STRATEGIC ALIGNMENT

An Approach to the Harmonisation of Business and Information Systems Strategies

A Thesis submitted for the Degree of Doctor of Philosophy

by

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May 1998

Abstract

Information Systems are fundamental to both the day to day operations and competitiveness of most organisations. As the rate of change in organisations continues to increase this dependency has become more critical. However methods for determining the Information Systems that an organisation needs have not moved forward to reflect these increases in organisational turbulence and new capabilities offered by Information Technology.

Strategic Alignment is proposed as a new method for Information Systems Planning which recognises the dynamic role of Information Systems as an agent of change and to enable organisations to model and determine how Information Systems can be exploited to improve and transform Business Strategies. Important innovations in the method are incorporation of feedback to ensure that analysis of the interaction of the Information Systems and Business objects within the model is bidirectional. Also that the development of an Information Systems Plan is a complex process which has to be modular. This enables it to incorporate existing results and information where applicable and to deliver its results incrementally. The Strategic Alignment Method has been developed from extensive research which used the Electricity Supply Industry as the source of information because it was facing immense change after its privatisation. As a result detailed case study material is presented as well as the Strategic Alignment Methodology.

Maintenance of an Information Systems Plan is also addressed. Once an Information Systems Plan is produced, its implementation can take a number of years. During this time the changes in Business Strategy and Information Systems capability will change. Strategic Alignment proposes methods that will ensure the ongoing harmonisation of the Strategies during the implementation of the plan.

The practical nature of the research is reflected in the Addendum which describes the work that has been done to incorporate Strategic Alignment into ICL's services methodology and to train ICL Consultants in its use.

Contents

Acknowledgements

The research that produced this thesis would have not been possible without the support and faith of a large number of people.

The faith in me displayed by Neil Bagshaw and David Teague, my managers in ICL, to allow me to go to Brunel University was instrumental in starting the work. Also the faith that my supervisor at Brunel University, Professor Gerry Musgrave, showed in letting me decide to research exactly what I wanted was very significant. I hope that these people feel that the results have justified their commitment.

During the research I was supported by a number of people to whom I owe a great deal. Two are especially significant. The first is Hugh MacDonald, formerly of ICL, who introduced me to the original ideas of Strategic Alignment and encouraged me to take them further. The second is Gerry Musgrave who encouraged me throughout the whole time and forced me to think very hard about what I was doing.

Finally, I must thank my wife, Liz. She supported and encouraged me throughout the whole of the research, helped me through periods of doubt when I thought that I would never get it done and gave me the physical and mental space to do the work.

Table of Acronyms

BSP	Business Systems Planning
CRUD	Create, Read, Update, Delete
CSF	Critical Success Factor
DAMS	Distribution and Asset Management System
DITS	Developing Information Technology Strategies
DSM	Demand Side Management
ESI	Electricity Supply Industry
ESKOM	Electricity Supply Commission
GIS	Geographical Information System
I.S.	Information Systems
I.T.	Information Technology
JIT	Just in Time
JV	Joint Venture
KPI	Key Performance Indicator
LSDM	Logical Systems Design Method
MIT90s	Management in the Nineties
NORWEB	North West Electricity Board
REC	Regional Electricity Company
ROI	Return on Investment
SAP	Strategic Alignment Process
SECV	State Electricity Commission of Victoria
SISP	Strategic Information Systems Planning
SSADM	Structured System Analysis and Design Method
UKLF	U.K. Land Forces
YEG	Yorkshire Electricity Group

Chapter 1. Background

1.1 The Problem to be Investigated

Information Systems, I.S., Planning has been available since the early 1980s. A number of methods had been defined to develop I.S. plans; the more popular of these having met with significant success and wide use. They also have evolved during the last 10 years and have become much more comprehensive methods. This process of evolution has also become a process of convergence, whereby those that were heavily Information Technology, I.T., oriented have taken on a business capability and the business oriented methods have a strong I.T. flavour.

Despite this evolution, I.S. Planning has lost some of its earlier popularity. The reasons not particularly easy to discern, especially because I.T capability and the use of I.S continued to accelerate. The indications were that organisations were finding that existing I.S. Planning methods were cumbersome and inflexible to use, so they were no longer responsive to organisational needs that were changing at ever increasing rates.

Nevertheless a major research programme, Management in the Nineties, MIT90s, run by the Sloan School of Management, [Scott-Morton, 1991] identified that I.S./I.T. was the key factor that would enable organisations to compete successfully in an increasingly turbulent business environment. The programme further suggested that the alignment of Business and I.S. Strategies was the essential first step for an organisation wanting to effectively use I.S./I.T. to manage its way through a turbulent business environment.

The problem therefore was that existing I.S. Planning methods were no longer adequate for their purpose, yet their need and importance was increasing. To solve this problem a new approach to I.S. Strategy Planning was necessary. It had to overcome the limitations of past methods, but retain their positive aspects, and develop the ideas that were emerging from new research such as MIT90s.

1.2 Historical Perspective

1.2.1 Development of I.S. Planning Methods

The earliest attempts to develop methods for planning information systems can be traced back to the late 1970s. At this time the first reliable integrated database management software was becoming widely used. Organisations, as a result, realised that data was often common to more than one application and could be shared if stored in a database. Until this time applications had tended to be developed as individual systems, supporting the needs of a single department or business function.

The implication of this change, which was essentially a move from Stage 1 to Stage 2 in Nolan's 4 Stage I.T. Growth Model, [Nolan, 1979], was that data was now a corporate asset and had to be planned as such. If a database was to support a set of applications then some planning of these applications was necessary.

However the early attempts at I.S. Planning were all data oriented. Much of the early thinking in this area can be traced back to the concept of the Strategic Data Model as suggested by Gane and Sarson [Gane and Sarson, 1979]. This proposed that a single model which defined all the data needed by an organisation should be produced.

Methods which achieved this rapidly followed and fell into the generic heading of Data Analysis. The work of Rosemary Rock-Evans [Rock-Evans, 1981] in defining how to carry out a data analysis study emerged as the most influential of a number of very similar approaches.

It took two further developments to rationalise and formalise these early approaches. The first [BCS, 1979] was the splitting away of the logical data models from the physical versions in Data Dictionaries that were independent of the Database Management Systems. This increased the focus on data modelling and removed it from physical database design. The second was the requirement of the UK Government, defined by the Central Computing and Telecommunications Agency, for a single data analysis methodology. This emerged as a method called Structured Systems Analysis and Design Methodology, SSADM, [SSADM, 1981]. SSADM's success was certain because the of the Government insistence on its use for all of their I.T. projects. In turn this led to its adoption by a large number of other organisations, both in the public and private sector. Also there emerged over the following years a number of variants, such as Logical Systems Design Method, LSDM, and Integrated Systems Design Method, all of which enjoyed success. LSDM for example was adopted by the Electricity Industries I.S. Steering Group as the industry's standard method.

All of these methods were oriented to the definition of information systems and paid very little attention to the business requirement. The only exception to these methods was IBM's Business Planning System, BSP, [IBM, 1984]. BSP used a top down business planning method which was linked to a bottom up data modelling and I.S. development method. It also recognised and incorporated ideas proposed by the Nolan 4 - Stage I.T. Growth Model [Nolan, 1979].

Whilst these approaches all worked within their parameters, they nevertheless had serious limitations. These are discussed in the next section.

1.2.2 Limitations of Earlier Methods

The underlying problem about these early methods was that they had been developed by I.T. specialists. They therefore tended to focus on technology and systems and ignore the business aspect. Retrospective examination of these early I.S. planning methods is normally by comparison with subsequent developments and methods and as a result can be relatively subjective. It has to be remembered that SSADM and BSP were very successful over the best part of a decade and some of the tools and techniques they employed are still be used by todays methods. An example of this is Entity Modelling. Whilst "Data Architecture" is the term in wide use today, many data architectures are still constructed using Entity Modelling techniques.

SSADM and its derivatives were limited by the fact that they were data oriented. Their purpose was to produce a corporate data model which would be logically broken down into a set of application models. Each of these was defined to support a set of business functions. The problem was that the tools for defining the business functions were data oriented; for example Data Flow Diagramming, which was the nearest the method got to process engineering; and Entity Life Cycles. Little regard was paid to whether the application would support the business objectives, the focus was on automating the existing process. The systems that resulted from an SSADM project tended to be very good at improving efficiency whilst maintaining the organisational status quo.

BSP on the other hand does link business objectives with information systems and seeks to deliver an I.S. strategy plan that is supportive of the business' needs. When initially introduced in the early 1980s its capability was very limited. By 1987 however, the version then in use was much more sophisticated and comprehensive, having incorporated such techniques as Value Chains, and could be regarded as a full Strategic I.S. Planning, SISP, method (see Section 1.3).

It still had serious weaknesses in a number of areas.

1. Integration of its Various Elements.

   BSP had 10 discrete steps, 2 were concerned with the business strategy, and the rest were concerned with I.T.. Linking the outputs of business steps to other steps was not well defined.

2. Focus of the Study

   Despite its start point of enterprise modelling, this part was superficial and attention was rapidly focused in I.S.

3. Process

    To carry out a BSP was a difficult and lengthy exercise. It required a level of commitment from the organisation which was felt to be excessive by many of the organisations which undertook a BSP. This problem was highlighted by Lederer and Sethi who studied organisations who had undergone a SISP [Lederer, 1992].

4. Usability

    The I.S. Strategy Plans, once produced, had no easy update and maintenance capability. Their relevance to the organisation therefore rapidly diminished.

1.3 Strategic Information Systems Planning

1.3.1 Original Ideas and Concepts

In the early 1980s there were developed 2 models which, although not originally intended to assist I.S. Strategy Planning, had a fundamental impact on it. They were both developed by Michael Porter and were the Value Chain and the Porter Model of Competitive Forces.

The Value Chain [Porter and Miller,1985] examines and assigns the tasks of an organisation into one of eight activities. The value each of these activities to the organisation's products is then assessed. From this analysis an organisation is able to identify where it must focus its efforts to improve its efficiency and competitiveness. Logically this also indicates where I.S. investment should be made.

The Competitive Forces model [Porter, 1979] identified the generic forces which acted on an organisation and so indicated how an organisation needed to respond to be successful in a competitive environment. This work was extended by McFarlan [McFarlan, 1984] who took the elements of the Porter model and suggested how I.S. could be used in each element to help achieve competitive advantage.

These two models were the first occurrence of suggestions that I.S. had a strategic role to play in an organisations business planning and strategy formulation process. Although BSP had already recognised the need to link Business and I.S. Strategy and the work of Porter and McFarlan suggested how it might be done; no serious attempt to do so was made until the Developing I.T. Strategy Method, DITS was proposed by John Ward at Cranfield University [Ward et al, 1990]. Also during the 1980s a number of proprietary methods for Strategic I.S. Planning, SISP, were developed. These included

Method-1 from Andersen Consulting [Andersen, 1987], TETRARCH from PA [P.A. 1989]. The general direction of development is shown in Diagram 1.1.

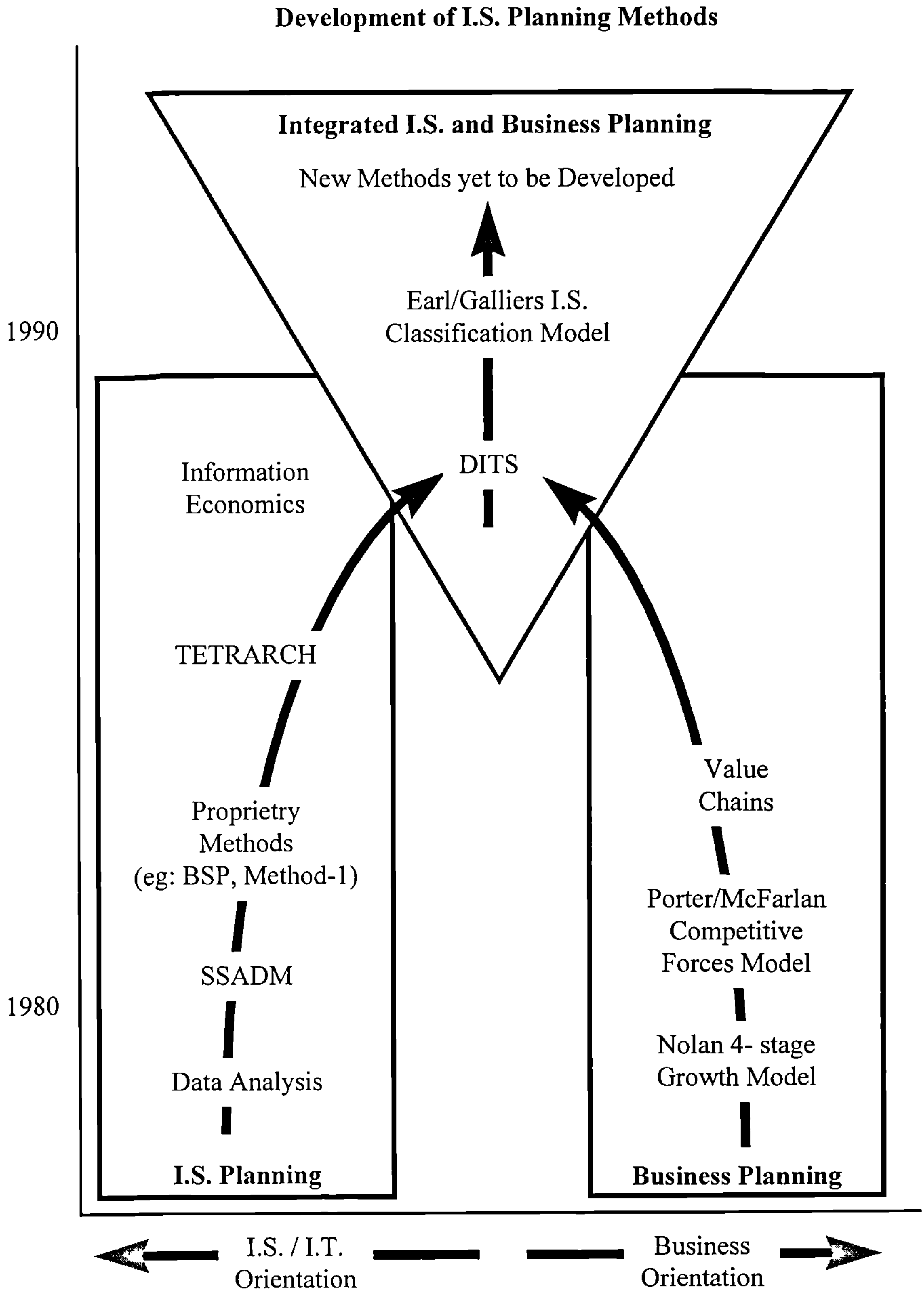


Diagram1.1

These methods were all very similar in nature in that they sought to develop an I.S. Strategy Plan that provided direct support for the existing business strategies of the organisation. Their general approach was similar to that of BSP and is shown generically in Diagram 1.2 below. Consequently they had the same limitations as BSP and these are discussed in Section 1.4.

GENERIC SISP ROUTE MAP

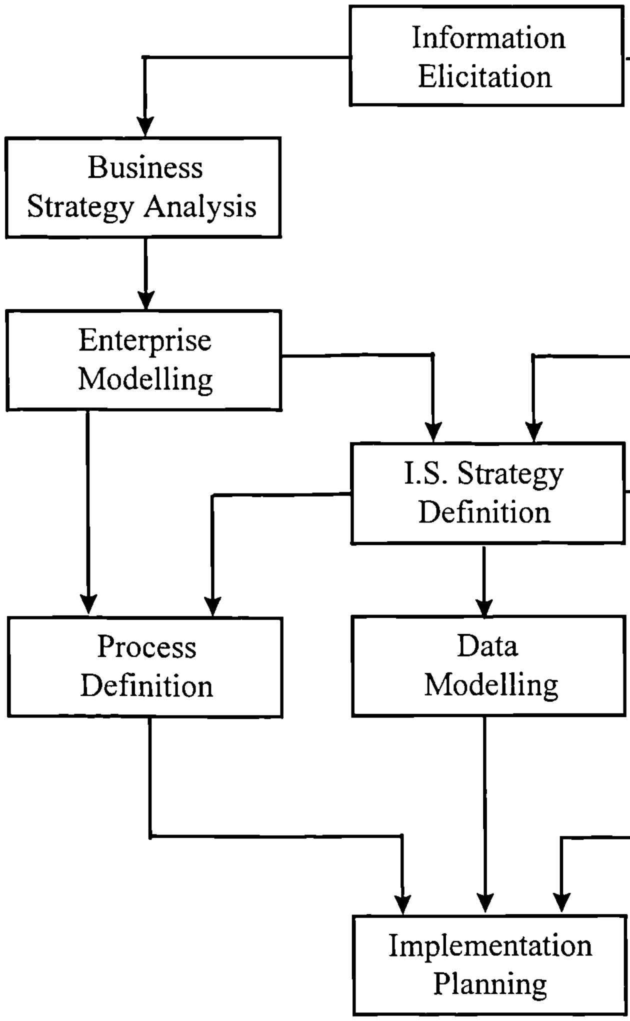


Diagram1.2

DITS did have 1 fundamental difference from other the methods discussed. This was that it provided a set of generic strategies for I.T. which it tried to map to the organisations business strategy and previous use of I.T. This gave it common features with another stream of I.S. Strategies that also were developed in the late 1980's. These are discussed in the next section.

