to challenge the involved, not on their expertise, but their principles bring the dialectic process of democracy in an organisation towards an equal basis for contribution.

As Ulrich suggested in his Chilean critique, the shift is from the design of a social system to the design for a social system. The people are ends, not means.

4.2.4 Measures of Success

One of the main challenges of the designing a system is to attempt to build in some kind of guarantee for performance. As the guarantor of an inquiry process defines the standard for the definition of knowledge and meaning, the MOS of a system is the standard for the self organising as a stable system behaviour over some time.

The Multiple Perspectives approach enables the definition of MOS's for the Personal, Organisational and Technical levels in a similar manner to Morgan's levels for paradigms, Philosophy, Methodology and Technical (Easterby-Smith, 1991). In a sense, the MOS's of the perspectives reflects the paradigm of each perspective.

The concept of time as another basis for the definition of a system has interesting possibilities. As with Hoebeke's definition of time related domains and process levels, the multiple perspectives introduce three systems with different purposes and measures of success, but also with different times associated with each system's realisation of its transformations within the purpose. A suggestion is that the efforts and time invested in the investigations of issues ought to be directly proportional to the time of transformation associated with that issue.

A basis for decentralised decision making can be an evaluation with respect to the potential of a decision for risk to the organisation, not only in financial terms , but also with respect to time. Learning is often associated with failures and planning with time perspectives in mind can support the design of systems that can survive errors. This approach can limit the investment of too much effort on prevention of errors with short time implications, especially as the shorter cycles of failing and correcting imply more learning cycles for a time period.

4.3 The future

A more critical reading of Vickers, Churchman and Ulrich will be the basis to develop an intellectual right to make any more assumptions about the validity of their development of systems thinking.

Of specific interest is the practical application of rational discourse to the challenges of politics and hidden agendas in the organisation. One could possibly develop a way to present a list of questions to the affected in a system, that will be accepted by the involved as the challenged. 'Why' questions have the tendency to get people's backs up and is a potential threat to the practical relevance of the approach.

SAP as an enabler for the Modular Enterprise Design model (MED) could be an interesting and pragmatically relevant topic for further research. A more in-depth investigation as to the specific cybernetic nature of the standard software can be an appropriate start to an inquiry into the validity of R/3 as a common information system for the MED, as a basis for an organisational design for optimal flexibility of structure. The MED recognises the flexibility of the internal markets approach to organisational structure, with the Viable Systems Model as an enabler for regulation and cohesion. The approach was presented to the author by Dr Strümpfer, of the University of Cape Town, during the course of the Masters in Industrial Administration, 1995.

Luc Hoebeke's development of a systems approach for the design of work systems included the ideas of Checkland, Beer and Elliot Jacques Further inquiry into the "Forms of Time" by Jacques will be the next step for the development of a more thorough understanding of Hoebeke's domains, process levels and information processes.

Bibliography

Ackoff, R. (1994) Mechanisms; Organisms and Social Systems, Published in the Strategic Management Journal, John Wiley & Sons, New York

Beer, S. (1985) Diagnosing the System for Organisations, John Wiley & Sons, Chichester

Beer, S. (1994) Brain of the Firm, 2nd Edition John Wiley & Sons, Chichester

Beer, S. (1994) The Heart of Enterprise, John Wiley & Sons, Chichester

Burch, J. G. and Grunitsky, G. (1989) Information Systems, Theory and Practice, 5th Edition John Wiley & Sons, New York

Burke, R. (1992) Project Management- Planning and Control, Management Press, Cape Town

Checkland, P. (1981) Systems Thinking, Systems Practice, John Wiley & Sons, Chichester

Checkland, P. and Scholes, J. (1990) Soft Systems Methodology in Action, John Wiley & Sons, Chichester

Churchman, C. W. (1971) The Design of Inquiring Systems, Basic Books, New York

Clemson, B. (1984) Cybernetics: A New Management Tool, Abacus Press

Collins, E. G. C. and Devanna, M. A. (1994) The New Portable MBA, John Wiley & Sons, New York

Covey, S. (1994) First Things First, Simon & Schuster Ltd, London

Easterby-Smith, M., Thorpe, R. and Lowe, A. (1991) Management Research- An Introduction, Sage Publications Ltd, London

Espejo, R. and Harnden, R. (1989) The Viable System Model, Wiley & Sons, Chichester

Flood R. L. and Jackson, M. C. (1991) Critical Systems Thinking, Wiley & Sons, Chichester

Flood, R. and Jackson, M. C. (1991) Creative Problem Solving, John Wiley & Sons, Chichester

Gouillart, F. J. and. Kelly, J. N.(1995) Transforming the Organisation, McGraw-Hill Inc.

Handy, C. (1993) Understanding Organisations, Fourth Edition Penguin Books, London

Handy, C. B. (1989) The Age of Unreason, Business Books

Hoebeke L. (1994) Making Work Systems Better, A Practitioners Reflection, John Wiley & Sons, Chichester

Kaufman, D. L. Systems 1- An Introduction to Systems Thinking, The Innovative Learning Series

Minto, B. (1982) The Pyramid Principle, Minto International, London

Mitroff, I. I. and Linstone, H. (1993). The Unbounded Mind, Oxford University Press, Oxford

Morgan, M. (1986) Images of Organisation, Sage Publications Ltd, London

O'Connor, J. and Seymour, J. (1990) Introducing Neuro-Linguistic Programming, Crucible, Cornwall

Patching, D. (1990) Practical Soft Systems Analysis, Pitman, London

Reilly, F. E. (1970) Charles Peirce's Theory of Scientific Method, Fordham University Press, New York

Revans, R. (1957) Management and the Scientific Method, Chapter 11 of: Bromley (1982) The Origins and Growth of Action Learning, Chartwell-Bratt Ltd.

Rosenhead, J. (1989) Rational analysis for a problematic world, John Wiley & Sons, Chichester

Russel, B. (1995) History of Western Philosophy, 2nd Edition Routledge, London

Senge P. M. (1990) The Fifth Discipline, The Art and Practise Of The Learning Organisation, Doubleday, New York

Smith, C. T. (1995) Towards a Peircean Framework For Organisational Development, Thesis University of Cape Town

Stacey, R. (1992) Managing Chaos, Kogan Page Ltd, London

Stolovitch, H. D. and Keeps E. J. (1992) Handbook of Human Performance Technology, Jossey-Bass

Strümpfer J. P. (1995) Systems Thinking at Work: Problem Solving, Systems Conference Seminar Notes

Strümpfer, J. P. (1993) Modes of Inquiry: Acquiring knowledge about Complex Phenomena, Course Notes MBA, University of Stellenbosch Business School

Topp, W (1995) The Organisational Change Agent as an Appreciative System, Half Dissertation University of Cape Town

Ulrich, W. (1983) Critical Heuristics of Social Planning, John Wiley & Sons, Chichester

APPENDIX A

A summary from Luc Hoebeke's book on work systems follows on the next three pages. (Hoebeke, Making Work Systems Better, A Practitioner's Reflections, 1994)

NOTE: The application of the Work Systems model makes the critical assumption that the "correct" client is served and that the value and moral system is in order, as its main focus is the design of operations and the related processes to result in the what and how the organisation does for relevance in the marketplace. It does not address the issue of why the organisation does its business and who the clients are.

Process level 1: 1 day to 3 months

Generic transformation process

> "To materialise a specified output (product, service or a combination) with a prescribed means, technology and method in the most efficient way., i.e. with a minimum of waste."

The processes that produce what the client wants are housed at this level, in other words, the viable systems of the organisation,

Basic strategic dilemma

> "Can the required output be realised with a minimum of waste?"
> The demand for efficiency of the basic transformation for meeting a client requirement is satisfied at this process level. Nowhere else can efficiency be achieved."

Control information

> There is a need for real-time feedback about the present state of output relative to the planned output, as well as the waste produced.

Audit information

> Evaluation of the output specifications, the procedures used to materialise them and an analysis of waste patterns generated in the process.

Co-ordination information

> Develop an understanding of practises, procedures and planning related to the activities in the process. A shared understanding of purpose and meaning is essential for synergy with minimal waste.

Development activities

> Group debates to establish the relevance and minimum critical specifications of the output, the input and process.
> These activities are designed to effect more efficient work

Process level 2: 3 months to 1 year

Generic transformation process

The design and deployment of the socio-technical system into effective processes to achieve the customer requirements. These requirements are translated into minimum critical specifications in terms of output, the procedures, tools resource allocation and the required inputs for the performers of the work.