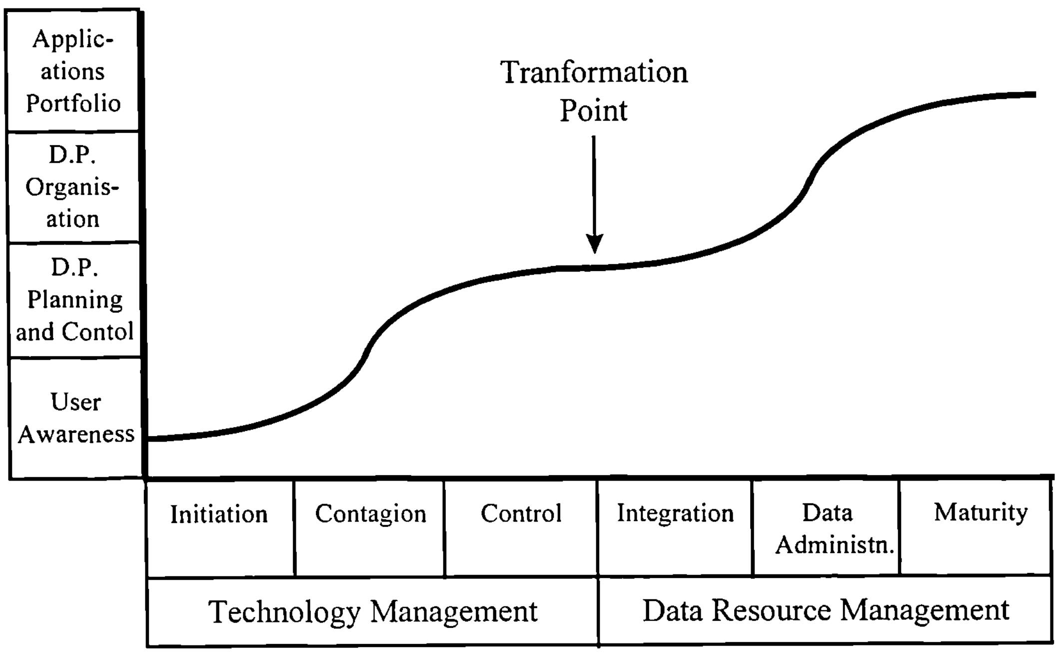
1.3.2 Recent Methods and Tools

The Nolan 4- Stage I.T. Growth Model [Nolan, 1979] suggested that the I.T. Expenditure of an organisation was dependent on which of the 4 stages of I.T. use an organisation was at. The 4 stages were:

1. Initiation
2. Contagion
3. Control
4. Maturity

This model was extended by Nolan [Nolan, 1986] and modified by Galliers [Galliers and Sutherland, 1991] to a 6 stage model which also considered the processes that caused growth of the use of I.T. It also recognised that there was a transformation point where the attitude of the organisation changed from technology management to data resource management. The model is shown in Diagram 1.3 below.

Six - Stage I.T. Growth Model



After Nolan and Galliers

Diagram1.3

Galliers also suggests that a mature organisation needs to integrate key elements of the organisation if it is to be successful in its use of I.T. at this 6th Stage. Whilst this model described the stages of growth, it did not address the issues of what the characteristics of each stage were. Further work by Galliers and Earl brought together Earl's I.S. Planning Stages Model [Earl, 1989] with the revised Nolan model. This defined 6 stages of growth and to describe them used the Pascale and Athos "7 S" Model [Pascale and Athos, 1989]. The resultant model is shown in Table 1.1, on page 23. The table only defines 2 of the 7 S's in the model. The others being, Structure, Staff, Style, Skills and Subordinate Goals. This is because in the work of Galliers and Earl the main focus is on Strategy and Systems. That is; what are the generic characteristics of the I.T. Strategy and what are the generic systems (or applications) it creates. It is interesting to note that all of the other S's, except the last, have found relevance in the Strategic Alignment Method (see Chapter 5).

DITS mentioned earlier also uses the idea of generic I.T.. Ward [Ward et al, 1990] proposes 6 generic strategies. These are described below:

1. Centrally Planned

   I.S./I.T. is totally integrated with corporate strategy.
2. Leading Edge

   I.S./I.T. can create business advantage by keeping ahead of competitors.
3. Free Market

   The business users can best determine their own needs and make their own choices.
4. Monopoly

   There is a single source for I.S./I.T. which is there to satisfy user demands within a budget.
5. Scarce Resource

   I.S./I.T. use is financially constrained, with a heavy bias towards return on investment to control spending.

6. Necessary Evil

   I.S./I.T. is only used when there is a legal necessity or it will give an extremely high Return on Investment, ROI,.

DITS then applies these strategies to the competitive position of the organisation in its market place. From this the appropriate strategy can be determined and once this is agreed the appropriate applications portfolio is derived.

The final method to emerge in the late 1980s was Information Economics which was the work of Benson and Parker [Parker et al, 1988]. This built on previous methods and had most of its roots in BSP. However its contribution was to propose that I.S. investment at the planning stage should not just be based on a cost benefit calculation, but should also include other factors that were softer in nature such as organisational risk, competitive value and innovation. The resultant model provides a comparative assessment method for a proposed I.S. portfolio which requires deeper understanding of the real value of the I.S. investment. This is where the method is innovative.

An interesting point of commonality exists between TETRARCH and Information Economics. In the TETRARCH method there is a stage where the I.S. Opportunities are prioritised. This is done by construction of a matrix in which each I.S. Opportunity is scored against a set of business oriented variables. Whilst TETRARCH has these variables predefined, the method allows the analyst to amend the default set to the extent of completely defining his own set of variables. From personal experience it adds value to the TETRARCH method to replace their set of variables with those used in Information Economics. The resulting prioritised list of I.S. Opportunities is usually markedly different. Where the Information Economics variables have been used the I.S. Opportunities that are more oriented to management and decision support tend to score much higher than the I.S. Opportunities that are oriented to operational efficiency.

CHARACTERISTCS OF THE GROWTH OF I.T. USE

GROWTH STAGE	STRATEGY	SYSTEMS
Adhocracy	Concentration on hardware and software acquisition.	Ad hoc, Operational, Uncoordinated, Focus on financial systems, Automation of manual processes.
Starting the Foundations	I.T. Audit, Annual I.T. budgeting, Reactive establishment of user requirements.	Diverse spread, Large backlog, Many gaps and overlaps, Centralised, Operational, Heavy Maintenance Load.
Centralised Dictatorship	Linkage of I.T. and business plans in a linear way, Top down I.T. planning internal to the D.P. dept..	Mostly centralised, Uncontrolled end user computing, Most gaps filled.
Democratic Dialectic and Co-operation	I.T. has emerged from its "ivory tower", Integration and co-ordination of I.T. and end user department planning.	Decentralised with some controls, Lack of co-ordination, Ad hoc Decision Support, Integrated office systems.
Entrepreneurial Opportunity	I.T. is an externally facing weapon to achieve competitive advantage, I.T. is driven by external forces.	Decentralised but with good central control and co-ordination, Added Value Systems (Marketing oriented, Some use of external data, Integrated comms. and I.T..
Integrated, Harmonious Operations	Maintenance of competitive edge through use of I.T., Continuous assessment of role of I.T. in organisation through interactive planning, Strategic Alliances enabled by I.T. in place, Monitoring and interception of futures.	Inter-organisational systems (Value Chain extension), New I.S. based products, Internal and external data integration.

After Galliers Table 1.1

One can conclude from this that there are dangers in using methods that are heavily prescriptive because they encourage the analyst not to think too deeply about what is really required from the analysis.

All of these methods have uses and value but they also have limitations. This is because they tended to be incremental, building on each other but remaining until recently focused on either the business or I.T. domain. Diagram 1.1 shows this clearly. The exact nature of the linkages between the methods is further discussed in Chapter 4. But it is apparent that the limitations of these methods, which are discussed in Section 1.4, would have to be overcome with some radically new insight into SISP.

1.4 Difficulties with the Earlier Approaches

1.4.1 Existing Methods and their Limitations

Sections 1.2 and 1.3 reviewed the development of SISP methods during the late 1970s and throughout the 1980s. It discussed their origins in data analysis and showed how the work of Porter, McFarlan, Galliers, Nolan, Ward and Earl brought in a business dimension. It can be seen from this discussion that there are 2 types of SISP method:

1. **Data and I.S. Oriented Method**
2. **I.T. Classification Method**

The Data and I.S. Oriented Method relies heavily on the production of data architectures to which various business variables are applied in order to define the I.S. Opportunities which are then prioritised to derive the SISP. The classic method is BSP and all of the others have much in common with it. These methods have all been revised and updated during the 1980s, the most common revision being to include some form of process modelling. The general limitations of these methods are those which apply to BSP and were discussed in Section 1.2.2.

The I.T. Classification Method is much more business oriented and seeks to understand the nature of the organisation, its competitive position and current exploitation of I.T.. From this analysis the organisation is assigned to one of a number of I.T. growth or usage classifications. Each of these classifications had predefined characteristics which theoretically defined the type of I.S. applications that the organisations needed. The specific limitation of these methods was that they were non-specific. Whilst they worked out what it needed in general terms, they tended to be weak on definition and prioritisation of specific I.S. Opportunities.

A hybrid approach which used the Classification Method to focus in on the general area and then used a Data and I.S. Oriented Method to define the detail of the SISP would provide obvious advantages. Some of the later derivatives of BSP and TETRARCH did in fact provide this a limited capability to do this. However by the late 1980s other limitations had emerged and these started to discredit the whole SISP approach. The limitations lay not so much in the tools and techniques but in the staff and management aspects. A survey by Lederer and Sethi [Lederer, 1992] highlighted the following limitations:

- The need to secure and win top management commitment.
- The time taken to complete the study
- The resource needed to complete the study
- The dependence on scarce skills (usually only to be found in very expensive consultants belonging to the method vendor)
- Further analysis required to complete the study fully
- No development prioritisation
- Limited cost benefit analysis

Whilst all the above points are serious and need to be addressed, 2 other issues have also emerged which need to be considered in detail and are discussed in the next 2 sections..

1.4.2 Process or Data Dominance

As has already been discussed most SISP methods carried out data analysis to provide information which determined the I.S. Opportunities. This was perfectly acceptable if the objective was to automate clerical type operations in stable organisations. However, if competition was increasing and organisations were being required to change merely to survive, then this argument was going to fall down. Add to this that I.S. was being seen as a competitive weapon, as had been suggested by McFarlan [McFarlan, 1984], then applications that did much more than just automate were required. This was suggested by Zuboff [Zuboff, 1988] who proposed the 4 stage model in Diagram 1.4 below .

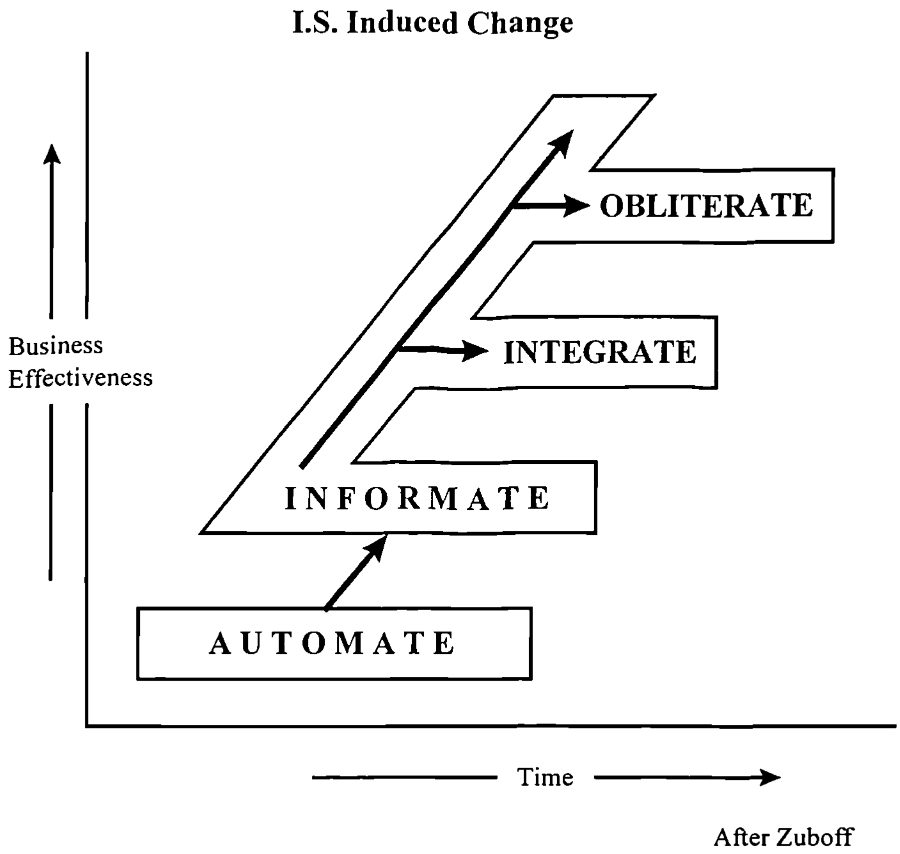


Diagram1.4

Zuboff suggests that to improve business effectiveness, I.S. has to used firstly to informate the organisation (i.e. to turn data into information that will assist with the decision making processes), then to use I.S. to integrate the organisations processes with those of its suppliers and customers and, finally, to remove the need to carry out the process altogether.

This new thinking changed the emphasis of I.S. strategy planning from data to process and as a result required a rethink of the methods. It also had a further architectural significance which emerged in the MIT90s research (see Section 2.2.2).

1.4.3 Time Needed to Implement the Plan

The remaining generic problem was that of the time required to implement the I.S. strategy plan. It was recognised that any I.S. strategy would take years to implement and much success had been achieved in reducing this timespan by the introduction of 4th Generation Software and System Builders. The real problem lay in the fact that an organisation's business strategy was changing far more frequently than ever before. It was becoming common for the users to find that their requirements had changed before the application was developed. At the level of the individual application, more flexible development methods and prototyping techniques helped control the situation.

At the level of the I.S. Strategy Plan the problem still remained. The cumbersome nature of the methods available made revision a complex and lengthy task. It was just not possible to carry out a short review of the plan every few months. The ideal situation would have been to identify all the changes that had occurred, assess their impact and revise the plan. With the methods available, doing that kind of task would take months for a team of people and most organisations did not have the resources to do such an exercise.

The result was that many SISPs gathered dust as they fell into disuse, often as soon as a year after their completion. This also had the other result of giving the whole SISP process a poor reputation as organisations were forced to focus on tactical responses to change.

1.5 Structure of the Research

The subject of I.S. Planning is highly topical due to the realisation towards the end of the 1980's of the increased dependence of organisations on I.S. and the increased influence of I.S. on an organisation's competitiveness. Consequently literature on the subject was readily available. However, even a cursory examination of the literature, revealed that many of the I.S. Planning methods were not delivering the benefits expected from them.

Consequently a logical start point was to try to understand why existing methods were failing as opposed to just identifying what they were and how they compared. From this point a new method could possibly be developed that overcame at least some of the existing problems.

There were also some further work that gave insight and direction for any new research in this field. This was the Management in the Nineties, MIT90's. This was a seminal programme run by the Sloan School of Management and whose findings had just been published. It represented the latest thinking on the subject of the role of I.S. in business but was incomplete in the sense that no methodologies had emerged from it. The ideas that it contained and the approaches to I.S. Planning suggested by it were of great interest. As an I.S. planner working for ICL, I was frustrated by the lack of credible tools. The opportunity to research and develop a new method for Strategic I.S. Planning was extremely important both personally and also to ICL. A further challenge was that SISP had, to a degree, fallen into disrepute. Consequently any proposed shallow broad based investigations would meet with resistance from most organisations if asked to contribute. What possibly would be attractive to them were in depth investigations that held out the potential to add value to their business. Any proposal had therefore to reflect this need. In consequence of the above discussion a research framework, shown in Diagram 1.5 overleaf was constructed.

STRUCTURE OF THE RESEARCH

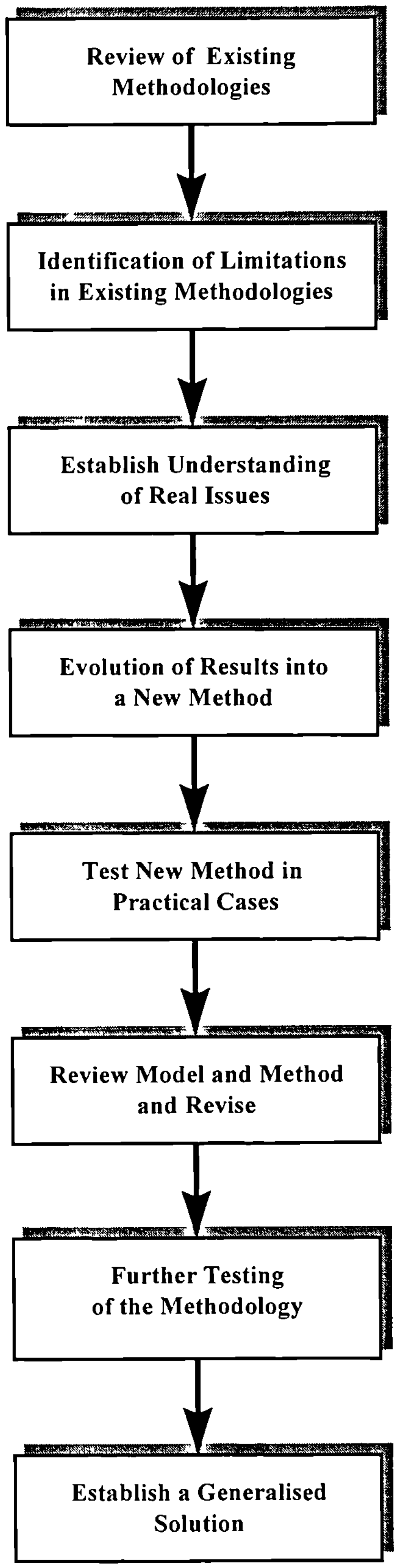


Diagram 1.5

In summary the approach was to understand the problem, research and develop a new method, research and develop improvements, then finally test the new method and refine it. However what actually was done differed from proposed structure.

As was mentioned above, organisations were very reluctant to commit resources to research activities, unless the work could be shown in advance to deliver some business benefit. The initial approaches made to organisations to contribute to broad investigations were met with a negative response which strongly indicated that the point was valid. Consequently a different approach was explored and proposed. This was as follows:

1. Research existing methods and ideas and formulate theoretical method.
2. Carry out I.S. Planning studies that produced real I.S. Strategy Plans using the theoretical method.
3. Use the results and knowledge gained from the work to develop the method.
4. Repeat activities 2 and 3 until the method was rigorous and proven.
5. Review the method, document it and consider further areas of potential development.

The route map for this experiential approach is shown in Diagram 1.6 overleaf. Activities 2, 3 and 4 on the list above correspond to the blocks labelled 1, 2 and 3 in Diagram 1.6 overleaf.

The method for the research had therefore moved from a more observational approach to one that had a high experiential content. Instead of observing what organisations were doing and developing a method from the observations; the approach would now seek to apply basic ideas in a real situation and use the results to review and revise the ideas into the methodology. The benefits of this experiential approach are discussed in Section 7.2.3.

Method Used for the Research

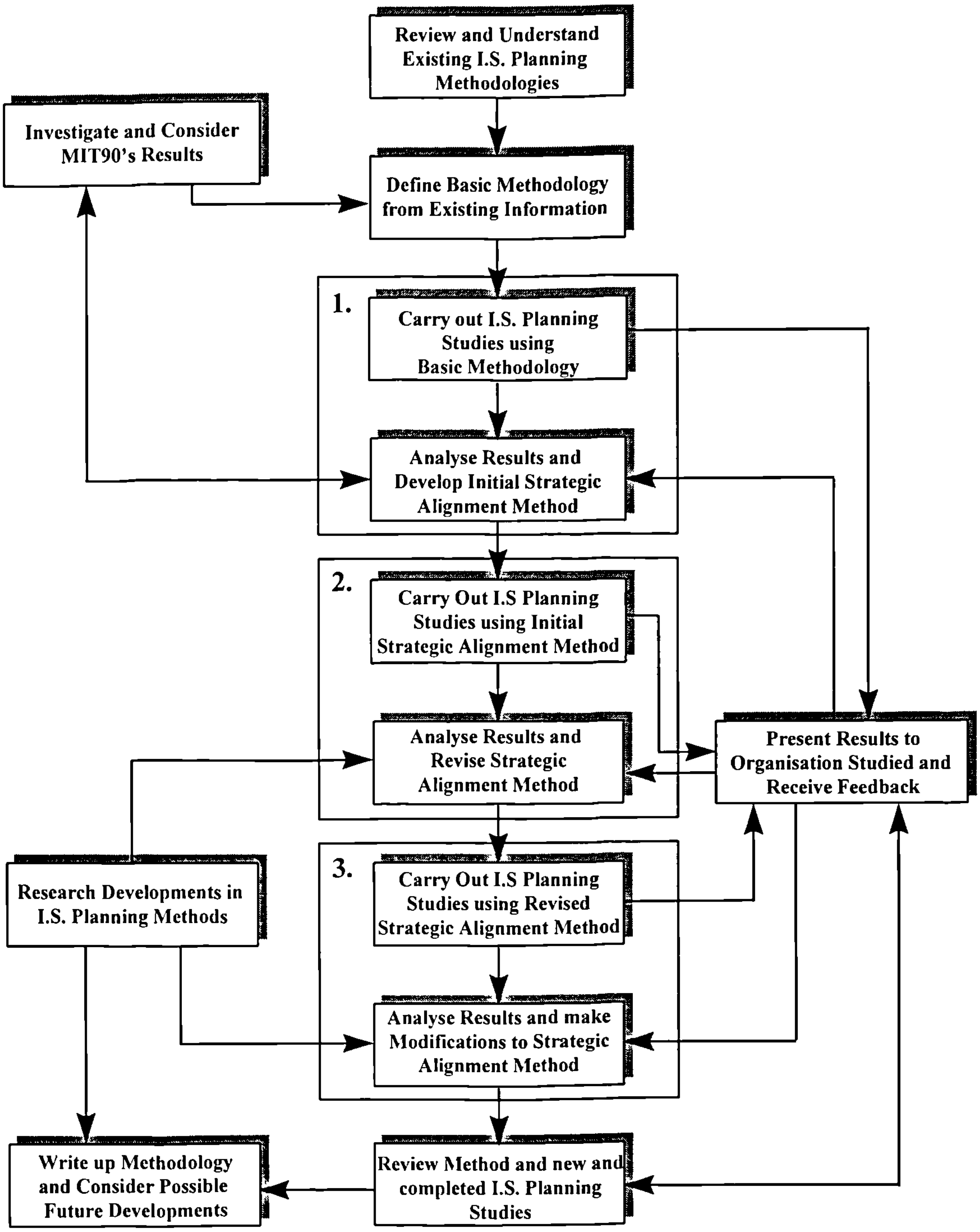


Diagram 1.6

The risk was that the studies would fail to produce an I.S Strategy Plan. However once the objectives and purpose of the work was explained to the two organisations who were asked to participate in the initial work, they agreed to contribute. In the event the studies did produce I.S. Strategy Plans that were of added value, even though the studies demonstrated that the method and model needed considerable modification and development. This initial Phase is labelled "1." In Diagram 1.6. The next iteration, labelled "2." in Diagram 1.6, repeated the activities and, as a result of the further modifications and developments, a third iteration labelled "3." in Diagram 1.6 was completed to prove the methodology. All the studies in Phases 2 and 3 produced I.S. Strategy Plans which the organisations then went on to implement.

The results from each of the steps in the above research method are reported and discussed in this thesis in the chapters and sections identified below. Additionally Section 4.8 reviews how the methodology evolved over the 3 Phases of the research.

Chapter 1. Contains the review of existing methodologies, how they have evolved and explores their limitations.

Chapter 2. Contains a discussion of the MIT90's project, the results from which provide the basic input to the research and also discusses why a new approach to Strategic I.S. Planning is required and important.

Chapter 3. Builds on the discussion in Chapter 2, exploring in more detail the different requirements for Strategic I.S. Planning that the business and I.S. place on a method. This chapter also discusses the reasons for choosing the Electricity Supply Industry as the research environment.

Chapter 4. This chapter describes the research projects, how they were carried out and their results. It describes the initial methods and model, explores its limitations and then discusses how these were overcome and the methodology was improved.

Chapter 5. This is a detailed presentation of the Strategic Alignment Model and Method. It describes fully the content of the model and the sequence of activities in the method that will build an I.S. Strategy Plan. This chapter is the presentation of the methodology that is the objective of the research.

Chapter 6. This chapter evaluates the method and model and assesses their capability and relevance as a new SISP.

Chapter 7. The last chapter explores how the research could be continued to enhance the model and the methods and concludes with comment on the importance and contribution of the results of the research.

Chapter 2. Purpose of the Work

2.1 Introduction

The previous chapter discussed the limitations of existing Strategic I.S. Planning methods. Whilst they all had been of value, they were looking outdated and a number of researchers had already commented on the general weaknesses. Henderson and Sifonis had reported on the difficulties associated with identification and qualification of I.S. opportunities [Henderson and Sifonis, 1986] and Galliers states that 58% of organisations in a survey admit that their SISPs are only tenuously linked to their business strategy [Galliers, 1991].
More recently the MIT90s programme (see Section 2.2) had identified even more issues that indicated that something different was needed. MIT90s furthermore suggested a new method, Strategic Alignment, which could be a new approach to I.S. Strategy Planning. This approach had as its underlying principle analysis of the interactions between Business and I.S. Strategies. It therefore fitted into the evolution of I.S. Strategy Planning as was shown in Diagram 1.1.

This Chapter therefore considers the findings of MIT90s and then considers how they, coupled with the examination of existing methods, suggest the drivers for a new approach.

2.2 Management in the Nineties Research Programme

2.2.1 Background and Purpose

The Management in the Nineties (MIT90s) Programme was a large research programme undertaken by the Sloan School of Management, Massachusetts Institute of Technology, between 1985 and 1989. It was sponsored by twelve organisations from government and industry, two of whom were ICL and BP, the rest being American. The findings and conclusions of the programme were published in 1991 in the book The Corporation of the Nineties, [Scott-Morton, 1991].

MIT90s was set up in response to the turbulence observed in the business environment during the mid 1980s. It's purpose was to investigate the following issues:

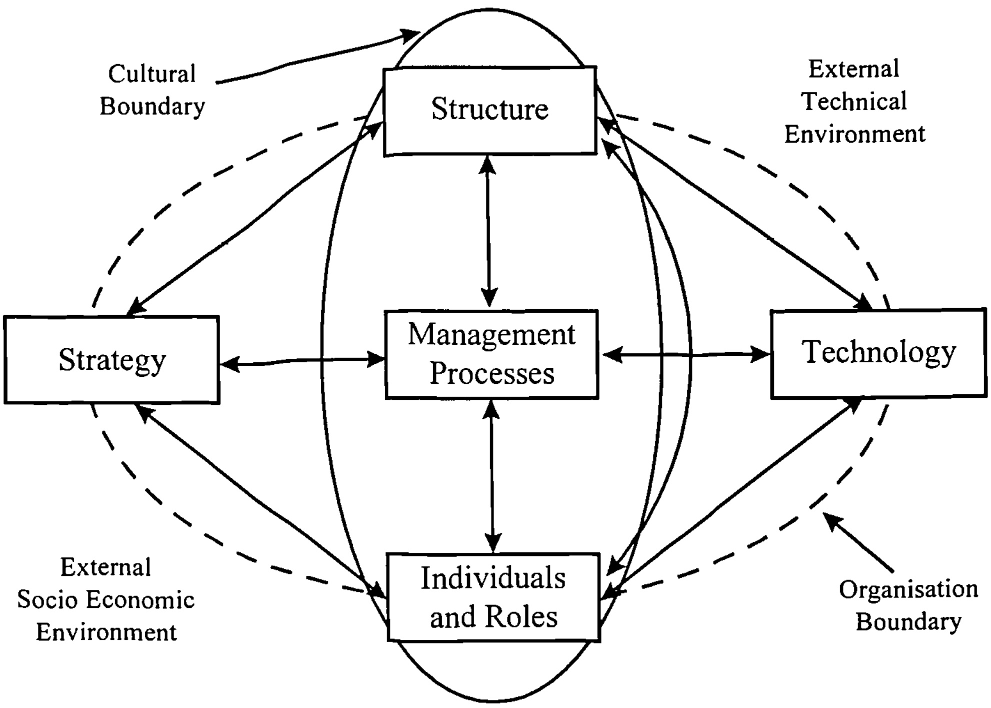
- Would the business turbulence continue?
- What caused the business turbulence?
- What role could I.T. play in responding to the turbulence?
- What role did I.T. have in causing the turbulence?

Even at the initiation of the programme, it was clear that the researchers suspected a causal link between business change and IT and it was exploration of this link that occupied subsequently the focus of much of the research.

An early stage of the programme the researchers defined the model [Scott-Morton, 1985] which would serve as the framework for all the research. This is shown overleaf in Diagram 2.1. The model represents the five components that must be balanced in an organisation if it is to respond effectively to the drivers which come from the external environment.

It is also significant that the organisation's culture had been recognised as a factor that was of potential importance (see Section 6.4.1).

MIT90s Research Framework



after Scott - Morton

Diagram 2.1

2.2.2 Findings

MIT90s produced ten major findings which are listed below. They have been extracted from MIT90s reports and through discussions with Hugh Macdonald who was the ICL sponsors representative on the MIT90s programme.

1. **Turbulence in the business environment will continue and increase.**

   The research found no evidence that the rate of change of technology, including I.T., competition, business methods and economic systems would do anything other than increase.

2. **Improvement in I.T. capability will continue.**

   I.T. now contributes not just to productivity, but also to changes in the way business is done and how an organisation performs its tasks.

Finding 2 (contd.)

Given that the improvement in speed of I.T. will continue, then I.T. influence will continue to increase.

However there is no evidence that I.T. will provide organisations with sustainable competitive advantage, because competitors can always catch up. Sustainable advantage only comes when I.T. is combined with the organisations people and processes and harmonised with its business strategies.

3. **It is necessary to rethink the core of the business.**

   As I.T. provides new ways of performing business activities (see Finding 2) then new entrants will be more effective. To survive existing players must re-engineer themselves.

4. **Integration provides the main opportunities for improving business effectiveness.**

   This is not just using common databases. It is about achieving effective processes that cover the whole business and beyond into the suppliers and customers organisations.

5. **Flexible networked organisations need to be created.**

   This leads on from Finding 4, organisations will integrate themselves electronically and team working across organisational boundaries will develop.

6. **Data and information will be a major problem area.**

   To achieve integration and networked organisations will require accurate timely data. However in most organisations data is dispersed, inconsistent and often inaccessible. Solving this problem must be of the highest priority.

7. **The nature of work is changing.**

   This is more than just automation. The way work is done will fundamentally change. Consequently staff will need to be given much more training and education on a continuing basis to ensure that they have the right skills.

8. **Managers must be the agents of change.**

   To be able to deliver Finding 7, managers must predict change and proactively position themselves to exploit the opportunities it presents before external pressure becomes excessive.

9. **There are new roles for organisation leadership.**

   Leadership is no longer about maintaining a status quo. It is about predicting the nature of a change and positioning the organisation to exploit it.

10. **Line managers must take up the roles of leadership.**

    Managers must become missionaries not corporate generals.

2.2.3 Comments on the Findings

The findings can be divided into two areas; first, those concerned with business change and the role of I.T. as an enabler of this change, and second, those concerned with the culture, skills and people issues.

The first set of findings radically improve on the ideas that had started to emerge from experience of SISP projects. In essence they suggest that business change is going to continue, and increase, and if organisations are to be successful in such an environment, then business planning to understand and manage the environment is absolutely essential. Furthermore I.T., and I take this to include

I.S., will play the pivotal role in enabling this change. Therefore harmonising Business and I.S. Strategy Planning is essential.

The second set are really saying that I.T. on its own is not enough. It is necessary to include the softer issues of people, culture and skills as well. Examination of the second set also leads to the thought that this was an area that was not well understood. The last four findings tended to be anodyne and somewhat repetitive. There is the basis of much more research because the issues raised are important, but MIT90s has not provided the solution.

MIT90s has gone much further in demonstrating that I.S. is critical to an organisations success and that business planning must be harmonised with I.S. planning at the strategy level. It also demonstrates that in this process I.S. is a driver which contributes to definition of the business strategy. It is no longer to reactive to it. SISP methods must therefore be iterative and include feedback. The MIT90s Findings however do not suggest a method by which this might be achieved.

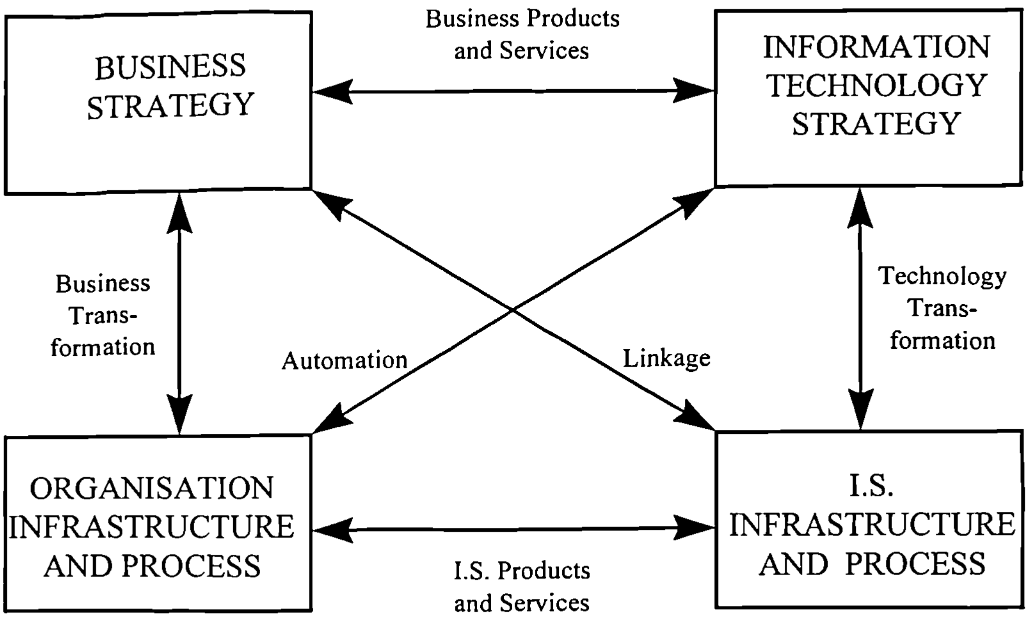
Although not in the Findings a basic method was researched in MIT90s. This is discussed in the next section.

2.2.4 Concept of Strategic Alignment

MIT90s recognised the need for I.S./I.T. to do more than automate an organisations processes but to informate them as well [Zuboff, 1988 and Macdonald, 1991(1)]. It also recognised that existing SISP methods had only limited capability to understand how the role of I.S. could defined in such a situation. To address this issue Henderson and Venkatraman [Henderson, 1989(1) and Henderson, 1989(2)] proposed the Strategic Alignment Model.

Venkatraman [Venkatraman, 1991] proposes that if the role of I.S. in proactively supporting Business Strategy is to be defined, then the alignment must cover at least 4 domains. These are represented in Diagram 2.2 below

THE STRATEGIC ALIGNMENT MODEL



after Henderson and Venkatraman

Diagram 2.2

Initially it was suggested by Venkatraman that alignment could be developed by understanding the nature of the linkage between any two adjacent domains. However it was recognised quickly that such an approach would only give a limited understanding of the possible transformations that I.S. could deliver. For a richer understanding it would be necessary to link at least three of the domains. This caused the diagonal linkages to be added to the model.

The concept of Strategic Alignment was extended by Macdonald [Macdonald, 1991(1) and Macdonald, 1991(2)] who proposed a Strategic Alignment Process (SAP). SAP had two sets of activities.