This level is indicated by questions relating to resource allocation and organisation.

Basic strategic dilemma

A critical evaluation of the inputs to the process, the procedures and the tools to continuously consider better means to satisfy the client's requirements. The focus at this level is on effectiveness.

Control information

Two feedback loops have to be monitored permanently: the transformation of the requirements of the client in workable specifications, and the adequacy of the means used.

Audit information

Regular diagnostic procedures must be introduced. The focus of the understanding must be on the fit between the resources made available to process level 1 and the understanding of the client's requirements.

Co-ordination information

Understanding the practices and procedures and general business processes from a systems perspective. Debate is regularly required to facilitate an improved understanding of the processes to stimulate creative contributions for improvements of the efficacy of this level.

Development activities

"All project activities which lead to an improvement of specifications and the resources available on process level 1 belong here."

Process level 3: 1 to 2 years

Generic transformation process

The evaluation of alternative products and services and alternatives for meeting the requirements and needs of known clients. The focus is on achieving the right balance between the ends and the means.

This level is indicated by the question: Why are we doing what we are doing?.

Basic strategic dilemma

Choices have to be made for the allocation of means for the chosen alternative products and services. The question asked is: How long do we wait before we react to changes in our environment?.

The intelligence information system is critical to address this dilemma.

Control information

A systematic follow-up to see if the procedures, tools machines, processes, inputs and outputs are starting to show strange behaviour. Strange behaviour includes persistent trends taking place in the environment. Adaptive or steering actions are decided at this level.

Audit information

Internal audits are no longer sufficient. There is a need for regular attendance at trade fairs, conferences, an evaluation of the way competitors do business, benchmarking, etc.

Co-ordination information/Equivalent to the Intelligence function in the VSM

A systemic understanding of the organisation, its people and its relevance in the environment is necessary for ecological decisions regarding the future. Decisions at this level affect many, which require clarity of the values and principles underpinning the organisation.

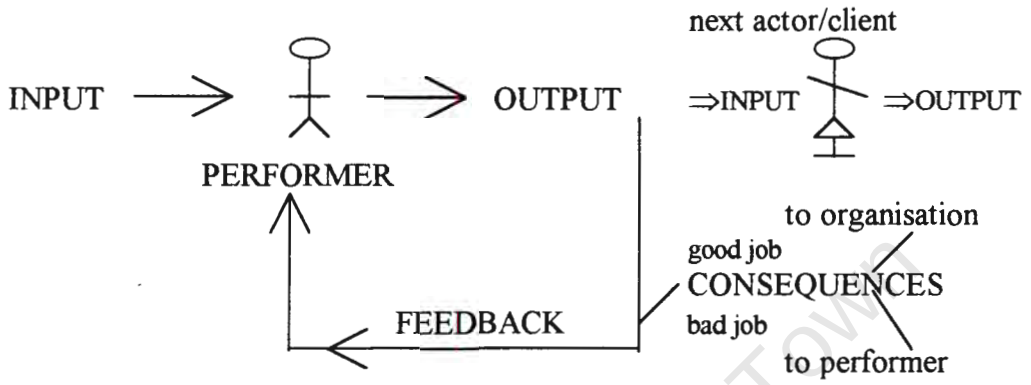
Development activities

Research and development into alternative products and services, alternative markets and the evaluation of alternative technologies and business science are priorities at this level.

APPENDIX B

HUMAN PERFORMANCE TECHNOLOGY (HPT)

The Human Performance System



INPUT: quality, relevance, user-friendly, etc.

PERFORMER: job specification, work structuring, ownership of process, standards

OUTPUT: relevance to next actor, completeness, timeliness, Quality

CONSEQUENCES: for a job conforming /not conforming to specifications
what is the effect on performer/organisation, risk

FEEDBACK: regarding output vs. target, information required to perform tasks
can the performer react to feedback i.e. correct target/output mismatch

FACTORS AFFECTING HUMAN PERFORMANCE:

Work structuring/flow - task interference, group size
Performance specification - purpose definition
Resources - knowledge, skill level
individual capacity: variety, energy
Feedback loops - feedback w.r.t. performance, outputs, feedback for decisions
information for the successful execution of the tasks
Consequences - of a job well done / badly done
to organisation / individual

THE HPT APPROACH TO SOLVING PERFORMANCE PROBLEMS OR DEVELOPING OPPORTUNITIES

STEP 1: Problem, Opportunity definition
Purpose of diagnosis & intervention, scope, cost and time factors

STEP 2: Analysis- **Organisation level**
Which variables at this level affect performance
Which cross-functional process should be examined further

Process level
Determine changes required to processes, product and service line specific
Identify jobs which are key to the performance of these processes and which are to be examined further

Job/ Performer level
What job outputs of which critical jobs are to be improved
What actions are to be taken w.r.t. structure, capacity and standards
What feedback/consequence loops should be changed
Refer to Human Performance System

STEP 3 Design and develop changes

STEP 4 Develop and Maintain
Respect self organising, feedback and variety of the system

STEP 5 Evaluate throughout and check final major evaluation against STEP 1 for effectiveness of the intervention. Provide relevant feedback for all involved with the HPT intervention

APPENDIX C : The proposed Systems Questions (As adapted by Prof. Ryan, UCT, 1995)

SYSTEMS QUESTIONS - **Define:** **Environment-R0**
System in focus-R1
Sub-Systems-R2

SQ1

What is the transformation achieved by the general activity of the system (R1)?
What are the outputs?
What are the inputs?
What outputs are required by the containing system (R0)?
What choice is there regarding outputs? (Include: quality, cost delivery)
Who is affected by the transformation?
Who are the customers (beneficiaries or victims)?

SQ2

What is the purpose of the system (R1)?
Is this the real purpose?
Can other purposes be inferred when observing what the system is actually doing?
What is the desired purpose?
How does it contribute to the purpose of the containing system (R0)?
Who is the owner of the system?
Who can stop it operating?

SQ3

What are the constraints imposed on the system by the environment?
(that which cannot be changed from within R1, or are
assumed as outside direct control due to power, resources, etc.)
Are these real or perceived?
How do they affect inputs and resources?
Are these constraints avoidable?
Can these constraints be avoided by re-describing / redefining the situation (R1, R2, R0) and or purpose?

SQ4

What are the protagonist world views that make the system meaningful and relevant within the organisation?
Are there any antagonist world views?
What language is used in these world views to think about the system?
What are the limitations, assumptions and beliefs contained in these world views and their languages?
What problems do these create?
Can we develop a "meta-language" that would deal with these problems?

SQ5

How does the system (R1) work?
How does it achieve transformation?
What is the human activity system?
What are the processes and activities?
How do they interact with each other?
Who are the actors that carry out the processes and activities?
What are the underlying dynamics?
Which part of the system produces the actual results rather than the espoused results?

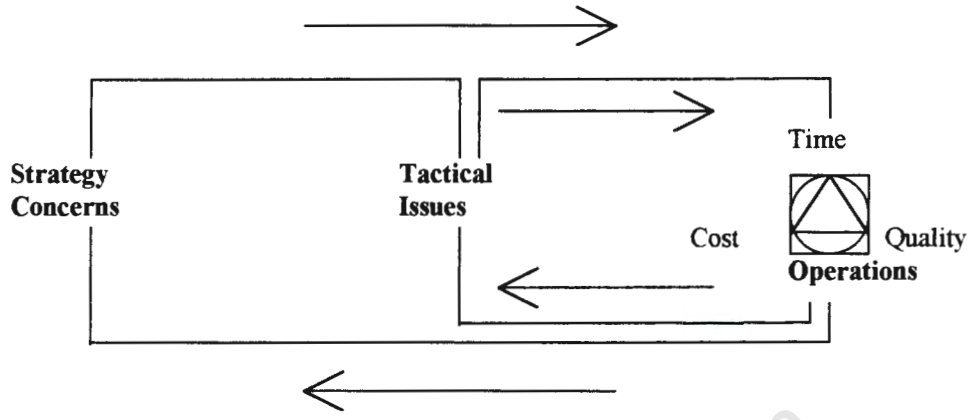
SQ6

What are the purposeful parts (actors, consumers, owners) in the system?
What self-organising tendencies do these have, how is power exercised, who has power (espoused and real)?
What are their goals and aspirations?
What are the social/cultural norms and values?
What are the organisational/technical imperatives (constraints such as rules, commands, etc.)?
(Level 3 ⇒ Level 2 ⇒ Level 1, as per Work systems process levels)
How does the system interact with its environment?
What are the feedback loops?
What are the rewards and punishments?