The first was to use the model to address four considerations:

1. The impact of industry and competitive changes, particularly under the influence of I.T. on the generic strategies.

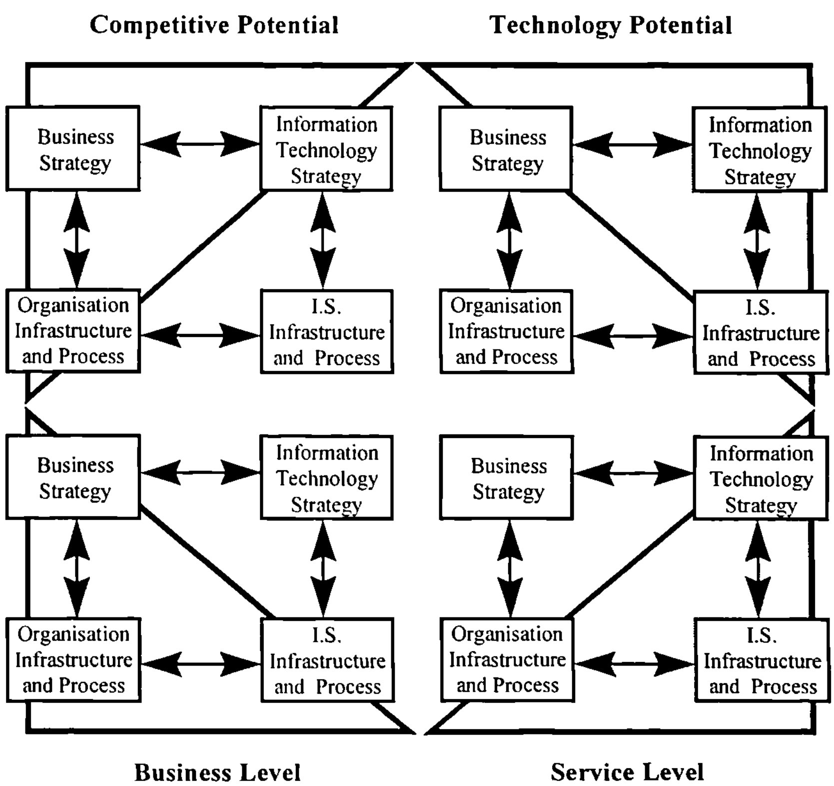
2. The changes, influenced by I.T., that affect the re-engineering of the value chain .
3. The changes, influenced by I.T. that will support the restructuring of the external value system of which the organisation is a part.
4. The I.T. capabilities which can expand the scope and domain of the organisation.

It can be seen that this set of activities will populate the model.

The second set of activities seeks to assess how all the factors and variables identified by the first set of each interact. Definition of these interactions will lead to harmonisation and alignment.

As was stated earlier, to achieve harmonisation the linkages between three domains had to be achieved. This meant that there were four domain triangles to link together. The concept is shown Diagram 2.3 below.

Strategic Alignment Domain Triangles

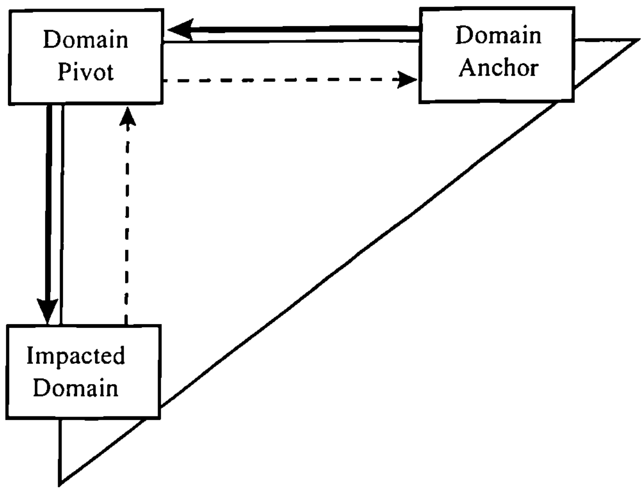


after Macdonald

Diagram2.3

The process of alignment as suggested by Macdonald is to consider each triangle in turn and attempt to align the three domains it contains. This is done by considering the triangles in the way shown in Diagram 2.4.

Domain Triangles: Inputs and Feedbacks



after Macdonald

Diagram 2.4

The domain anchor provides the change forces that are applied to the domain. The domain pivot is the domain being addressed and corresponds to the right angle corner of each triangle. The impacted domain is the component affected by change to the domain pivot, but more importantly, acts as a constraint on the changes that can be made to the pivot.

As can be seen from the diagrams each domain adopts each role in turn as each triangle is addressed. It should also be noted that the process implies feedback both within the triangle and within the model as a whole. Macdonald suggests that starting with the top left triangle and proceeding anticlockwise is the most profitable way to proceed. This is because it provides a domain pivot about which most is known, if only from a generic or industry perspective. An anticlockwise direction appears to be suggested because it aligns process with business strategy before addressing the I.T. issues.

Finally there is the question of the number of rotations. Macdonald suggests at least two before further effort becomes of little value. However he does not back up this assertion with any hard evidence that this is the right number. This is an important issue. If a method is to be useable it needs to gets to a rigorous result quickly. The number of iterations needed therefore has to be part of an methodological development.

2.3 Developing a Different Approach

2.3.1 Why a Different Approach is Needed

From the examination of the earlier methods in Chapter 1 and the discussion of the MIT90s results, a different approach to SISP is needed for the following reasons:

1. **Role of I.S. in the Organisation**

   I.S. is now no longer a means to improve efficiency by automation. It is a competitive weapon for many organisations. I.S. Planning needs to recognise that I.S. has a more proactive role in the business planning process and it can be used to support many more of the organisations activities.

2. **Management of Change**

   The rate of change is increasing. This occurs in a number of ways:

   - Change in I.T. itself.
   - Change in the drivers, both internal and external, that impact an organisations strategies.
   - Change in the processes that an organisation has to support.

   An I.S. Strategy Plan can no longer be considered to be a fixed or static object. If it is to be of value it will need to change itself during its lifetime. The method must make this an easy process to achieve.

3. **Speed and Ease of Use**

   Planning methods must enable a plan to be developed in a matter of weeks rather than months. They must also be simpler to use so a team of experts is not necessary to develop them. The tools they employ must also be easy to use so the organisations own staff can use them to maintain the plan. I.S.

Planning has to cease to be a black art only practised by a small coven of specialists.

4. **Dominance of "Process"**

   Process appears to have become more important than data for organisations. Modern applications, using client-server architectures are separating the process layer from the data layer. The advantage is that when a process changes, as it does far more frequently than the data, the change to the application can be done at the process layer and the data layer is not disturbed. Change therefore becomes much quicker and simpler to achieve. The I.S. applications remain in line with the organisation and do not hold up change. An I.S. Planning method must support this practice.

5. **Incorporation of "Feedback"**

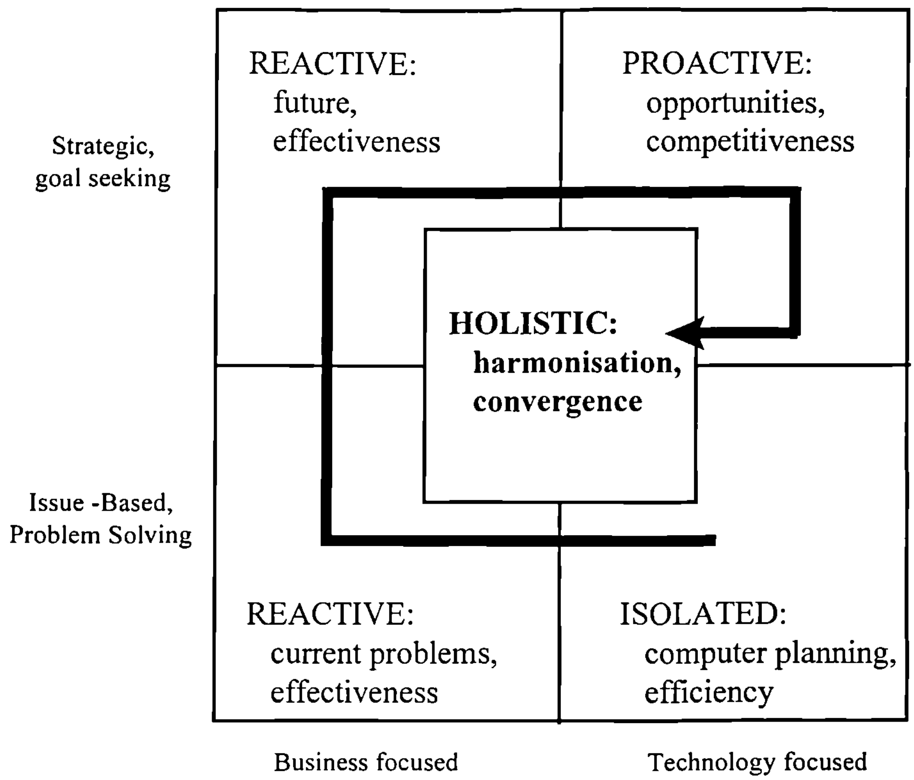
   Planning methods tended to be linear in nature. That is for a given business strategy a set of I.S. applications was derived that would support it. This ignores the increased influence of I.S. and I.T. on an organisation. A new I.S. Planning method must be able to consider the proactive nature of I.S./I.T. as a agent of change. Innovative use of I.S. is now able to enhance, or even change, an organisations business strategies. Consequently the method must feedback the opportunities I.S. provides to improve business strategy.

6. **Improvement of Rigour**

   Many earlier methods tended to be qualitative in nature which helped reinforce the reputation of SISP as an art not a science. Information Economics started to change this image. Any new method must be quantitative so the benefits of having the applications can be accurately measured against the costs of developing them. Furthermore these needed to calculated beforehand and incorporated in the model so achievement can be measured against forecast.

In summary therefore what is needed is a more holistic approach to I.S. Strategy Planning. This has been well articulated by Galliers [Galliers, 1991] in Diagram 2.5 below:

Development of I.S. Planning Methods



After Galliers and Ward

Diagram 2.5

This shows how I.S. planning has evolved through a series of iterations, none of which address the whole picture, each having a focus that ignores part of the complete picture. It is hoped that by developing a method that addresses the above six points, something approaching a holistic method will be derived.

2.3.2 The Start Point and Building Blocks

To attempt to develop a new I.S. Strategy Planning method that ignored the existing methods and knowledge of the domain would result in nugatory effort. The limitations of existing methods had been established so what was useful and still relevant could be included. Furthermore as well as existing methods there were the results of the MIT90s which provided some valuable insights and potential new approaches (see Sections 2.2) around which a new approach might be developed.

The following building blocks therefore provided the start point for the research:

1. **Deliverables**

   Although this might appear to be starting at the wrong end, it was necessary to know what the target was. This was a useable I.S. Strategy Plan that had the following characteristics:

   - The Applications that had to be delivered
   - The sequence in which they had to be delivered
   - The benefits that they would bring
   - The I.T. infrastructure needed
   - The processes that would be enacted by the applications

2. **Components of the Model**

   To deliver the I.S. Strategy Plan, it was necessary to build models of the following things:

   - Data Architecture
   - Process Architecture
   - I.S. Opportunities
   - I.T. Architecture

3. **Business Strategy**

To be able to understand and define the need for the I.S. Applications and Processes it was necessary to be able to develop some kind of Business Strategy Model which would map to the architectures.

The above three building blocks all were available in existing methods as well defined tools and techniques. It was decided that these should all therefore come from existing knowledge and nothing new should be attempted.

The things that were new were the methods for bringing together these existing building blocks. What was required were the following:

- **A method to link the Business Strategy with the Process, I.S. and I.T. Architectures.**
- **A method that supported the feedback requirement which would enable the opportunities to use I.S. and I.T. to induce business change.**
- **A method that would be quick and easy to use as well as producing a result that was rigorous.**
- **A method that would support on-going change and enhancement to the model and I.S. Strategy Plan.**

So it was clear the existing methods could provide a set of useful tools and techniques that would build the basic components of the model. What was not available, other than in the form of some ideas from MIT90s, were the tools that would do the analysis and harmonisation of the components and define an I.S. Strategy Plan that was flexible and which could be updated.

2.3.3 The Domain Addressed

In addition to defining what was going to be the prospective output from the research, it also important to state where it is to be used. I.S. Strategy Planning is used in a number of domains. However it has most often been used to develop the plan for those systems which will support the management, commercial and operational activities of an organisation. This will therefore be the domain addressed by this research. The reason for this is that it is the largest domain of activity in most organisations and the one that has most commonality across all industry sectors. If a method is derived for the Utilities Sector, then will probably be applicable to, for example, Retail, Manufacturing and Financial Sectors. The evidence for this assertion is the history of other methods. All of these have been to be portable across industry sectors when applied to the domains of activity mentioned above.

2.3.4 Relevance of the Strategic Alignment Concept

The need for an improved Strategic I.S. Planning method had been identified in Chapter 1. Given the evolutionary history of these methods, retaining the still useful parts of earlier methods, then adding in new capability is a historically correct approach. It is therefore appropriate to consider Strategic Alignment in the context of these needs.

It is conformant to the needs in the following areas:

- Linking Business Strategy with Process, I.S. and I.T. architectures.
- Provision of feedback to assess the opportunity to use I.T. as a change inducer.
- A method that was built on existing useful techniques.
- It had some focus on the soft issues.

There were some areas where the conformance was suspect.

- The speed and ease of use were totally unproved.
- The support of on-going change was by no means demonstrable or proven.

Finally there were some areas where there were serious question marks:

- The end result of an I.S. Strategy Plan did not appear to be a defined deliverable. In fact whether Strategic Alignment was intended to be an I.S. Strategy Planning tool was questionable.
- The object types in each of the domains did not conform to the object types that had traditionally been used in SISPs.
- The whole approach of creating alignment through the use of triangles appeared to be very cumbersome, theoretical and lacking in experiential evidence to back it up.
- The model implied a causal link between Business Strategy and I.T. Strategy. One of the problems, not really been addressed in all previous work, was how to analyse and define this link.

In conclusion Strategic Alignment had some very positive aspects where it tried to address some of the problems from the past. It had elements in common with earlier methods. However detailed examination of the results of the MIT90s research [Henderson, 1989 (1 and 2); Scott Morton, 1991 (1 and 2)] and further investigation of the literature failed to identify any evidence that Strategic Alignment was proved as a method. It nevertheless appeared to have serious potential to justify using it as a start point for a new SISP method.

The questions were:

- **Could Strategic Alignment be developed into a valuable Strategic I.S. Planning methodology?**
- **What were the changes and extensions to the model that would have to be made to resolve the first question?**

Chapter 3. The Requirements to be Investigated

3.1 The Business Requirement

This section discusses the points that had emerged from the initial considerations about investigating a new method of Strategic I.S. Planning.

3.1.1 The General Need

The requirements for a new Strategic I.S. Planning method have already been discussed in previous Chapters. Existing methods had fallen into disrepute because of their cost, the time taken to deliver them and their perceived failure to deliver real benefit. Clearly anything new had to address all those points immediately.

Additionally at this time there were other factors to be considered:

- Process Engineering was seen to be the key tool.
- Organisations had come to realise their dependency on their information systems for their survival which was raising the image of I.S. in all organisations.
- More was being expected from I.S. capability; automation was no longer enough, I.S. was expected to deliver business advantage.
- Managing change was becoming an issue for many organisation and the question was could whether I.S. could help.

Therefore a new Strategic I.S. Planning Method had to be much more than an incremental improvement on what currently existed. It had to be a step change in capability. It additionally had to be something that could be used by the whole organisation and not just a small group in the I.S. Department. It was clear that one of contributors to the poor reputation of SISP was that it was normally carried out by specialists who were not good at communicating the results to the rest of the organisation.

3.1.2 The Management of Change

MIT90s had demonstrated that business turbulence was going to continue and continue to increase. This meant that to survive organisations would need to be flexible and quick to reinvent themselves in response to a threat or opportunity. [Scott - Morton, 1991(2)]. It had also identified I.T. as the most important agent of change. Process also figured in change since for any organisation to change it had to reengineer its processes. This point was identified and explained by Hammer in his paper in the Harvard Business Review [Hammer, 1990] where he proposed that the real purpose of reengineering was to obliterate processes not just automate them. This idea, that business turbulence expresses itself as a need to change the way an organisation operated and to achieve change requires re-engineering processes, was further explained and argued by Hammer in The Reengineering Revolution Handbook [Hammer, 1995] where he advocates that change can only be achieved by re-engineering processes and that change is the key to organisation survival and success. Interestingly I have observed in a number of Utilities, faced with a very turbulent future, that survival is a mission that has validity. In such scenarios survival is success. The argument for such a mission is that; as the future is very uncertain and consequently cannot be predicted with any degree of certainty; planning for anything other than the short term is nugatory. Therefore to continue to remain as a profitable entity is the maximum that can be planned with any degree of certainty. Whilst the uncertainty drivers for such a mission statement are clear and certainly exist in the Utilities Sector; for example the regulatory framework and market deregulation; to adopt such a mission statement could indicates that the organisation is unwilling to change. if it were to explore and attempt to understand the change drivers then it could be able to adopt a more positive mission.

From these observations it became clear that any new method would need therefore to include the Management of Change as one of its underlying capabilities. However to do this change has to be understood. Developing the points in the above discussion, an organisation will change in response to a stimulus that is a driver which threatens it or provides an opportunity. Work by Sanderson and his collaborators [Sanderson, et al, 1996] produces evidence to support the idea that organisations are reluctant to change by their examination of organisations in mature and declining industries. Additionally change is achieved by developing new processes. Therefore by including drivers and processes in the research it is probable that change may be included. This assumption is by no means a proven link, all it does is suggest a way forward. It will be necessary therefore to assess whether, by this approach, the Management of Change is included in any new method produced.

3.1.3 Selection of a Specific Industry

For the research to be sufficiently rigorous to support the development of a new method it would be necessary to work with a number of collaborating organisations. The choice was either to work in detail with a small number or to work at a higher level across a large number. Given that the desired result was a method which had been proven the former approach was adopted.

The next question was whether the organisations should all be from the same industry. The advantage of using a single industry was that the organisations in it would have similar problems, threats, opportunities and so on. Therefore comparisons could all start from a similar baseline. It was therefore decided that a single industry would be used for the majority if the research studies. However to ensure some diversity and to check for general applicability, organisations some both inside and outside the UK would be sought. As a further test of applicability one organisation from a different industry sector would be also be chosen.

Selection of the industry sector was based on two criteria. The amount of change it was experiencing and personal previous experience. This made the Electricity Supply Industry a logical choice and this is discussed in the next section.

3.2 The Electricity Supply Industry

3.2.1 Why the Electricity Supply Industry was Chosen

The Electricity Supply Industry, ESI, had characteristics that made it a very suitable industry sector in which to carry out this type of research. These were:

Privatisation

The ESI had been privatised in the period 1988-9. This process had introduced a paradigm shift into a industry which had experienced little change over the previous forty years. Privatisation had started to make organisations rethink what they were about. It was an example of one of the findings of MIT90s: that organisations must rethink the cores of their businesses. Consequently there were huge changes taking place which made the study of these organisations interesting and timely.

The "change" point is discussed in the next section in more detail.

Homogeneity

In the UK there were twelve distribution companies, known as Regional Electricity Companies, REC, and three vertically integrated companies who both generated and distributed electricity.