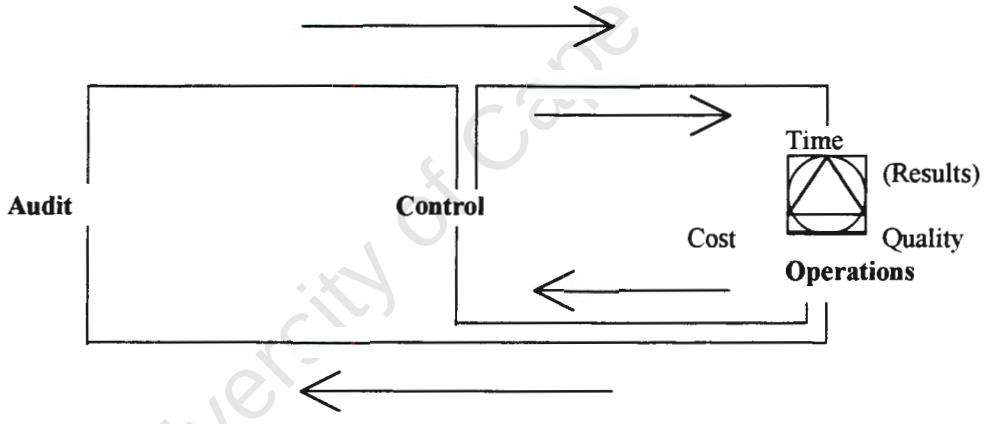
APPENDIX D

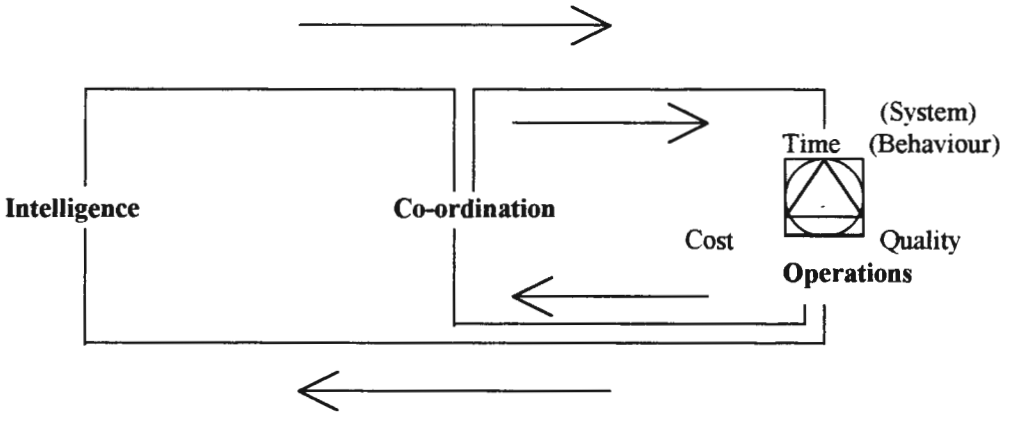
FEEDBACK LOOPS

Feedback Loops:



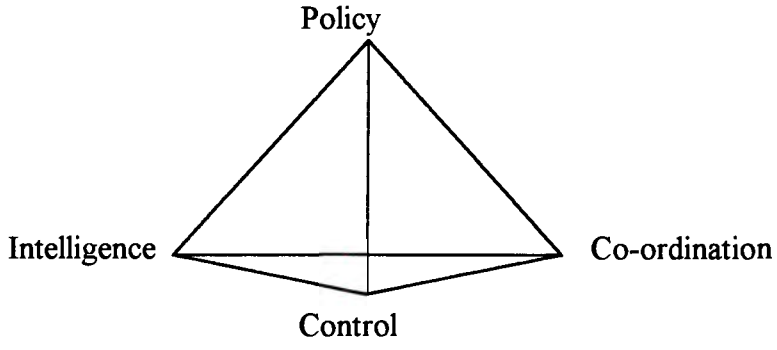
INFORMATION PROCESSES

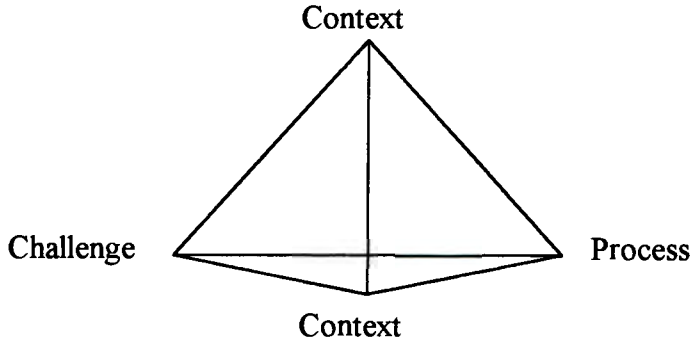


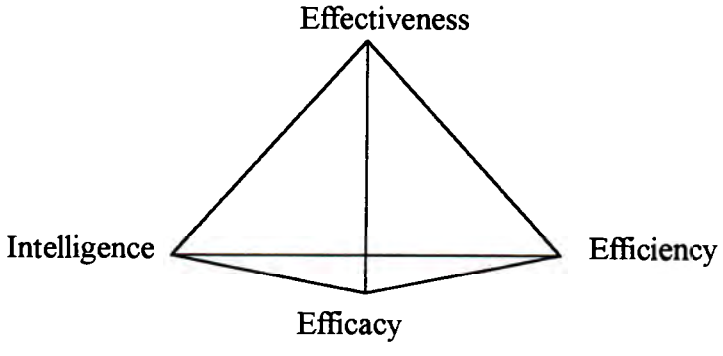


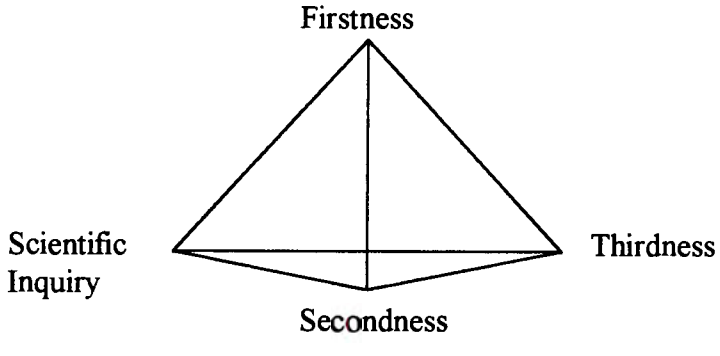
APPENDIX E

Tetrahedrons









APPENDIX F

KEY USER

Key user selection is critical as they represent the users of a specific business area. Input is given on the type of information needed and to some degree how it is presented. These individuals are lifted from their usual tasks and expected to contribute as full members of the project team. Other members of their department carry some of their normal workload, with the key users responsible to maintain some of their organisational work while being on the project.

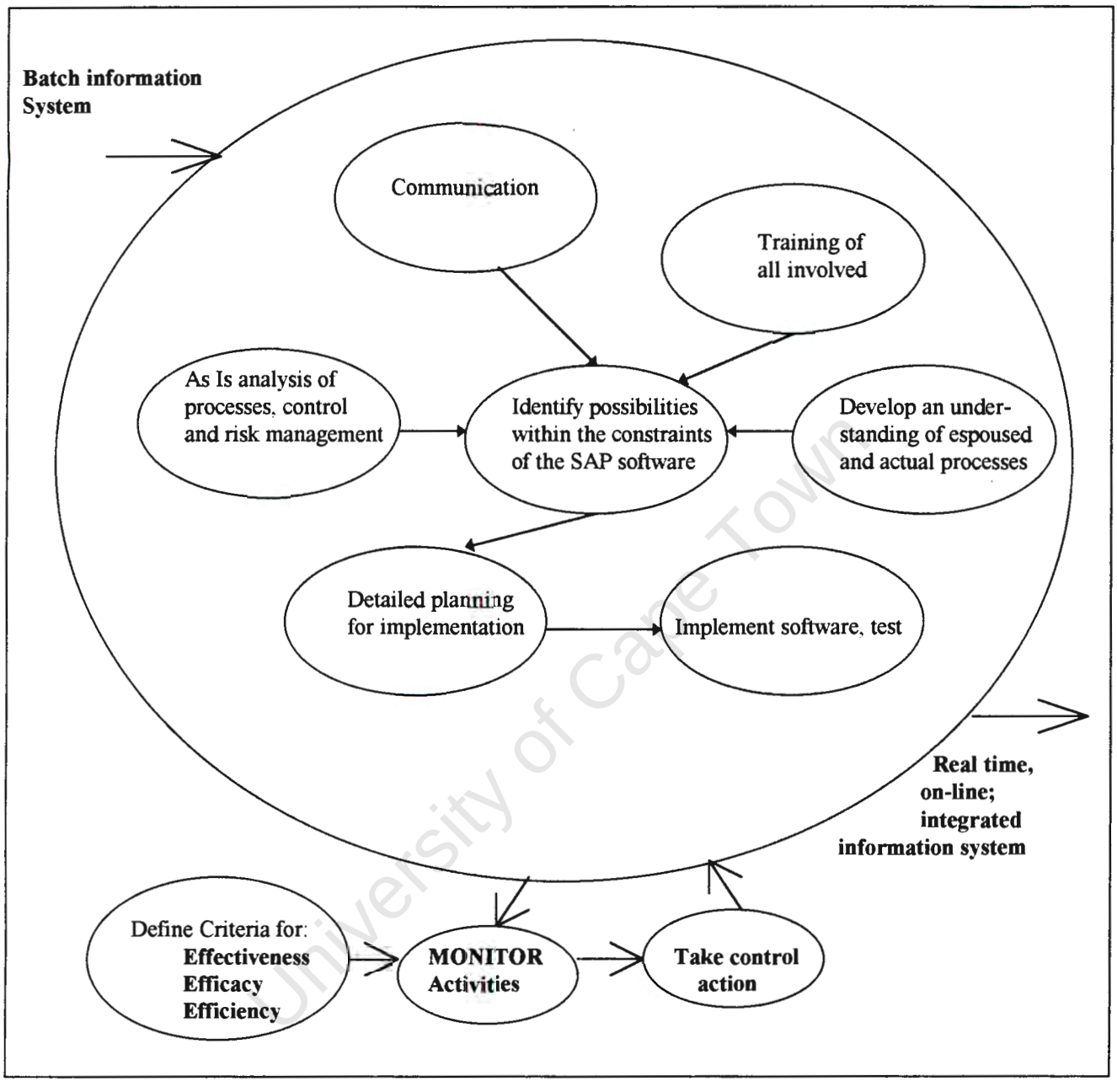
Customers- Victims-the "if it works, why change it" people, certain jobs become obsolete, negative personalities
Beneficiaries- Organisation, Shareholders
Actors- Project team, users
Transformation-Batch Information System (duplication of data entry) ⇒ Real time, on-line, integrated IS (one time data entry)
World view- The SAP information system provides information that is needed and when it is needed, a guide for Business Re-Engineering
Owners- The project team and in some cases, those with specialised SAP and Information System and Technology knowledge

Environment- Functionality of the SAP Information System

ROOT DEFINITION

The SAP implementation is a system to provide relevant, accurate and timely information to the organisation with one information system requiring one time data entries, and is a useful framework for a Business Re-Engineering process, effected by a project team and the information system users within the constraints of the software functionality. The implementation process, controlled by the project team and individuals with specialised knowledge, improves the working effectiveness and efficiency of the organisation, which improves the value of the business to the shareholders.

KEY USER Activity System



BPR SPECIALIST

The Business Process Re-engineering process is a joint effort of qualified individuals in the organisation, often with some input from outside consultants, especially regarding the constraints of the software on the choice of processes. Tasks include a thorough evaluation of current processes and their performance measurements and their adaptation and/or the design of new processes and measurements. Specifications for processes are communicated to the technical team, who translate and implement these processes in the system as SAP compatible activities and routings.

Customers- General organisation, users, shareholders
Victims- Those affected by: Shifts of control from central to decentral
The new transparency on information
The pressure of volunteering information
Changes in job relevancy
Direct Beneficiaries- Managers can get real time information

Actors- Project team, key users of old Information System, Executive committee of organisation, SAP support people outside formal project team

Transformation- Current processes and batch type IS ⇒ New processes and real time, on-line, integrated IS

World view- The SAP software provides the most appropriate information to managers for control decisions

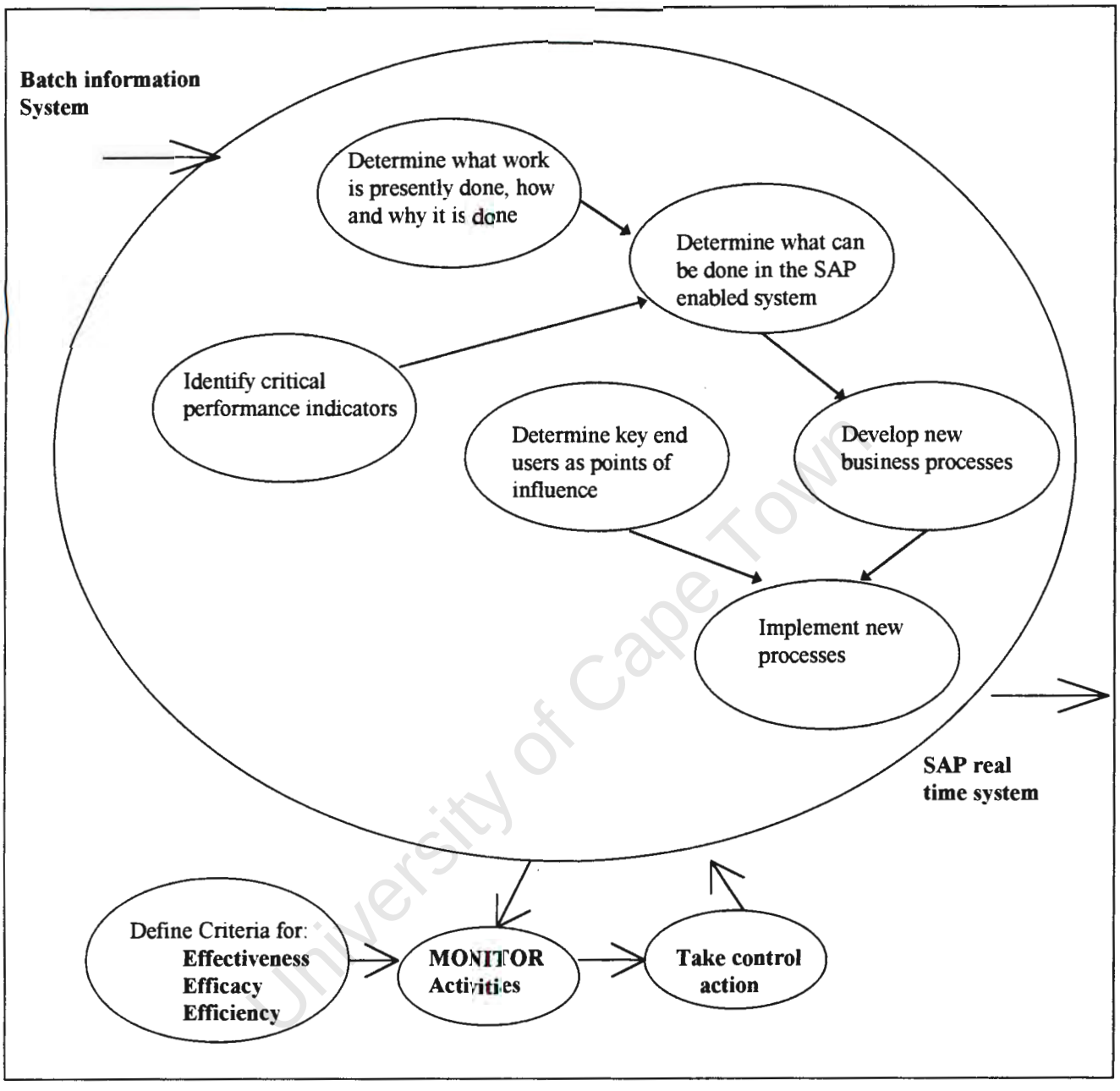
Owners- Executive committee of organisation, sponsor

Environment- Current organisational power structure, software functionality

ROOT DEFINITION

The SAP implementation is a system, controlled by the executive committee and the project sponsor, to effect an IS, through the actions of a project team and key users, that provides the most appropriate information to managers for decision making. The implementation is done within the constraints of the software functionality and the political environment of the project.