The distribution side of the ESI had fifteen players who were each responsible for distribution within a defined geographic area in which they had a monopoly. These organisations were driven by sets of engineering and safety practices that had been developed nationally over many decades. The organisations were logically very similar, they tended to operate in the same way and be organised in the same way. Also they had exported their practices to many other parts of the world where UK standards and methods were de rigeur.

This was an advantage for the research because the selected organisations would have all started from the same base and been subjected to the same change drivers. Comparison of their responses would provide interesting results.

Use of I.T.

The ESI had been a long time user of I.T.. It had been originally introduced in the 1960s for billing and financial systems and had moved forward from there. I.S. was now common across the whole organisation and in Distribution Operations it was used in real time for network control as well as on line for activities such as work and materials management. RECs were competent rather than innovative users of I.S., and the Engineers were also comfortable with the us of I.S. to support their technical activities.

In the Nolan-Galliers 6-Stage Growth Model (see Section 1.3.2), a typical REC would be at Stage 3, Control. In the Venkatraman 5-Layer model (see Section 5.3.1) they were moving to Level 2, Internal Integration. One question that was pertinent therefore was whether privatisation would cause them to more across the boundary to innovative use of I.S.

As regards the research, these organisations were suitable because they were at a transformation point and their familiarity and comfort with I.T. would help the project move forward.

A final point concerning the ESI's use of I.T. was that they had, in general, not previously experienced or suffered SISP projects. All I.S. planning appeared to have been tactical, which is consistent with their position in the Nolan-Galliers and Venkatraman models. It was hoped therefore that, and in fact this turned out to be the case, that they would respond positively to the research.

Size

RECs are big organisations, typically they have a turnover of £1.2bn and employ approximately four thousand staff. To undertake a programme of research and study into the whole organisation would potentially be an excessively large undertaking. To make the research manageable and ensure that the objective of depth in the study was achieved, it was decided that just the Distribution Operation Divisions would be studied. These were profit centres within a REC which were responsible for the operation and maintenance of the network. In size, they typically had revenues of £250m and employed on average about fifteen hundred people.

Culture

The Distribution Divisions had a track record of supporting research. It was very much a part of their culture. Prior to privatisation the Electricity Council, to which all RECs belonged, had sponsored and run many technical and business oriented research programs. RECs were therefore used to this type of work and would readily accept it.

3.2.2 Change in the Electricity Supply Industry

The UK ESI was largely ignored by many of the changes that affected the rest of the UK industry. Its change could be summed up as slow evolution. Privatisation in the late 1980s exposed it to commercial realities and the industry has been subject to change on a massive scale since then. Diagram 3.1 overleaf shows the major changes, which are also described below:

Privatisation turned RECs from public monopolies into private monopolies. Competition only existed only existed for customers consuming over 1mw and the impact on the RECs was in the areas of regulation and shareholder pressure.

The introduction of competition for 100kw customers further increased competition and caused fundamental changes in some of the internal processes in the marketing and technical support areas of the business.

This has been followed by the takeover of all but one of the English RECs, the majority by US Energy Companies. The motive for these takeovers has been return on investment. UK RECs generate much higher profits than their US counterparts. The effect on the RECs has been to force them to drive down costs, while at the same time the Regulator has been forcing ever higher standards of service on them. These drivers are pulling in opposite directions .

Paradigm Shifts in the UK ESI

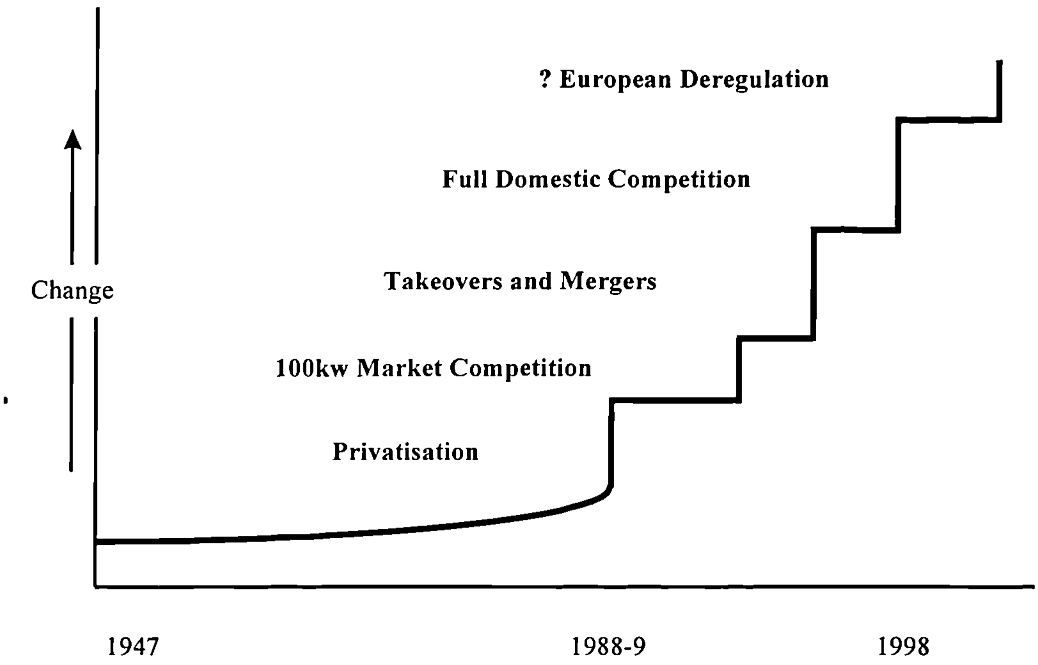


Diagram 3.1

The next paradigm shift will be in 1998 when the whole supply side is opened to competition. The impact of this can only be predicted, but most analysts forecast new players entering the supply market and some existing RECs moving out of supply.

3.2.3 The Needs of the Electricity Supply Industry

The ESI as can be seen from Section 3.2.2 is undergoing enormous change. The change is being driven by regulatory forces which by their nature have opened the industry to commercial and competitive forces.

The industry has responded by driving costs out through organisational change and demanning. However it recognises that these actions are once off and cannot be repeated. It therefore has to do something else. Discussions with senior executives in the industry indicate that there is an expectation that better use of I.S. may deliver the advantages and benefits that RECs need to survive. However the question that they cannot answer is how I.S. will do this. They need to know to which parts of the organisation I.S. will bring the most benefit quickest.

3.3 The Information Systems Requirement

This section briefly considers how the role of I.S. is changing by considering the new factors that have to be included when devising an I.S. Strategy Plan. These are the things which will need to be considered when developing a new method.

3.3.1 The Lessons from Management in the Nineties

3.3.1.1 Change or Transformation

Transformation is a much more radical form of change. Where change delivers a 10% improvement, transformation delivers a "ten times" improvement. MIT90s suggests that in a turbulent environment it is organisations that transform themselves will be the ones that are successful. Consequently a new SISP must be able to identify the opportunities to transform the organisation.

3.3.1.2 The Role of I.S. as an Agent of Transformation

Leading on from the previous point, MIT90s suggests that I.S. can be the agent of transformation. Innovative use of I.S. will enable an organisation to transform itself. If this is true then a new SISP must be able to identify the innovative I.S. needed.

However to be of real use it must do more than that. It must define how that I.S. can deliver the added value including all the other factors that need to be considered, including the risks .

3.3.1.3 Culture, Skills and Other Softer Issues

MIT90s identified that it was necessary to include "soft" factors in any Strategic I.S. Planning method. The issue is with these is that they cover a very wide range of factors. It will be necessary to establish what the soft issues are, having achieved that where they impact on the other factors, (for example: do they impact directly or indirectly on I.S. applications?) and finally what is their relative importance.

3.3.2 The Importance of "Process"

Process Engineering has become the most important analysis tool in use today. It has superseded many of the established data and business modelling techniques.

Practitioners of process engineering are encouraged to use the tools to radically rethink the organisation by Hammer [Hammer,1990] and to move beyond automating to informating integrating and obliterating by Zuboff [Zuboff,1988]. There is also the question of using process engineering to think beyond the organisations boundaries and see if benefit can be gained by linking your processes with those of your suppliers and customers.

This last point is an interesting concept because it can be done in a collaborative way where organisations share risks, costs and benefits or it can be done aggressively where processes are dumped on suppliers or customers. This concept known as "process invasion". It requires that the organisation knows exactly what its processes are and do, where their boundaries lie, what their strategic importance is and what the costs and risks are.

Just in Time, JIT, is a good example. It is where a manufacturer or retailer holds a minimum or zero inventory of stock and has contracts in place with his supplier(s) to deliver regularly to keep his operation functioning. For the organisation the benefit is that inventory costs are reduced and the risk is having an unreliable supplier. For the supplier the cost is that he now has to carry his customers inventory costs. The potential benefits lie in more flexibility in production with longer production runs. If JIT works as a true partnership then both the supplier and the organisation win. If as is often the case, the organisation is only seeking to dump inventory costs without giving anything in return then eventually both players will become disenchanted and the relationship will fail.

Consequently it has to recognised that process is going to be an important element in any new SISP method if the method is to be used to achieve any degree of transformation.

3.3.3 Integrating Data, Process and Technology Architectures

The new SISP methodology will have to deliver an I.S. Strategy Plan which defines what the applications are and the sequence in which they have to be implemented. This plan has dependencies on the I.T., data and process architectures. All of these have their own internal dependencies. Therefore what may be the ideal development sequence for applications may be constrained by the other architectures. For example a certain application may provide most support to achievement of a business strategy; but if it requires data that is created by another application then there is a problem to be resolved.

All the architectures have interdependencies and so cannot be considered in isolation. The method must therefore build this consideration into its processes.

Chapter 4. Development of the Methods

4.1 The Approach

As was discussed in Chapter 2, Management in the Nineties, MIT90s had proposed new methods for I.S. Strategy Planning, using the principles of Strategic Alignment. However at this time, both the model and process of Strategic Alignment were totally unproved, they had not been used to develop an I.S. Strategy Plan. Discussions with the UK based expert in Strategic Alignment, Hugh Macdonald, Visiting Professor of Management at Bath University about his ideas for a Strategic Alignment process [Macdonald, 1991(1) and (2)] supported the idea that Strategic Alignment could be used in this role. Caution was advised as well due to the radical nature of the approach.

This raised the question of how to carry out the research and what should be its aim. Given that I.S. Strategy Planning was a concept understood by many organisations, discussions on the subject would not be too alien to potential collaborators. What would be difficult was the fact that many organisations had tried it with very limited success (see Sections 1.4 and 2.1). Therefore just to investigate how organisations had done it and where they had gone wrong would not be particularly attractive. A different approach was required.

An initial investigation into the evolution of I.S. planning methods indicated that a hybrid approach which attempted to integrate the earlier I.S. oriented and Business oriented approaches was appropriate. The result of this investigation is shown in Diagram 4.1 in Section 4.2.1. This indicated that an approach which was based on the ideas in Strategic Alignment was most logical because it had emerged from MIT90s which proposed the need for a hybrid approach. The results and experiences from attempting to use Strategic Alignment in a real project could be used to develop the methodology. The risk was that the research might produce nothing of practical value for the collaborating organisations. Therefore organisations known to supportive of research projects would need to be approached (see Appendix 1).

From experience of carrying out other I.S. Strategy Planning work using other methods, specifically DITS [Ward, 1990] and TETRARCH [P.A.,1989], it was known that a study of this type would take up to six months to complete, but that this would not be a full time commitment. On studies of this type, there are gaps in the time spent doing the work due to difficulties in getting access to executives, problems in co-ordinating diaries and waiting for research reports to be read and commented on. It was therefore decided to attempt to undertake two studies concurrently. Not only would this double the results but would also allow comparisons between organisations which would help with development of the methodology.

In conclusion it was decided that the research approach would be to use Strategic Alignment, as it was defined in MIT90s, to attempt to define I.S. Strategy Plans. Two organisations North West Electricity Board, NORWEB and Yorkshire Electricity, YEG, would be the first two organisations. The methodology and model resulting would then be applied to two more organisations. Headquarters UK Land Forces, UKLF and Electricity Supply Commission of South Africa, ESKOM. From the results of the work an attempt to develop Strategic Alignment into a more formal methodology would be made. This would be tested on one organisation already used, ESKOM and one new organisation, Eastern Energy, Australia. Appendices 1, 2 and 3 contain a description of the projects and examples of the results. The model and methodology developed are described in the rest of this Chapter and Chapter 5.

4.2 Specification of the Requirement

4.2.1 The Evolution of I.S. Planning Methods

The Diagram 4.1, overleaf, shows how I.S. Planning Methods have evolved in the last twenty years. A summary of the Diagram is also contained in Chapter 1.

Investigations into this area at the beginning of the research showed that whilst there were two distinct orientations, that of I.S. and Business, there had always been a tendency for the I.S. side to adopt and use methods developed from the business side. Additionally there had also been a degree of retrofitting where one method had been enhanced by inclusion of later developed methods.

Consequently to formally acknowledge that an I.S. Strategy Planning method should include both Business and I.S. elements as equal interacting drivers was not new and eminently desirable. MIT90s was the first step in this direction. This result merely reinforced that Strategic Alignment, as a result of MIT90s was the correct place to start.

4.2.2 The Basic Model on Which to Build

The start point was the model was that suggested by Dr. J.S. Henderson and Dr. N. Venkatraman in MIT90s Working Papers 89-076 and 89-077 [Henderson, 1989(1) and Henderson,1989(2)] . This has been discussed in Section 2.2.4. This model had the four domains and a set of object types for each domain. It also postulated a method of creating alignment. As stated earlier, the method was not proven and there was some doubt concerning the suitability of the object types, see Section 2.3.4. This however was the latest thinking on the subject so it was applied to the two initial projects.

History and Evolution of I.S. Planning Methods

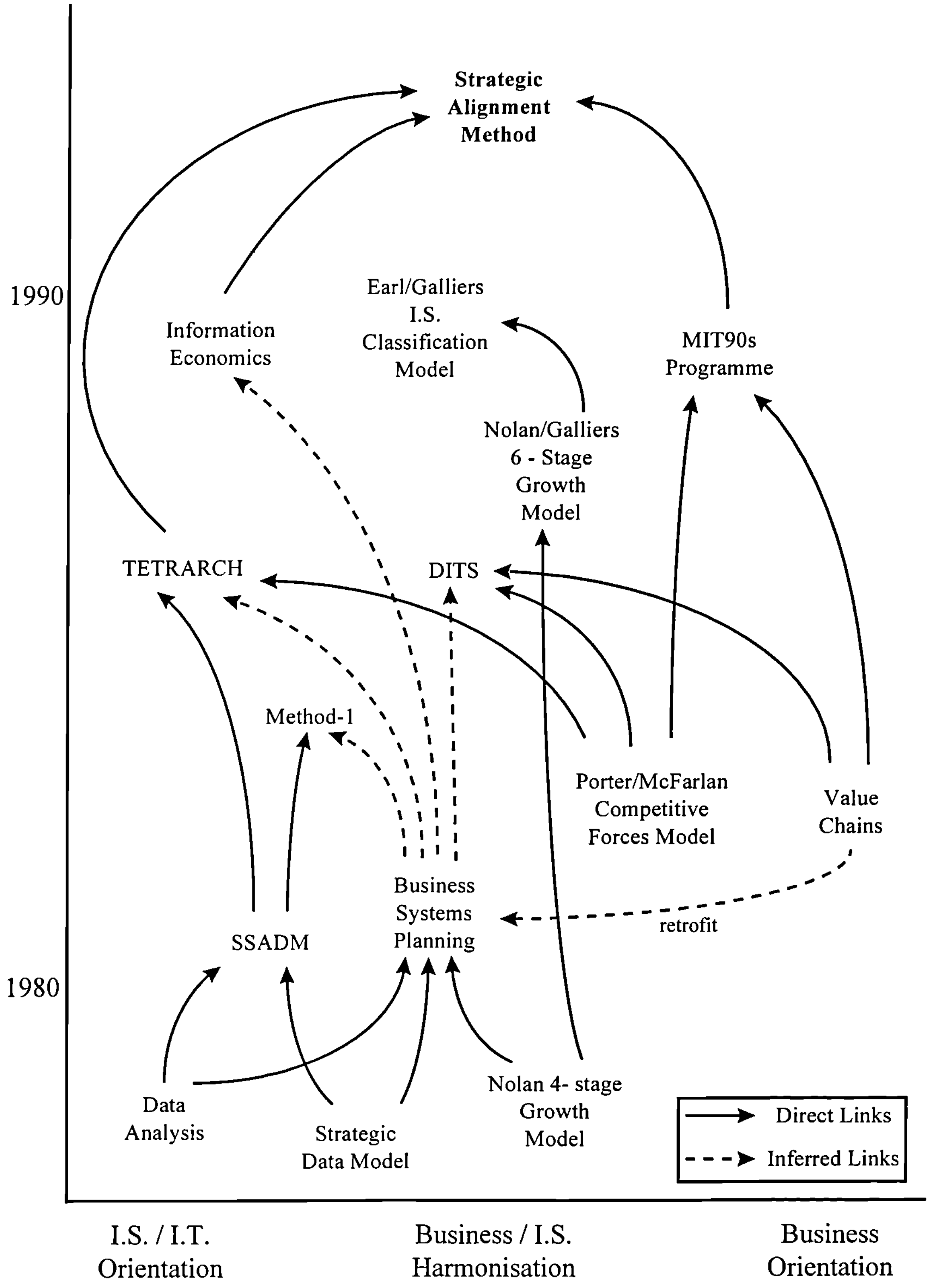


Diagram 4.1

The content of the Strategic Alignment model and the processes used are described below.

Business Objects

3 objects types were contained in the model:

- **Business Scope:** products, markets and plans
- **Distinctive Competencies:** important and distinguishing characteristics
- **Business Governance:** rules and relationships

Process and Organisational Objects

This domain also had 3 object types:

- **Infrastructure:** roles, responsibilities, and organisation structure
- **Processes:** the management and business strategy enacting processes
- **Skills:** the key skills possessed or needed to deliver the processes.

Data and I.S. Objects

The object types in this domain were:

- **Applications Infrastructure:** configurations of hardware and software.
- **Processes:** the systems design and development process.
- **Skills:** those needed to implement the I.T. strategy.

Technology Objects

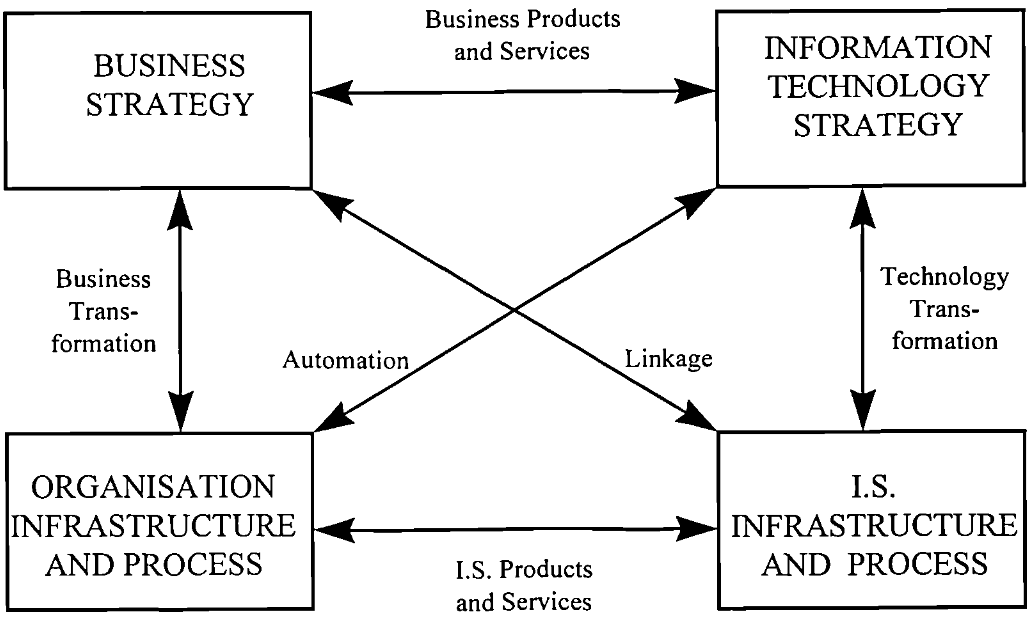
The object type in this domain were:

- **Technology Scope:** the capabilities of the organisation to exploit technology.
- **Distinctive Competencies:** the requirements that have been placed on the technology and the absolute capability of the technology.
- **IT Governance:** relationships and standards

Object Linkage and Analysis

- The model which was postulated in MIT90s suggested linkage at the domain level as shown in Diagram 4.2 below. These linkages were used as the start point. This was found not to work when it came to attempting to align the domains and a new approach had to be devised.

STRATEGIC ALIGNMENT MODEL RELATIONSHIPS



after Henderson and Venkatraman

Diagram 4.2

Model Maintenance and Updating

- There was at that time no mention in the literature of maintaining a Strategic Alignment Model. However it was already known that this was an issue (see Section 2.1.1) and that some other methods, such as TETRARCH, did provide limited capability in this area [P.A., 1989]. Consequently this was a known issue that projects would have to address, (see Section 4.4.1).

4.3 The Structure of the Initial Projects

Both the NORWEB and YEG projects were set up in exactly the same way at the start of the project. The framework used is shown in Diagram 4.3 below.

NORWEB and YEG Project Frameworks

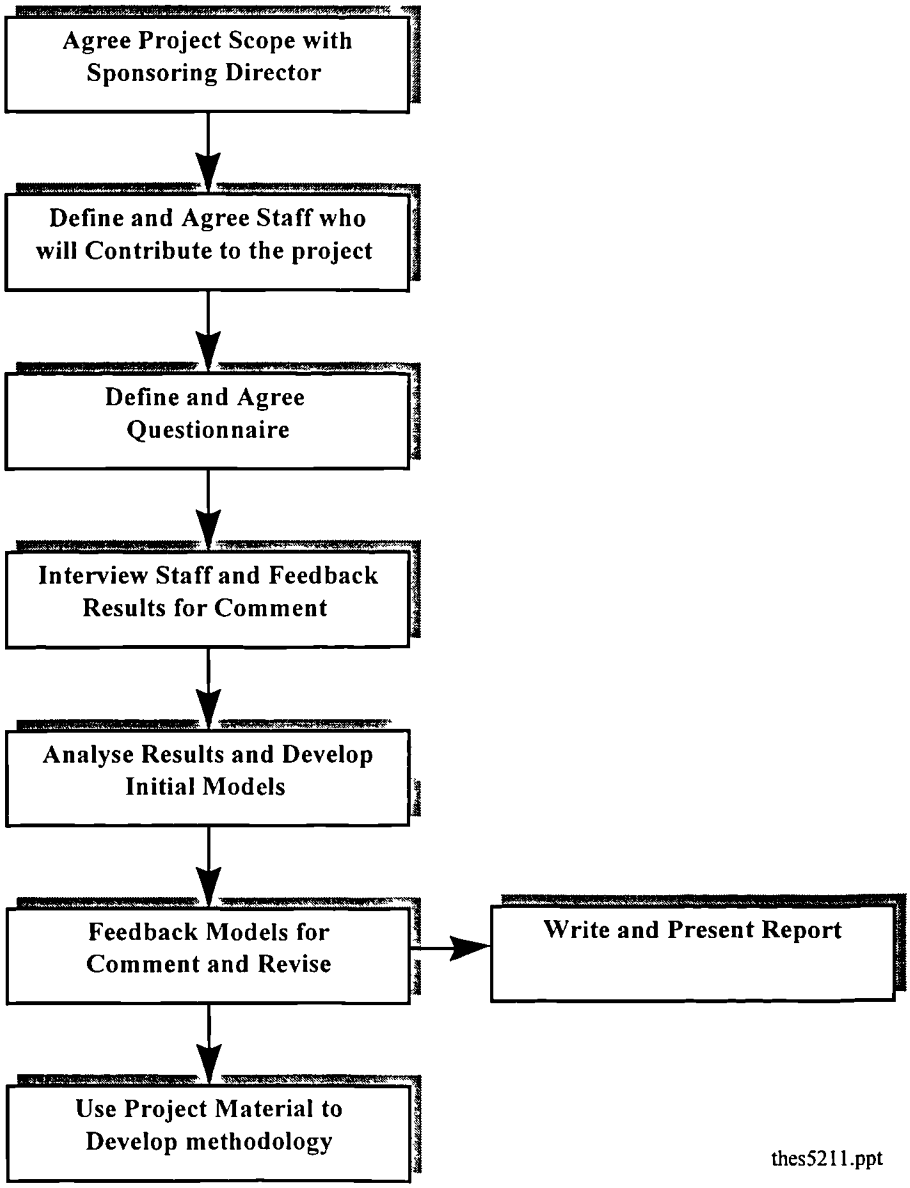


Diagram 4.3

The project would attempt to build a Strategic Alignment Model that was conformant to the basic model described in Section 4.2.1. The model would then be used to define an I.S. Strategy Plan which would be contained in the report delivered to the sponsoring Director at the end of the project. As there was no guidance in the literature concerning a route map for carrying out a project; the approach shown in Diagram 4.3 was based on that recommended in the TETRARCH method [P.A. 1989].

In parallel with production of the report, an evaluation would be made of the methodology and route map used and this evaluation would provide input to the development of a different methodology.

4.4 Results from the Initial Projects

4.4.1 Methodology Design

The single most important conclusion that emerged was that Strategic Alignment as defined in MIT90s was unworkable. This was for two reasons:

1. The object types in the model bore very little relationship to the things that the staff in the organisations were familiar. They found the objects types very hard to understand and not relevant to their own working environment.
2. The process of alignment was very much more complicated than was suggested. The approach of harmonising the domains by use of the triangles approach (see Section 2.2.4). could not be made to work. It gave a totally trivial result when applied at the domain level or when applied at the object type level could not be made to create a meaningful alignment.

It was clear therefore that the approach had to be revised in a number of ways. These are discussed below:

Domain Names

The original names of two of the domains caused confusion. What was meant by Information Technology Strategy and I.S. Infrastructure and Process was not clear. The names had been derived to create commonality with the names in the corresponding domains in the other half of the model. However when this confusion was examined it was found that the it was the object types that were the real cause of difficulty. When these were revised (see Section 4.4.2) the domain names no longer reflected the object types that they contained. The names were changed to the more accurate domain titles of Information Technology Capability and Information System Infrastructure.

Object Type Level Linkage

Trying to link domains at the domain level proved to be nugatory. The results were trivial and did not provide information that could be used to develop an I.S. Strategy Plan. Therefore the linkage was attempted at the object type level where pairs of objects were linked. This is shown in Diagram 4.6.

Diagonal Linkages

The original model showed linkage between the Business Strategy and the I.S. Infrastructure and Process domains and linkage between the I.T. Strategy and Organisation Infrastructure and Process domains. These linkages existed because of the requirement to align by the triangles method. When alignment no longer used the triangles and aligned at the object type level, there was found to be no logical connections or interactions between the object types existing the diagonally opposite domains. These linkages were therefore removed.

Link Between the Business Strategy and I.T. Capability Domains

The link between these domains as proposed by MIT90s implies a causal link between I.T. Strategy and Business Strategy. This is one of the key findings of MIT90s (see Section 2.2.2) and it implies that I.T. can be used to enhance or change a business strategy. Whilst MIT90s provided evidence of this causality, it didn't explain how it was delivered. That is if a piece of I.T. is adopted, then how the changes it is expected to deliver are achieved. Both the NORWEB and YEG studies seriously questioned this MIT90s finding. For example in both organisations Cost Reduction was a business strategy and Object Oriented Databases were I.T. that was new and felt to be important. However there was no way of understanding and assessing the direct impact of one on the other. After much investigation and discussion it was decided that the evidence pointed to an indirect link through object types in the other two domains. An I.T. capability could be used to develop a new Information System, which in turn would enable a new Process to be enacted and this would enable a new Business Strategy to be achieved. This seemed to be a much more logical model and it was realised that it would need to be thoroughly tested in the second projects.

Comparing Object Type Occurrences

As was stated earlier in this Section, to achieve alignment it was necessary to compare the impact of one set of object types on another. This was done for object types residing in the same domain, as well as for object types existing in different domains. This comparison was done as part of the alignment process and it was found to be the key to the process. The comparisons used are shown in Diagram 4.6 in Section 4.4.2.

The process itself is based on the method of Concept Analysis [Ketchen and Shook, 1996] and is described in Sections 4.5.3, 5.2.4 and 5.4.3..

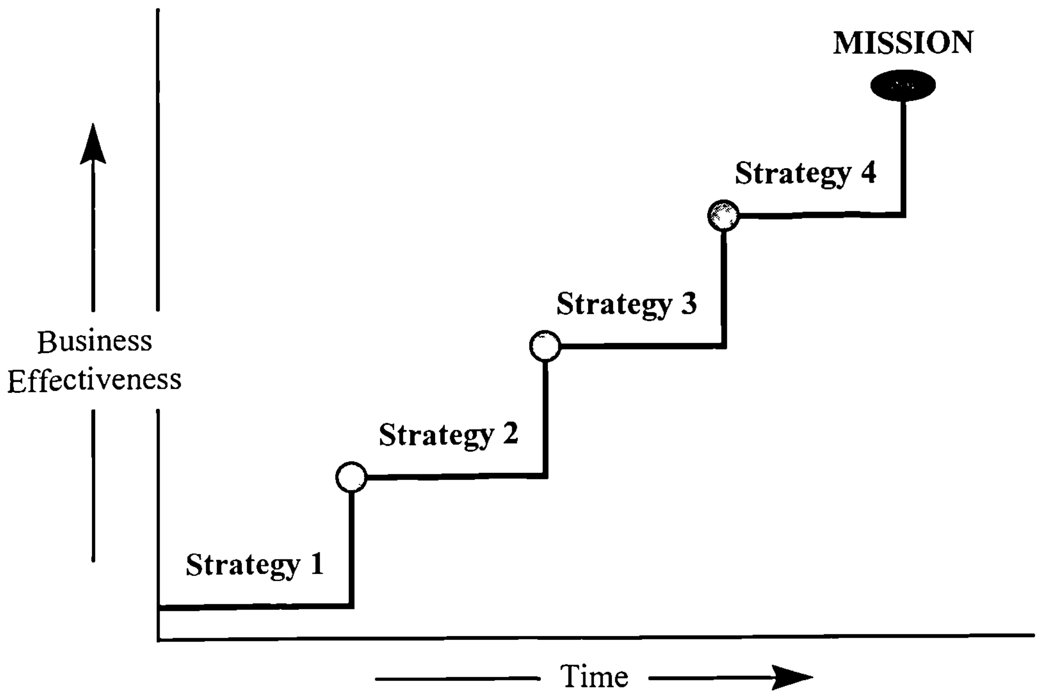
Business Objective Priorities

From both projects the problem of determining the sequence in which the Business Objectives had to be addressed. Both organisations were following a number of Business Objectives, but the issue was in which sequence.

The alignment process tended to derive a sequence based on the technical issues which determined the sequence in which the I.S. Applications had to be developed. But was this correct sequence for the achievement of the organisations Business Objectives? Eventually it was identified that the Drivers were the key to this. They would determine the sequence provided their relative importance was known. The projects tested this idea by holding the workshops at which the attendees were asked to prioritise Drivers relative to each other. This was found to work and in subsequent projects this prioritisation became the first matrix. Using this analysis, it then became possible to prioritise the Objectives from the business standpoint. This then enabled a reference point to be established against which the changes that I.T. could enable would be assessed.

In discussing this with the Directors of the organisations, it was found that a resolution to another problem had been identified. That was a method, which determined and justified the sequence in which Objectives were tackled, was available. The organisations had known that they could not tackle everything at once due to lack of resources and now a method by which a logical sequence could be created was available. To display the results a pictorial representation was adopted. This was the Strategic Staircase as proposed by Hay and Williamson [Hay and Williamson, 1991], 1991]. Hay and Williamson from their work with Komatsu argued that an organisation to be successful had to define and follow a logical sequence for its strategies. The idea being that each strategy once achieved would deliver new capability which would enable the next strategy to be tackled effectively. Diagram 4.4 below shows the principle.

THE STRATEGIC STAIRCASE



After Hay and Williamson

Diagram 4.4

Adoption of this diagram proved to be very effective in subsequent projects and Strategic Staircases has been added as a tool into the overall

Strategic Alignment Methodology. Its use in practice is discussed in Section 5.2.4.4.

Strategic Staircases raised another issue, the difference between Strategy and Objectives. At this stage Objectives were a more important object type in the model than Strategy, see Section 4.4.2. However the Second Projects with UKLF and ESKOM brought Strategy into higher profile.

Model Maintenance

Although one of the objectives of the projects was to establish a Model that could be used after the I.S. Plan was developed to manage the applications development process; this was not possible to do. Both organisations were going through organisation change which resulted in the sponsors moving to different positions. Consequently all I.S. investment was put on hold. It was therefore not possible to see how the models could be used in the development phase.

Methodology Steps

The route map adopted for the projects proved to be an inaccurate representation of what was done and the sequence in which it had to be done. At the end of the projects a revised fifteen step method which accurately described the process was defined. This is shown in Diagram 4.5 overleaf. This was used as the route map for the Second Projects and after these underwent further significant enhancement. The results of the first two projects were published in the ICL Technical Journal [Thurlby, 1993]. This paper is in Appendix 3.

STRATEGIC ALIGNMENT ROUTE MAP

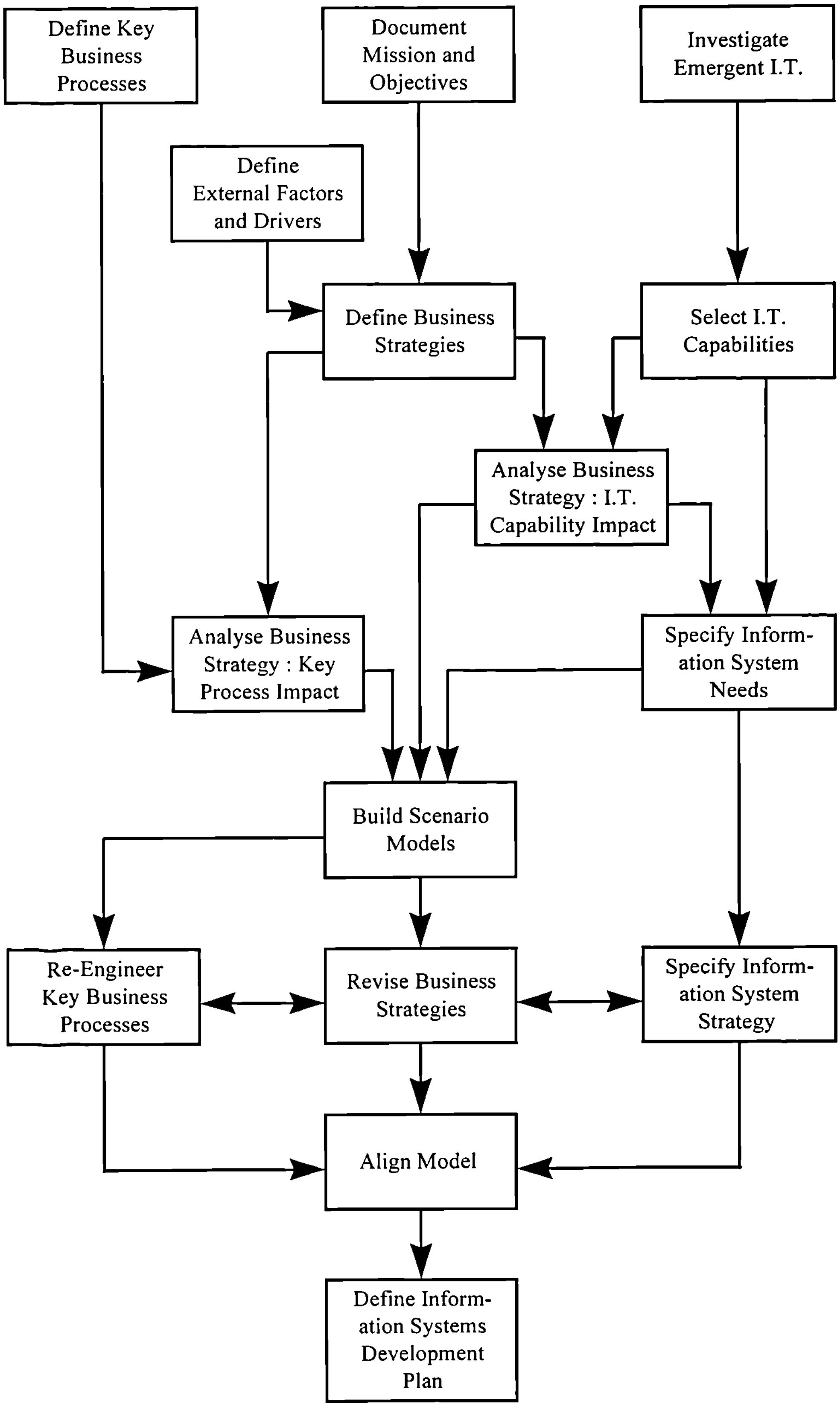


Diagram 4.5

4.4.2 Strategic Alignment Model Objects

The Object Types that the projects attempted to define were those defined in the original Strategic Alignment documentation [Henderson, 1989(1) and Henderson, 1989(2)] and discussed in Section 4.2.1. It emerged at an early stage that some of these Objects Types were confusing or irrelevant or both. Examination of this problem revealed that it arose from use of terms and semantics that were unfamiliar to the participating organisations. For example use of the words “governance” and “competencies” created difficulties even when their definitions were explained and discussed.