BPR SPECIALIST Activity System



PROJECT MANAGER

The role of project manager is similar to general project management, with the added level of unpredictability and uncertainty associated with the implementation of such a comprehensive and sophisticated information system and the newness of the very latest technology. Further challenges include the presence of so many experts and specialists on one project as well as the ever present resistance to change in any social system.

Customers- End users, internal and external auditors, Executive Committee
Victims- All people going the extra mile for the project, key users

Actors- Project team: Current Management Information System (MIS) people
Key users
Consulting partners
Project manager
Executive Committee and Sponsor
Auditors
BPR and OCM specialists
Stand-in staff for the work neglected by the project members dedicated to the project for the implementation period

Transformation- Business processes enabled by current legacy (batch) IS ⇒ Best business practises supported by SAP IS

World view- SAP provides a transparent information system, standard across the enterprise, with a financial system that is reconciled on a real time basis (always in balance), thereby enhancing the global competitiveness of the business.

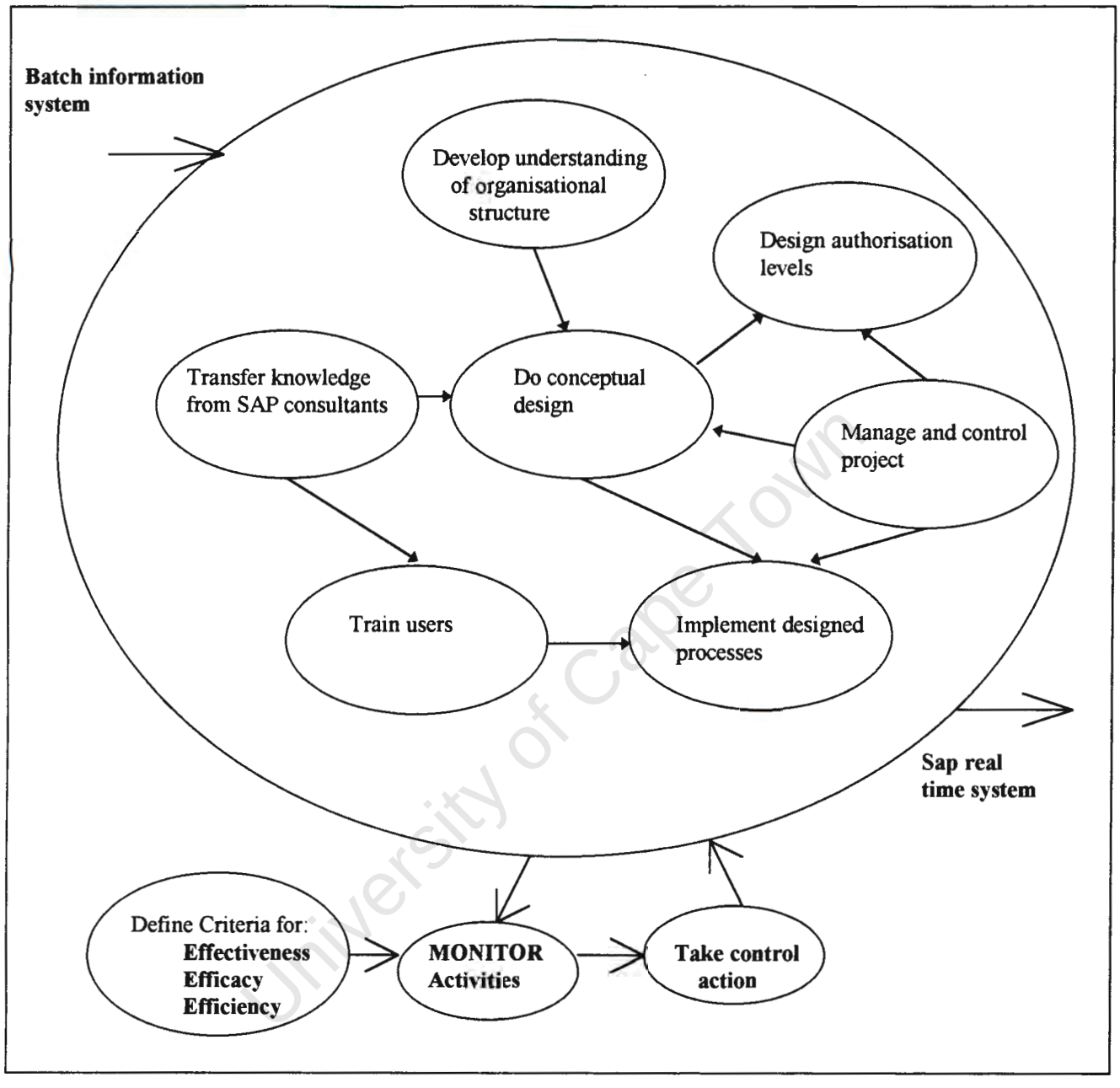
Owners- Steering committee, project sponsor

Environment- Budget, software limitations, SAP skill level available in South Africa, choice of modules, initial quotations for implementation cost often low due to a poor understanding of SAP implementation projects

ROOT DEFINITION

The SAP implementation is a system that transforms the information system to a real time, on-line and integrated system, through the actions of a project team, system users and support from the rest of the organisation, under the control of the project sponsor and the approval of the steering committee of the project, to increase the global competitiveness of the business through quality information for decision support, within the constraints of the software functionality, the allocated budget and the available SAP skills in the country of implementation.

PROJECT MANAGER Activity System



OCM SPECIALIST

Various descriptions are given to the tasks of the Organisational Change Management specialist. It includes managing the social change during the project, establishing the training and education needs required by the new system, determining the criteria of the end users that can be of value to the system designers, create "buy in" of the users and the maintenance of the communication system of the project. Organisational change management are often stated as a critical component of a successful project, but is often secondary to technical expertise in practise.

Customers- Senior management, end users, shareholders
Victims- people filling in for project members
Actors- Project team, sponsor, Executive Committee, users

Transformation-

Current level of skills in organisation supported by batch information	⇒	Higher level of skills supported by SAP information

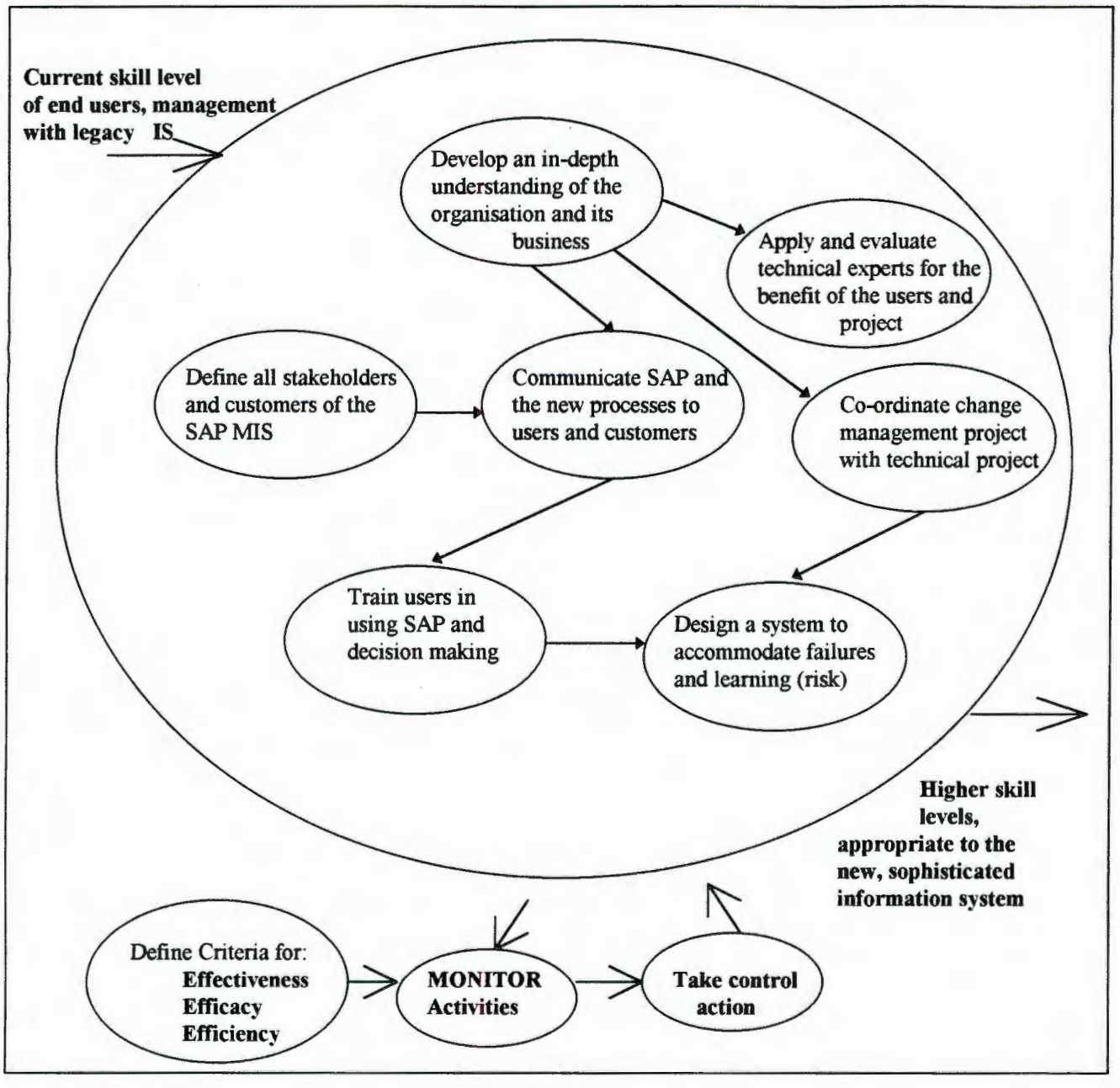
World view- SAP software provides a progressive step towards first world technology
Owners- Project sponsor, senior management