Whilst it would have possible to persevere with the existing set of Object Types, it was decided that revisions of the set into ones with which the participating organisations were comfortable would be more productive. The process of creating a new set of object types was done by firstly asking NORWEB and YEG staff what they felt were the necessary objects types and secondly by examining what other methods used. The results of these two investigations were then combined into the new set of object types. The other methods examined were IBM’s BSP [IBM, 1984], TETRARCH [P.A. 1989] and Andersen Consulting’s Method-1 [Andersen, 1987]. The new set of object types were then tested by using them in the next stages of the YEG and NORWEB projects.

The changes made were as follows:

Business Strategy

The three object types were fundamentally changed and replaced with three new object types. These were **Strategy** and **Objectives**, which attempted to define what the organisation wanted to do and how it was going to achieve it. The third was **Drivers** which defined all the forces rules and characteristics which impacted on the organisation.

Business Process and Organisation

The Process object was found to be insufficiently precise to be of real value. Processes were clearly important but could a study cover all the processes that an organisation carried out? It was found in the workshops and interviews that some processes were much more important than others in terms of the support they gave to achievement of Objectives. It was therefore decided that only those critical processes would be used in the model. To differentiate them from all the other processes the term **Value Process** was created. The other object types, Skills and Infrastructure, created a level of detail that did not add to the richness of the model. They were combined into a single object type; **Capability** (see Section 4.4.3).

I.S. Infrastructure

This domain was found to duplicate two of the object types, Process and Skills that were in the previous domain. If the systems design and development process was that important, then it was a Value Process and would be modelled elsewhere. The same argument applied to Skills. Application Infrastructure was a hard object type to define. It was therefore redefined as two objects **I.S. Applications** which defined the set of systems required and **I.T. Groups** which defined how these systems were integrated.

I.T. Strategy

This domain had once again been given object types that reflected those in the Business Strategy domain. Again this caused confusion until it was realised that all that was required was definitions of the I.T. infrastructure components needed to support the I.S. Applications. To reflect the need to look to the future this object was named **Emergent I.T.**

Diagram 4.6 overleaf shows the revised Strategic Alignment Model structure including both the new object types and the links between the objects discussed in Section 4.4.1.

A weakness identified in this new set of object types was the difference between an Objective and a Strategy. Exploration of the issue with NORWEB and YEG staff revealed no common view and a similar result was achieved when the literature was searched. It was therefore decided to let the issue stand as unresolved and explore it in the Second Projects. The conclusions are discussed in Section 4.6.2.1.

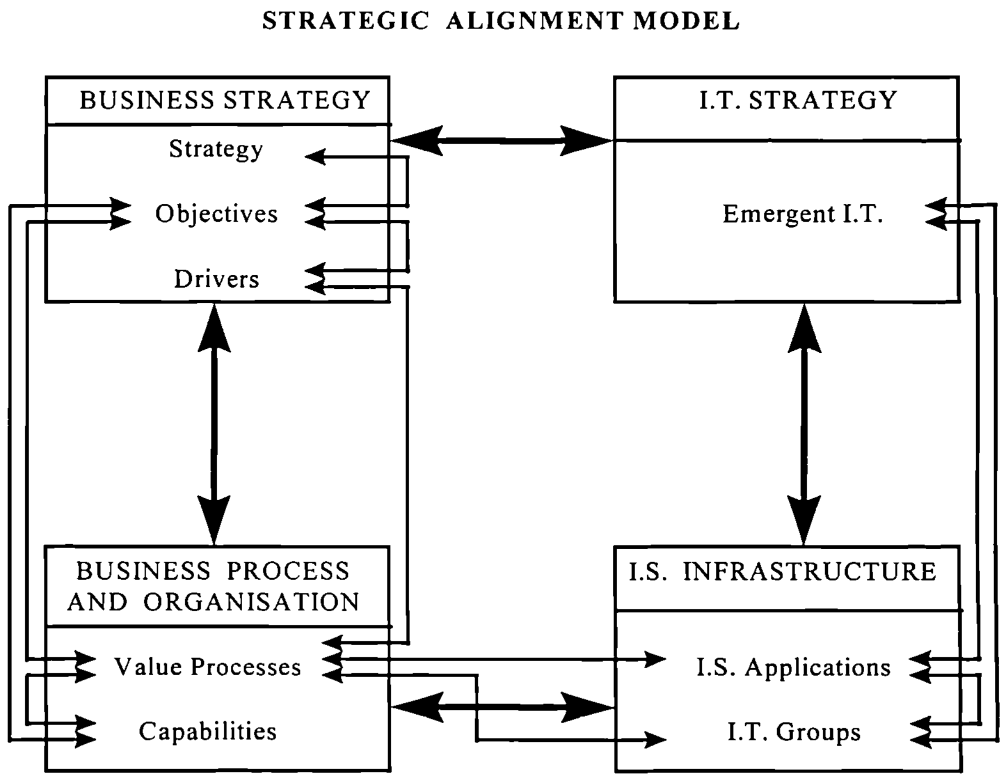


Diagram 4.6

Diagram 4.6 also shows the linkages between the Domains made at the object-type level. This point; that linkage has to be at this level has already been made and discussed in Section 4.4.1. It was one of the most fundamental results from these projects because it provided a significant move forward from the original MIT90s theory. The principle of aligning by creating linkage at the object as opposed to domain level formed a major element of the Strategic alignment method. The final set of linkages and the method used for analysing them is contained in Section 5.4.3.

4.4.3 Cultural Results

The original MIT90s work had identified Skills and Culture as an important force which would either enhance or inhibit change. It was therefore necessary to include this subject in the NORWEB and YEG projects. This was done by including the subject in the interviews and the workshops.

The objective was to establish how important to the delivery of an I.S. Strategy Plan were the skills and cultural issues. The results were clear; Skills were important to both organisations, but Culture was low down on the list of issues that the both organisations considered to be important (see Table 4.1 below). However both organisations saw the things they identified more as organisational capabilities than just skills. For this reason Capabilities became the Object Type which subsumed both Skills and Culture.

The privatisation of the ESI, had introduced a set of new Drivers which demanded new Capabilities be developed in the organisations. Skills were part of these because, traditionally, the Industry had always spent heavily on training and so tended to be traditionally concerned with Skills. As far as the organisations were concerned skills were not an issue, they needed Capabilities. Similarly the ESI had a "tell not sell" culture where keeping the network running was the prime objective. The organisations did not worry about culture. The table below shows the results received.

CAPABILITY	NORWEB Priority	YEG Priority
Political Lobbying and Influence	1	2
Leadership and Communications	2	6
Responsiveness to Opportunities	3	3=
Competitive Aggression	4	3=
I.S./I.T. Literacy	5	1
Financial Management	6	3=
Business Planning	7	7
Transformation Culture	8	7=
Risk Analysis	9	
Staff Productivity		9

Table 4.1

The other significant finding is that although they had commonalty in the list of Capabilities, the priorities were very different. This was largely due to the fact that the Objectives that they were following had different priorities. Both organisations saw survival as the prime objective but beyond that one was more concerned with expansion by take-over and Joint Venture, JV, whilst the other was more focused on customer service.

In conclusion the Cultural investigation demonstrated that whilst Skills were an important object in Strategic Alignment; Culture was not seen as an important issue. Also the organisations were thinking beyond just Skills and Capability was a better definition for the object type.

4.5 The Second Projects

4.5.1 Purpose and Objectives

Whilst the first two projects had produced a Strategic Alignment Model, the method was not as logical as was needed. Additionally some of the object types had not been particularly easy to define and align in the model. Nevertheless the projects had enabled a method which produced a valid result to be defined. Also its areas of weakness were known.

Consequently the second set of projects were undertaken to address these issues. They had the following purpose:

- To apply the Strategic Alignment Method as derived from the 2 initial projects to new organisations to produce models that were of value to the organisations.

The objectives of the projects were as listed below:

- To satisfy the participating organisations by achieving the above stated purpose.

- To use the participating organisations to develop the method of Strategic Alignment to remove the weaknesses that existed.

- To derive a cohesive set of object types that were relevant to the process of alignment and were logical, definable and understandable by the organisation.

- To apply the method to a non - Utility organisation to try to establish whether it had general applicability.

In order to meet the last objective Headquarters U.K. Land Forces was selected to be a participating organisation. ESKOM, the other participating organisation, was an Electricity Utility.

4.6 Results from the Second Projects

4.6.1 Revisions and Extensions to the Methodology

The two projects, UKLF and ESKOM Distribution Engineering, provided large amounts of project information that enabled major changes to be made to the methodology. These changes are listed below:

- The "15 Step" approach is expanded to 28 activities and that these are grouped into four large steps. These are shown in Diagram 4.7, overleaf.

- Each of the four steps has its own deliverable which has value in its own right.

- The methods had to be iterative to allow model reworking and revision during the project as more information became available. This was one of the most significant findings and is discussed fully below.

- A Strategic Alignment study can just investigate one or a number of the steps depending on the requirement of the organisation.

- Facilitated Workshops is a tool which should be employed heavily throughout the project to improve control, and the quality of analysis.

- Matrix Analysis is used as the primary tool for developing alignment.

- The scope and objectives of the project should be reviewed at the end of every step.

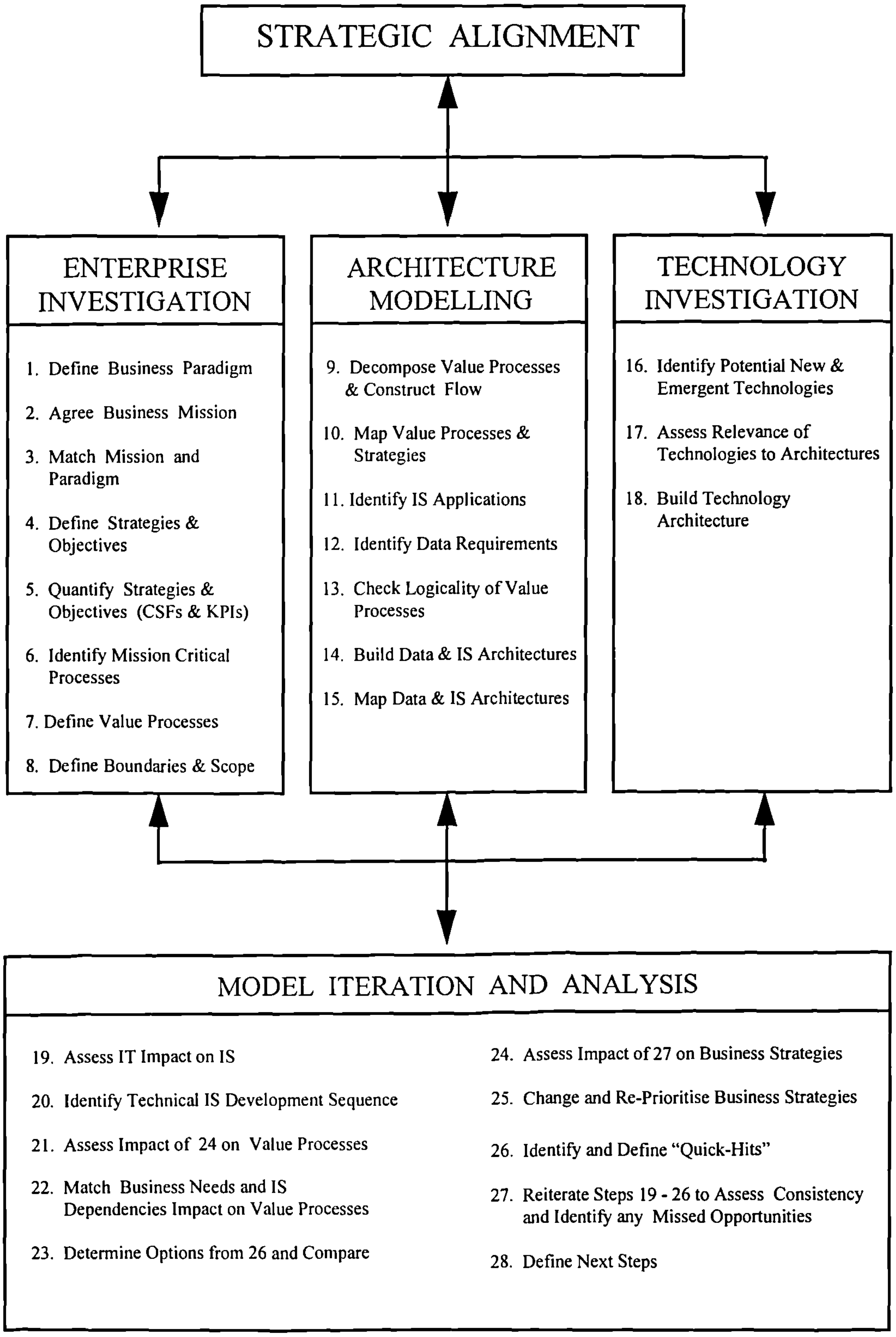


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Diagram 4.7

All the above revisions were incorporated into the methodology which was used when it was evaluated on the Eastern Energy Project (see Section 4.7.2) and form the basis of the methodology which is described in Section 5.2.
During the projects, the complexity and size of the organisations under study became apparent. One of the results of this was that information had to be gathered from a large and wide ranging number of sources. There were both differences of opinion and inconsistencies in the information as well as incompleteness. For example in ESKOM there were wide differences in what the process contents should be, as well as in what their priorities were. The Operations and Field Services Managers had very different opinions in these areas. Furthermore incompleteness in the knowledge meant that it was not possible to define all the CSFs and KPIs, let alone agree on them.

To manage the project in such circumstances would have impossible if a full and complete analysis were required for each step before the next one was started. Progress would have been reduced to a crawl as further information was sought and agreement and consensus would have been much harder to establish. It was realised that gaps would have to be left and assumptions made to maintain progress. The danger was that the analysis would become less than rigorous.

To avoid the pitfalls, the following approach was adopted:

- *All assumptions would be fully documented, along with the reasons for* making them. (This was invariably incomplete information.)

- All gaps in the collection of information and analysis would also be documented.

- The Activities within the Steps would be carried out in strict sequence, but the Steps themselves would be executed parallel as far as resources permitted.

- The Analysis and Iteration Step would be initiated as early in possible in the project and be used to help address the gaps and assumptions.

- Best Practice would be used as a method of providing input to trigger discussion and analysis to resolve gaps and assumptions.

In essence it was an approach that sought to do as much as was possible in a logical sequence; then to reiterate to fill in the gaps. This worked very well. Progress was maintained which kept the team motivated. Of greater significance, information which emerged downstream often was the factor that helped fill in the gaps. For example, data models helped understand and define the process architecture, particularly when the sequence and dependencies of process enactment was being explored. Also the radical rethink to define the processes, provided the information to resolve what the CSFs should be.

Reiteration therefore became an important factor in the methodology, and it was consequently built into the route maps of each of Steps (see Section 5.2.3).

4.6.2 Revisions and Extensions to the Model Objects

One fundamental finding from these two projects was that the set of object types used for the first projects was not adequate. The reasons why are discussed in detail in Appendix 1, Section 1.5., but they can be summarised as not provided a model that was of sufficient richness to fully describe the organisation. Consequently the object types were revised again. The Strategic Alignment model with the revised set of object types for each domain is shown in Diagram 4.8 overleaf and the definition of each of the object types is contained in the Sections 4.6.2.1 to 4.6.2.4 which follow. These object types, when used in the final research project, Eastern Energy (see Section 4.7), needed no further revision. Therefore they are now the current definitive set for Strategic Alignment.

STRATEGIC ALIGNMENT OBJECTS

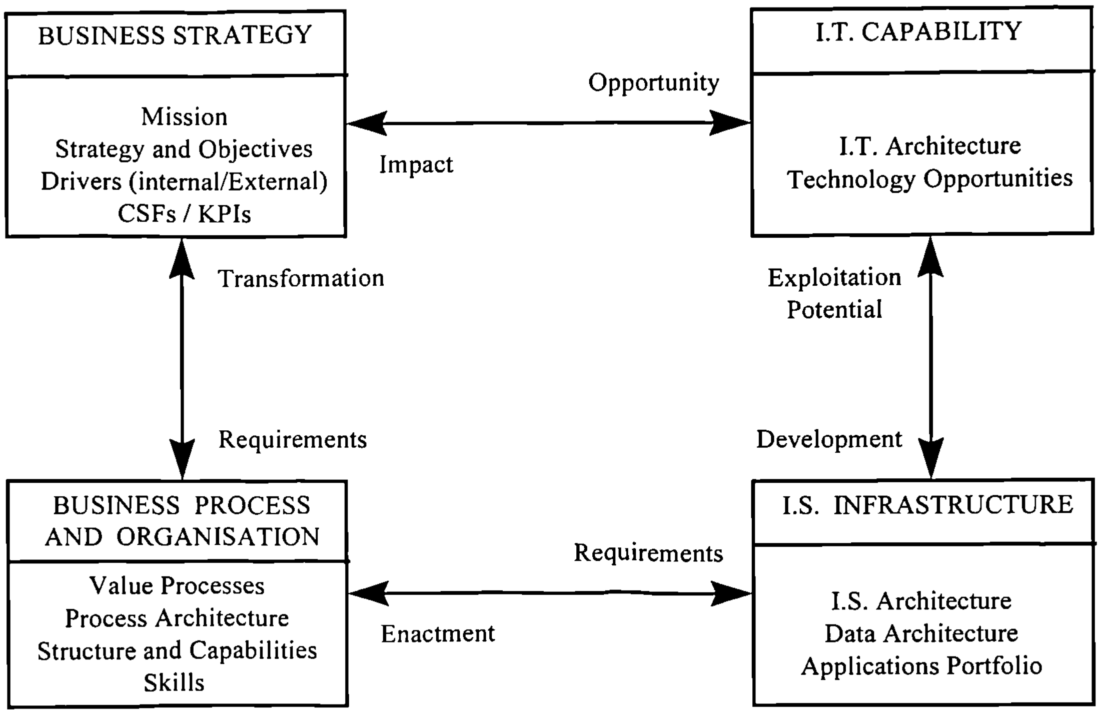


Diagram 4.8.