Environment- Software functionality, budget, resistance to change

ROOT DEFINITION

The SAP implementation is a system that transforms the skill levels of the human system in the organisation to a generally higher level, enabled and required by the resulting information system. The implementation of the new system is done by a project team interacting with system users, with the approval of the project sponsor and senior management, and within the constraints of the software functionality, budget allocation and resistance to change, to enhance the effectiveness and efficiency of the organisation. through first world technology.

OCM SPECIALIST Activity System



SAP DEVELOPER

SAP generally attracts employees with a high level of academic intelligence for the development teams. The specific developer included in the inquiry process has an interest in the effect of the software system design on the end users.

Customers- End users, organisation (business processes), management (scope of control)

Actors- Project team, senior management, BPR and OCM specialists, users, SAP support

Transformation-*(End user)*

Multiple MIS	⇒	Single MIS
Focus on information		Focus on tasks

(Organisation)

Current business processes	⇒	SAP based business processes

(Basis of control)

Batch information	⇒	Real time information
History based decisions		Real time decisions

World view- SAP provides a single information system that shifts the emphasis away from locating information towards the activities of the business and decision making based on accurate and real time information

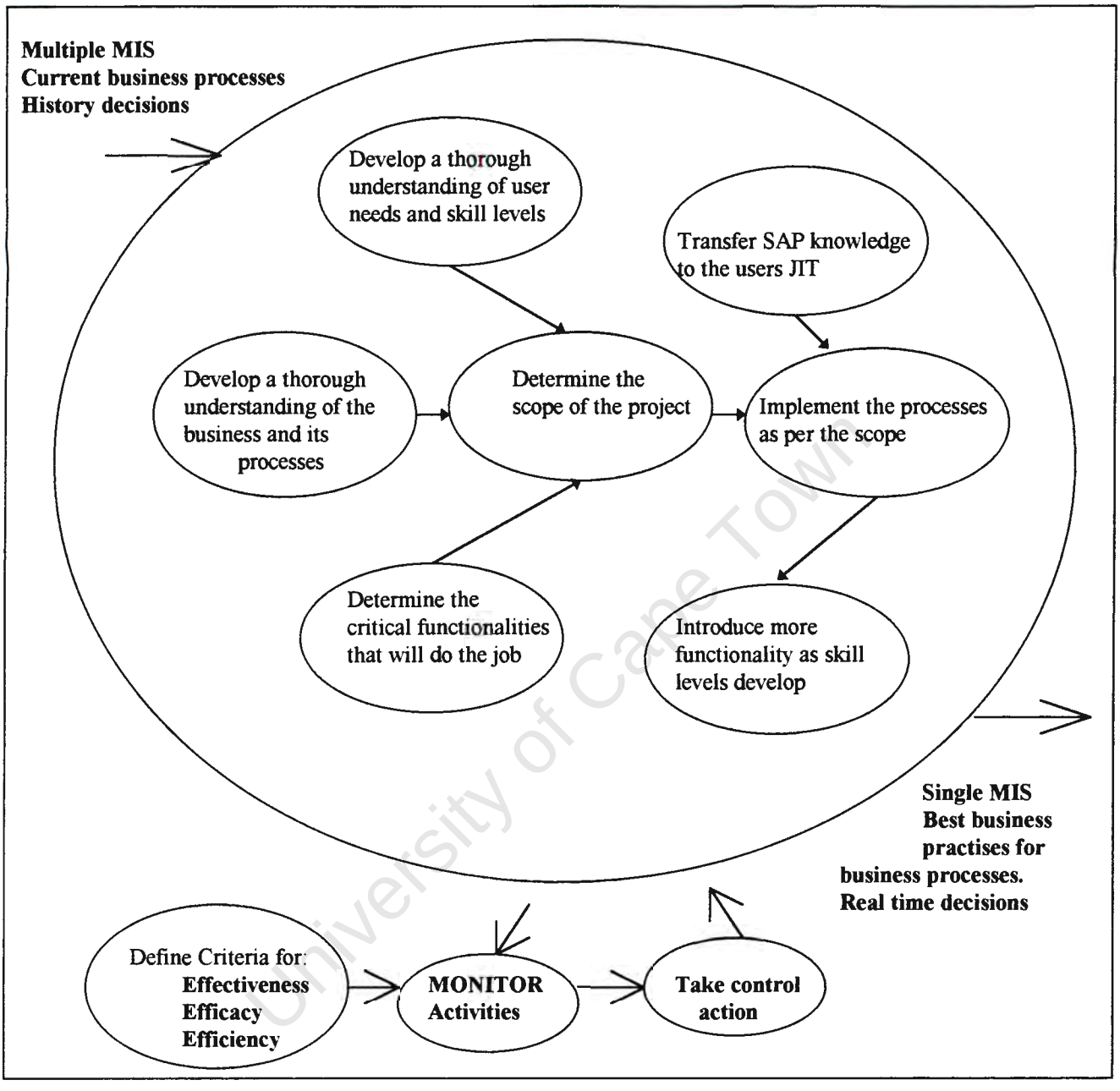
Owners- Project team, organisation (Steering committees, sponsor), Ultimately the key end users

Environment- Software functionality, budget, resistance to change (decentralisation of decision making power)

ROOT DEFINITION

The SAP implementation is a system that provides the capacity for the organisation and its MIS users to focus on the business tasks and decision making enabled by appropriate, accessible and real time information, with the support of best business practises. The implementation is controlled by the senior decision makers of the organisation and the key users interacting with the project team, within the constraints of the software functionality and the willingness of the key people in the organisation to change the methods and scope of control.

SAP DEVELOPER Activity System



SAP SENIOR CONSULTANT

One of the challenges in South Africa is the lack of senior experienced SAP consultants. Many of the local consultants use their new marketability to work in other countries to earn stronger currencies. On this project the team was fortunate to have a senior person not only with consulting experience, but also with a strong background in development of the software in the financial controlling and profitability analysis modules. The idealised task for a senior consultant is that of general strategic guidance and quality management.

Customers- End users, all levels of management, SAP(possible reference client)
Shareholders
Victims: Lower skill levels, those who did repetitive data capturing

Actors- Project manager and team, Key users, OCM and BPR specialists, management consultants, SAP Partner consultants, SAP support consultants, IT consultants

Transformation-

Current business processes and performance measurements	⇒	SAP supported business processes and performance measurements
Batch information		Real time information

World view- SAP provides an environment that raises the skill level of its users by automating repetitive tasks and leaving decision making for the people, by access to real time information in one integrated information system

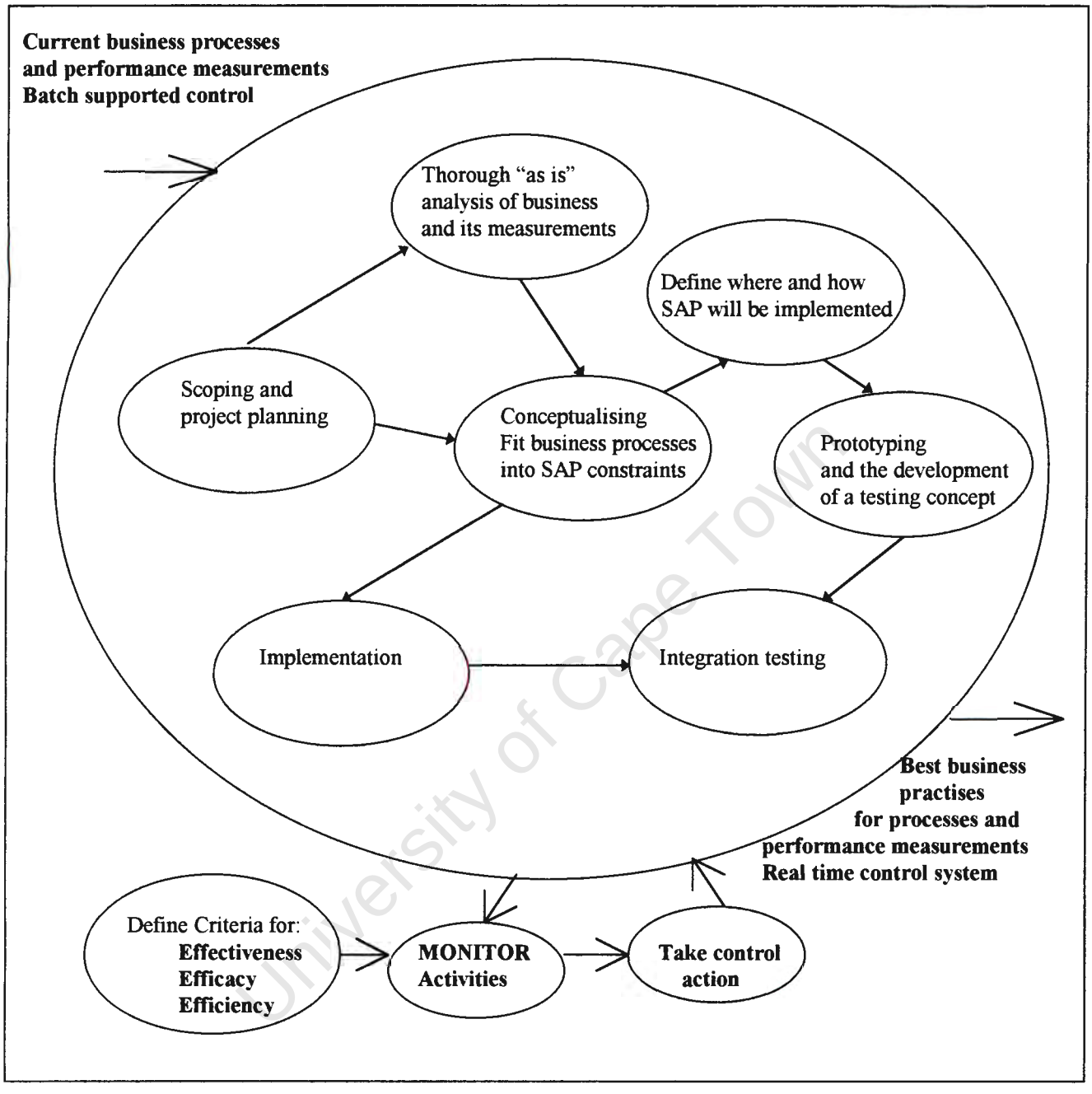
Owners- Client project manager, project sponsor, steering committee (depending on knowledge and power structure)

Environment- Skill level of project members and system users
Availability of SAP project people
Software releases and delivery times
Hardware chosen
Budget allocation

ROOT DEFINITION

The SAP implementation is a system that provides the management and system users with an accurate, integrated and real time information system that requires one time data entries, thereby reducing the margin for human error and raising the general skill levels of the employees in the organisation by shifting work from repetitive tasks to decision making. The project team develop and implement business processes as supported by best business practises in SAP, with the approval of the senior management and the project sponsor, within the constraints of software functionality and delivery.

SAP SENIOR CONSULTANT Activity System



IT MANAGER

The IT manager and the people in the department are particularly threatened by the new system. External consultants enter their work domain and take away a large portion of their control in the organisation by the implementation of a standard system. Many may lose their relevance in the work force with respect to the old IT functions, unless they use opportunities in the new system and create a new type of relevance for themselves. IT managers develop and co-ordinate the technical basis for the client server system.

Customers- Victims: Original IT people, especially those not directly involved with SAP Organisation, shareholders

Actors- IT people, project team and manager, Executive Committee (Excom)

Transformation-Management skills required by current system for control ⇒ Higher management and general skill levels within the SAP enabled system

World view- SAP makes it possible to disseminate real time information to all levels

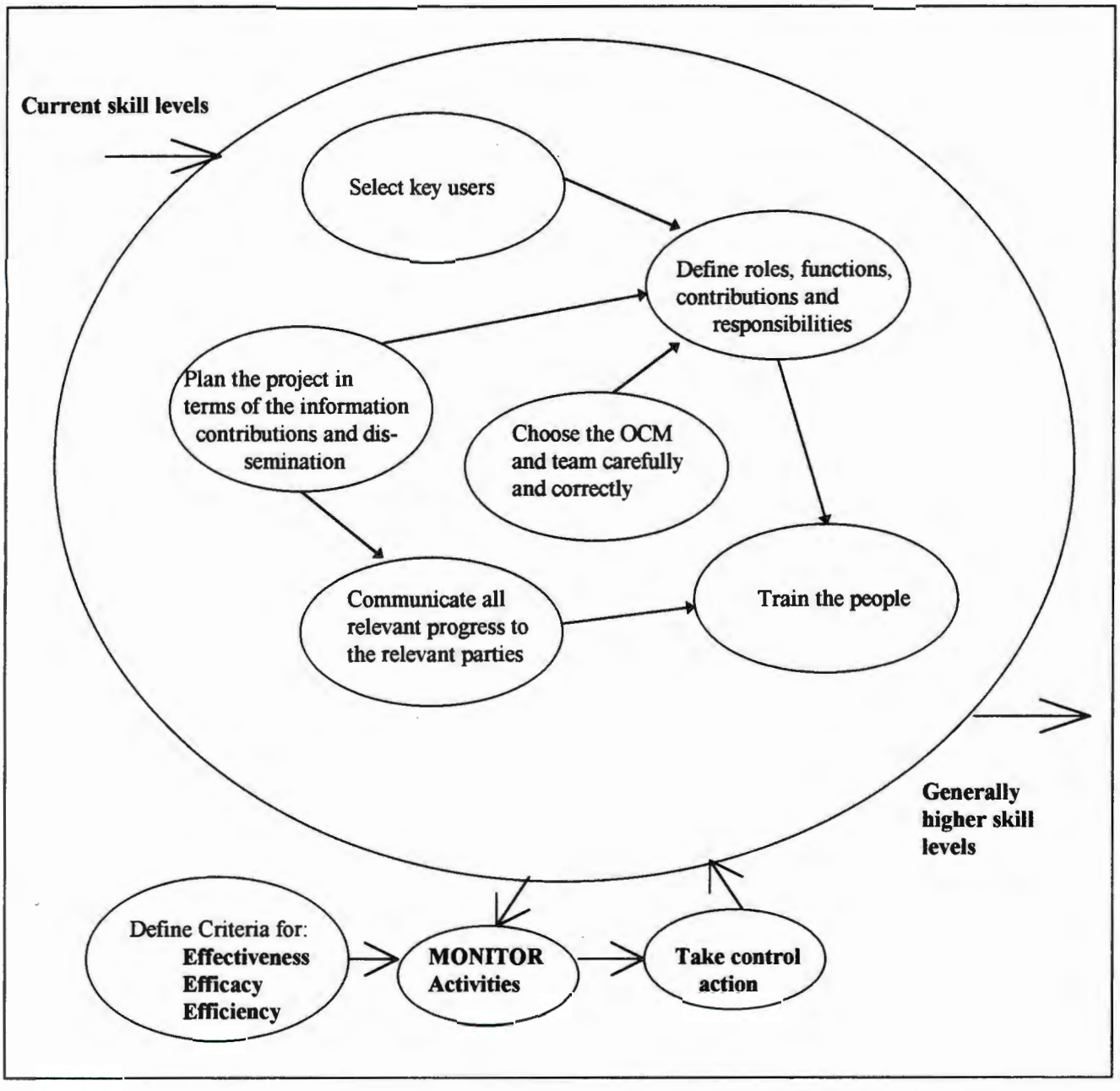
Owners- Project sponsor, Project team

Environment- Continuous changes and upgrades to the software, functionality

ROOT DEFINITION

The SAP implementation is a system that raises the management and general decision making levels in the organisation through the implementation of an integrated, real time information system and the best business practises it supports regarding business processes and measurements. The project is executed by the project team interacting with the IT people and key users, controlled by the project sponsor and project manager, within the constraints of the software functionality and the regular upgrades released by SAP AG (Head Office).

IT MANAGER Activity System



KEY USER

ACTIVITY PLANNED	ACTIVITY ACTUAL *(how well was it done?)*	**Suggestions for value-adding actions, possible improvements**
Communication	Generally good, with some gaps of communication to and from the extreme ends, end users and top management	Ensure top management is always kept up to date, end user participation critical not only for buy in, but validation
Train users	Generally well done, with some problems regarding the time allowed, too short	Carefully select delegates and plan training early to ensure the right skill level for the system users
Do as-is analysis of processes, control and risk management	Generally well done, with gaps appearing later in the project due to neglected areas	Use a rigorous approach of checking the validity and accuracy of the processes presented to the project
Identify possibilities within the constraints of the SAP software	The success varied with respect to the experience of the SAP consultants	Insist on quality consultants and quality time and communication regarding experts
Develop an understanding of espoused and actual processes	Some processes were done differently than designed, this presented no big risk in the old system, but with real time and integration, it is a risk	Ensure that the users understand and agree to the designed processes Ask for continuous validation
Do detailed planning for implementation	Well done generally.	Care has to be taken to check the accuracy of the "as is" information
Implement system and test	Went well, had one loose cable causing a scare, not critical	Ensure the presence of qualified people during uploads

BPR SPECIALIST

ACTIVITY PLANNED	**ACTIVITY ACTUAL** ***(how well was it done?)***	**Suggestions for value-adding actions, possible improvements**
Determine what work is presently done, how and why	Not well. Done by managers who are too far from where it happens on the floor	Prepare detailed documentation of "as is" processes and obtain validation from the operations supervisors that the documentation is accurate and complete
Identify critical performance indicators	Not done. The old measures were just duplicated in the new system	From the top down build indicators for all levels, approved by senior management. Include juniors in the process for "buy in"
Determine which key end users are points of influence	Hardly done. The system was developed in a "lab" environment and given to the users without their choice	Determine key users for each process and use them throughout to validate the BPR.
Determine what can be done in the SAP enabled system	Limited, the SAP consultants had limited knowledge and could not fulfil my requirements	Put more pressure on SAP consultants for performance. Have a more structured approach to "gap" analysis(SAP and business)
Develop new business processes	Average success We replaced what we had with SAP, one or two new processes	Have a more critical look at current processes, are they necessary? People on the project should have more power to change and improve business processes
Implement new processes	Reasonable, not enough communication with end users	Keep end users updated throughout the project, have them continuously validate the design of the system

PROJECT MANAGER

ACTIVITY PLANNED	ACTIVITY ACTUAL *(how well was it done?)*	**Suggestions for value-adding actions, possible improvements**
Develop an understanding of the organisational structure	Generally well done through workshops	Critical to the success of the project that team members understand the organisation structure, as well as SAP structures-this is the challenge.
Design authorisation levels	Was complex, major learning curve for basis team and key users. Requires audit input and is very time consuming, but critical for system security	Allocate more time Key users need to understand concepts. Co-ordinate carefully the basis, key users, BPR, OCM team members Develop software to automatically check unauthorised access
Do conceptual design	Generally well done, with much attention paid to structures	Establish gaps between planned processes and SAP functionality. Do not shortcut, it requires an in-depth business knowledge, essential to match with SAP
Transfer knowledge from SAP consultants to users and project team, IT personnel	Average success, "playground" SAP system not utilised well enough for user learning	Key users must learn from SAP consultants-in depth knowledge Ensure end users use "playground" simulation to learn functionality Manage resistance and fear of change
Manage and control project	Major co-ordination task of project issues, control. Seems to have been successful	More focus on authorisation and reports. Maintain close liaison with project sponsor
Train users	Some training too early, lost the benefit by the time the system went live	Major role played by OCM Critical to develop training manuals Identify users and their skill levels Start early to allow for repeats SAP and computer literacy training
Implement designed processes	SAP best business practices often lead to changes to existing processes, some resistance from senior management	There are no sacred cows, change whatever is best for the organisation Essential to get agreement from top management before the project starts on a "change" policy

OCM SPECIALIST

ACTIVITY PLANNED	**ACTIVITY ACTUAL** ***(how well was it done?)***	**Suggestions for value-adding actions, possible improvements**
Develop an in-depth understanding of the organisation and its business	Fairly well done, identification of group technical was left too late regarding Project Systems	Do proper visioning, planning Insist on quality guidance from SAP experts
Define all stakeholders and customers of the SAP MIS	Generally well done, with the exception of the late identification of users in two areas	As above
Communicate SAP and the new processes to users and customers	Well done, but can definitely improve	Add internal SAP letter to the current "Food for thought" magazine
Apply and evaluate technical experts for the benefit of the users and project	Well done, good skills on project, however towards the end of phase 1, experts did not give enough support	Change time scale of implementation Stick to project plan regarding activities and responsibilities
Co-ordinate change management project with technical project	Generally well. Integration should have been completed earlier for an earlier start of training	Earlier integration testing
Train users in using SAP and decision making	Not enough time allowed for follow-up training. General extent of training well covered	Start training earlier Monitor users on the simulation system prior to going live Test competency levels of users
Design a system to accommodate failures and learning (risk)	OK, but often waited for decisions from management Control of project by minority, which is reflected in the decision making process	Project members to have more decision power within reason Decisions involving the executive committee and the steering comm. to be quicker and more definite

SAP SENIOR CONSULTANT

ACTIVITY PLANNED	ACTIVITY ACTUAL *(how well was it done?)*	Suggestions for value-adding actions, possible improvements
Do a thorough "as is" analysis of the business and its measurements	Some areas had BPR done prior to SAP implementation. As is processes were well defined. In some other areas processes were forgotten, to be corrected later	Thorough training of people in BPR, Define what is a process Early integration will show missing processes
Do scoping and project planning	Well done even in the short allocated time Only one area was added to the original scope	During scoping, look for opportunities to reduce the costs by combining the implementation of a module in several areas. For this the users have to be available for all areas as required
Define where and how SAP will be implemented	Well done, where possible, modules were implemented in multiple areas with a budget saving. Where users were not available, the areas were left out, with resulting higher costs	Be careful not to implement in too many areas, as end user training requirements are often underestimated
Conceptualising: Fit business processes into SAP constraints	Well done, with the total commitment of top management Re-engineering was necessary with fast decision making processes	Select key users carefully for this phase, as they have a high impact on the success
Do prototyping and the development of a testing concept	OK Some teams had to be reminded to leave out nice to have functionality to save time Some users were not computer literate enough	Select key users carefully Consultants should be able to determine which functionalities to leave out if users cannot cope
Implementation	Well done due to good planning and sticking to the dead lines	Enough time must be provided for training and the technical implementation
Integration testing	Well done, however people had to be convinced of the importance of thorough test documentation. This enable easy repetition of the testing	Integration testing is often neglected The consultants did the testing, which should be done by the customer as the owner of the system. It also improves the user's understanding of the complexity of the system

IT MANAGER

ACTIVITY PLANNED	ACTIVITY ACTUAL *(how well was it done?)*	**Suggestions for value-adding actions, possible improvements**
Selection of key users	People are usually chosen on the basis that they have at least a remote involvement with a function	Key user must have minimum qualifications: technically versed, computer literate, understand processes, personality to influence end users
Clearly define roles, functions and responsibilities of the project team	Not thorough enough Positions filled rather than contributions satisfied	Offer basic training for the members of the project team to understand roles, functions and responsibilities
Plan the project with respect to information contributions and dissemination	Team managed too autocratic	Select and empower a diverse team with people able and assertive enough to contribute
Choose OCM carefully and correctly	OCM a technocrat who produces lots of documents and training requirements. Training manager is usually not fit for this type of project	OCM functions: Consistent communication Stipulate requirements of users w.r.t. hardware, information, training, gaps Report to project sponsor Have high enough status
Train people	Most training was good, but the timing bad (too early) and the choice of training delegates were often wrong	Do a thorough evaluation of trainees and their requirements Check the requirements at the management level for validation