4.6.2.1 Business Strategy Domain Objects

Mission

This, for most organisations, is a succinct statement of where the organisation is going over the next few years.

Strategy

A Strategy for an organisation a statement which specifies how, or occasionally why, it is going to achieve its Mission. Each Strategy represents a goal that must be achieved on the way to completing the mission. There are normally a number of Strategies which the organisation adopts and in Strategic Alignment these are prioritised by the sequence in which they are to be achieved. This point is discussed in Section 5.2.4.4, Use of Strategic Staircases.

Objective

An Objective is a statement of what is going to be done to achieve a Strategy. Whilst there are a number of Objectives that support a Strategy; an Objective can apply to a number of Strategies over a period of time.

Driver

A Driver is a force that will have an impact on the organisation. The impact can be negative or positive; that is it can help or hinder achievement of an Objective. Also Drivers can originate from within or externally to the organisation.

Critical Success Factor (CSF)

Critical Success Factors are those things that have to got absolutely right if the organisation is going to achieve its objectives. In many cases they are tasks that have to be executed by the organisation and so CSFs are useful in helping determine the Value or Mission Critical Processes of the organisation.

Key Performance Indicator (KPI)

The KPI is a measure or metric for the achievement of an Objective or CSF. Whilst KPIs can be applied to Objectives, when developing a Strategic Alignment Model they are only applied to CSFs. This improves the granularity of the model and check the true relevance of the CSF.

In defining the object types for this domain, confusion arose in the object definitions in two areas. These were the difference between an Objective and a Strategy and whether KPIs should be assigned to Objectives or CSFs.

There appear to be a wide range of definitions for Objectives and Strategies (See Sections 1.2.2 and 4.2.2) and the relationship between them is also not entirely clear. After consideration of the results of the various projects undertaken it was concluded absolute definitions were not really essential and that relative definitions would be sufficient, provided that they were consistent for all Strategic Alignment Models. Consequently the definitions above were proposed. From these it can be seen that an Objective is in effect a lower level Strategy and it also is something which is achieved in a shorter timescale. Additionally a Strategy tends to address the "how" and "why" an organisation should complete its Mission; an Objective tends to concerned with "what" and "when" things should be done to achieve a Strategy.

The following example taken from the ESKOM Distribution Engineering Project will serve to illustrate the point.

The Mission Statement of ESKOM Distribution Engineering is:
"To become a profitable independent organisation competing successfully in a competitive marketplace."

To successfully complete Mission, four Strategies were adopted. The first of these is summarised as:
"Improve the operational efficiency of the organisation."

To achieve this Strategy, three key Objectives were identified and defined:
"To reduce the overall cost of the business operations of the organisation."
"To identify and introduce demand side management opportunities."
"To carry out a programme of standardisation within the organisation."

The increase in focus and detail as one moves from Mission to Strategy to Objective can be seen clearly. A full description of the Strategic Alignment Model produced for ESKOM Distribution Engineering can be found in Appendix 4.

The second area of concern was whether KPIs should be applied to Objectives or CSFs. Once again no consensus could be found on the subject. (See Sections 1.2.2 and 4.4.2) Using the results of the projects it emerged that it was very tempting for organisations not to put quantitative metrics in place. For the Mission and Strategies there is some sense in this approach in that it avoids creating hostages to fortune. But at lower levels of analysis quantitative measures are absolutely essential if potential benefits are to assessed and achievable performance expectations set. A further point to emerge was that some KPIs were harder to measure than others. Once again there was an inclination to try to ignore the harder to measure KPIs. On the ESKOM Distribution Engineering project, the team found resistance from the end users who were reluctant to provide the metrics for some of the KPIs. The reason for this turned out to be that it was because it was a difficult thing to do. However it was these hard to measure KPIs were invariably the ones that gave the deepest insight into the organisation and so were exactly the ones that needed to be measured.

It was found that the issue could be resolved if the analysis was carried out at a lower level of detail. Essentially this meant considering what the KPIs were for each CSF. Given that a CSF was a precise object that mapped to a specific business operation or operations, it could be understood clearly. Consequently when end users were asked how they would know that the CSF had been achieved, it was normally possibly to derive a set of KPIs which measured this achievement. This was not possible when working at the Objective level because of the inability to firstly identify a set of measures and secondly agree the metrics for them. Therefore it was concluded that it was correct to assign KPIs to CSFs.

4.6.2.2 Process and Organisation Domain Objects

Value Process

These are sometimes referred to as Mission Critical Process. Both terms have their merits. Value Process provides the mental connection with the Value Chain concept developed by Porter [Porter and Miller,1985] which can be used as the start point for Value Process definition. Whilst Mission

Critical Process reminds the analyst that the purpose is to focus only on those processes which positively contribute to completion of the organisations Mission. In Strategic Alignment the terms describe the same thing; Value Process having emerged as the default term.

A Value Process is a set of activities which logically integrate to produce a deliverable that makes a major contribution to an objective or objectives of the organisation.

A Value Process will frequently cut across the organisations structure because its purpose is to add value that produces transformation rather than incremental change.

Typically an organisation has between six and ten Value Processes at any time and as one is enacted and the organisation moves forward others emerge to take its place. Value Processes fall into two types:

- Operational Value Processes which are externally focused and are concerned with creation and delivery of products and services.
- Infrastructure Value Processes which are internally focused and are concerned with creating the environment in which operational Value Processes can operate most effectively.

Value Processes are representations of future to be processes. They have emerged as the fulcrum of the Strategic Alignment Model (See section 4.6.1 and 4.7.3). The methods for their definition and development are described in Section 5.2.3.1 and 5.2.3.3.

Process Architecture

The process architecture consists of two things:

- The decomposition of the Value Processes to the next level, definition of the sequence in which the subprocesses are enacted and the feedback loops that exist within the process.
- Integration of the individual value process models into a single model which defines the interactions between the Value Processes.

Structure and Capability

These objects are of lower significance when compared with others in the Model. Structure and Capability refer to the organisation and cultural issues that will need to be addressed in order to achieve enactment of the Value Processes. They are a set of issues that need to be addressed.

Skill

Skill is the object type that defines the skill set needed to be developed to enact the Value Processes. It refers specifically to staff capabilities whereas the previous object type, Structure and Capability was concerned with issues at the organisation as opposed to individual level.

Whilst skill is primarily looking at new skills that will be needed, it also seeks to identify existing skill sets that can be exploited and from which Strategies may be enhanced.

As can determined from the above definitions, Value Process and Process Architecture are the object types of primary importance in this domain. On all the projects to date Structure and Capability and Skill have been of lesser significance when the I.S. Strategy Plan was finally being written. However that is something that will change in the future. There is already evidence that shows that one of the major causes of failure in Business Process Engineering projects is lack of attention to skills and cultural issues in the development and enactment phases, [Gartner, 1995]. In both the ESKOM Distribution Engineering and Headquarters UK Land Forces project significant skills and capability issues were identified (See Section 4.6.3). How Strategic Alignment could be extended to give more prominence in the method to these objects is discussed in Section 7.1.2.

4.6.2.3 I.S. Infrastructure Domain Objects

Applications Portfolio

The Applications Portfolio is a list of all the Information System Applications that are required to support enactment of the Value Processes. An Application is a set of related functions that are supported by a common set of data types. Originally an Application could be implemented as a stand alone system, but this is no longer a criteria because nowadays applications will often share common data with other applications.

In a Strategic Alignment Model, each Application in the Application Portfolio will have a high level functional description. The Matrix Analysis will also specify the data types that it requires and the processes that it supports.

I.S. Architecture

The I.S. Architecture is a model of all the Applications in the Applications Portfolio which defines the dependencies and interworking between the Applications.

There are three important things that have to be provided by the I.S. Architecture:

1. In which Application the data is created and maintained. This is important when data is shared by more than one Application.
2. The data dependencies and flows between the Applications.
3. The sequence in which the Applications have to be developed.

The last point is a representation of the fact that applications which create data used by other applications have to be developed first.

An example of an I.S. Architecture can be found in Appendix 4, The ESKOM Strategic Alignment Model.

Data Architecture

The Data Architecture is either an Entity - Relationship Model or a simple Object Oriented Model of data types. Its prime purpose is to define at high level the data types needed to support the Applications and consequently the I.S. Architecture and to show their logical relationships.

In the studies carried out with organisations in the Electricity Supply Industry, there were approximately eighty entities in the Architecture.

The biggest issues concerning definition of these object types were first, that a large number of the Applications already existed; the project was not really in a greenfield site and second, how far should the architecture go in proposing radical applications that were of technical high risk or possibly difficult to cost justify.

It was found that the best approach was to produce models that ignored existing I.S. Applications and included as many new and radical applications as could be supported by available data. "Available" in this sense means data that could be captured from a source that was identifiable. The alignment process then reviewed the existing I.S. Applications in terms of their conformance to the I.T. Architecture and support of the Value Processes. This review helped determine whether the existing I.S. Applications could continue to be used or whether they had to be replaced. It additionally weeded out those new and radical applications whose benefits in terms of support of Business Objectives were not tangible.

4.6.2.4 I.T. Capability Domain Objects

I.T. Architecture

The I.T. Architecture defines the hardware, software and communications components necessary to support and/or enable the I.S. Architecture. It includes relevant new or emerging technologies that will be relevant in the future and also lays down the underlying principles of the architecture.

For example it will specify whether the architecture is to be based on corporate file servers or whether it is to be distributed. If a client server approach is to be adopted it will specify the guidelines for where the processing is to be carried out.

Technology Opportunities

The Technology Opportunities are a set of definitions of those new technologies that will possibly be of future benefit in achieving Business Strategies. Although many will be I.T. oriented and will map into the I.T Architecture, there will be some that have nothing to do with I.T. but nevertheless are relevant as they can impact on enactment of Value Processes.

2 examples which have occurred in all the Electricity Supply Industry Studies will illustrate the definition.

Neural Network technologies have been available for some years but have enjoyed limited success. Load Forecasting has the characteristics that indicate that they have potential to be addressed by neural networks. It is therefore an emergent I.T. technology that could be of benefit to any new Load Forecasting application that was to be developed.

Ring Main Units, using Sulphur Hexafluoride as opposed to oil as the coolant, require very limited maintenance. Introduction of this technology provides the opportunity to reengineer a number of processes in the areas of Work Management, Planning and Scheduling.

4.6.3 Further Cultural Issues

Management in the Nineties had identified that skills and cultural issues would be a major force that could either enable or inhibit change. In the first 2 studies the only significant point to emerge was that the cultural differences tended to driven by the style and personality of the Director in charge of the organisation. Culture could in these circumstances be considered to be a Driver. There was therefore no real need to have object types in the model devoted to this area.

The ESKOM Distribution Engineering and Headquarters UK Land Forces studies produced a different set of results that caused the object types of Skill and Structure and Capability to be reinserted into the Model. Nevertheless it was not until the ESKOM Model went into its maintenance phase that the real significance of these objects was really observed and a 5th Step, Skills and Cultural Investigation was added to the process.

With ESKOM a process model was developed that would require fundamental change in working practice to implement. The change involved empowerment of the workforce down to a much lower level. Without this empowerment it appeared that the Cost Reduction objective would not be achievable. This was because most of the cost reduction would come from automation of clerical and industrial processes and removal of layers of supervision. When it came to explore how this would be achieved; four blockers emerged. These were:

1. Illiteracy rates in the field based staff.

2. An unwillingness to take decisions among the technical staff.

3. Strong resistance from managers to trust staff to take decisions.

4. Very low levels of computer literacy across all staff grades.

A further capability blocker was identified within the Strategic Alignment team. There had always existed a mind set within the I.T. Division that all applications were developed in house. The track record of these developments was consistently one of late delivery and non delivery to specification. It was therefore proposed that package solutions should be used to prevent the programme being delayed by the I.T. Division. This decision caused intense resentment from the I.T. Division staff assigned to the programme.

Headquarters UK Land Forces (UKLF) also revealed similar skill and capability issues. The blockers found were:

1. Lack of I.T. literacy across all senior officer ranks.

2. An unwillingness to work in mixed discipline groups.

3. A lack of interest in the financial aspects of the plans that the officers were charged to produce.

4. That military staff were on secondment to the organisation for two years, but civilian staff were there for many years.

The impact of the first issue was to create a operational barrier between junior and senior officers. Whilst the junior officers were enthusiastic about I.T., the senior officers were resistant to it. In a military hierarchy this meant that opportunities to use I.T. were ignored and the junior officers became very frustrated.

The purpose of the UKLF was to produce, maintain and execute operational plans. This involved each branch contributing its area of responsibility to any plan. As any operation required integration of the resources of a number of branches to be executed, there was a requirement for integration at the planning stage. Interbranch rivalries tended to cause much of the planning to be done with minimal co-operation. The impact was large amounts of revision work if any plan became operational.

There existed a culture in the military hierarchy that finance and accounting was not something an officer did. Over the years it had consequently become delegated to the civilian staff; civil servants from the Ministry of Defence. Also the civil servants considered UKLF to be a permanent position, but the military looked on it as a necessary secondment to be completed as quickly as possible.

The result was that there had emerged an "organisation within an organisation" who were driven by a different set of objectives and financial drivers were achieving a significance than they should have been. The Chiefs of Staff were aware that this was a problem that had to be resolved before new processes could be introduced.

From the results discussed above it became clear that Strategic Alignment needed to have object types which allowed the skills and capability issues that were identified to be included. However it also appeared that they were still not as important as many of the other object types. Consequently they could still to a degree be marginalised in the alignment process. How this is achieved is discussed in Section 5.2.3.2 and its limitations are discussed in Section 7.1.2.

4.7 Proving the Results

4.7.1 The Final Projects

At this point in the research, four studies had been completed at NORWEB, YEG, UKLF and ESKOM. Each had produced a Strategic Alignment Model which had been accepted by the organisations concerned. The models themselves were being used by the organisations to develop detailed architectures and I.S. development plans. Nevertheless two questions still remained from the original objectives set for the research.

1. How viable was the method to produce an I.S. Strategy plan that could be implemented? The issue was essentially about observing an organisation using a Strategic Alignment Model to govern the next steps in the I.S. and Process development programme and also to be able to govern change.

2. How rigorous was the method. It had been developed into a detailed process from the original ideas, but was it sufficiently detailed ?.

ESKOM Distribution Engineering had fully accepted the Model and now planned to implement it. It was agreed with ESKOM to use this as the means to prove the result and examine the first question.
In addition a further opportunity to do another study had already occurred and in the case of this organisation, Eastern Energy, it was known that they would have to implement the model. This projects also provided the opportunity to examine and prove the method as well as the results.

Both these projects are described in Appendix 1, Sections 1.6 and 1.7.

4.7.2 Final Revisions to the Methodology and the Model

The Eastern Energy Project had proved that the methodology worked, both in terms of the steps required and the sequence in which they were executed. Additionally that the set of object types in the model, together with their linkages, was also proven. Nevertheless there were some lessons to be learned which would enhance the methodology. These are discussed below;

1. During the Eastern Energy project there was significant investigation and debate concerning whether all nineteen matrices, see Sections 5.2.4 and 5.4.3, should be used. For completeness it is sensible to fully complete the exercise, however to analyse each matrix is a lengthy task which can take up to three days to complete. Therefore if the use of a subset is sufficient, then only that subset should be used. However at this stage of learning it is not possible to define whether that subset can be used on all projects and the recommended matrices should be reduced. This is an area where further work would be useful. It appears that the nineteen matrices are the set that will be maximum ever needed, but any individual project may require less. The issue is that the matrices not required is not consistent across all projects.

2. All the second phase projects demonstrated clearly that Value Process is the fulcrum to the model. The Value Process object type is the one which provides the linkage between the Business and Technology domains of the model. Examination of the model shows why this is the case. Firstly the end result of the Enterprise Investigation Activity is identification of the Value Processes. Secondly, in the Skills and Culture Investigation Activity, the start point is the Value Processes and all the skills and cultural issues identified are cross-referred to a Value Process. Finally the Value Process Architecture is used to define the data requirements from which the Data and I.S. Application Architectures are defined. These points demonstrate the pivotal role of

the Value Processes in the model. Therefore it is important that in the methodology due significance is given to the development of the process architecture. Other work in this field [Hammer, 1990 and Hammer, 1995] has produced similar conclusions.

3. The next methodological point to be concluded also concerned Value Processes. It was noted that during the process modelling there was a tendency for the modellers to only consider incremental improvements to the processes from what already existed. This is not the purpose of Value Process modelling. Its purpose is to make modellers radically rethink the process. This point was discussed as a need in Section 3.3.2, particularly in terms of adopting the ideas of Zuboff [Zuboff, 1988] and Venkatraman [Venkatraman, 1991] as well as the concept of process invasion. The difficulty lay in creating the environment where radical rethinking could occur. The projects showed that the approach most likely to deliver results was to set up workshops where the theory and ideas, with best practice examples, were discussed. This was then followed by brainstorming sessions which encouraged as many ideas as possible. After some filtering and classification the teams were then sent away to research and develop the ideas. Without such an approach the quality of the radical rethinking for the Value Processes was diminished. This is why it became a fundamental part of the methodology.

4. The final finding concerned the Steps and Activities of the method. The approach had been to use the 28 activities shown in Diagram 4.7. However reviews of progress indicated that whilst these were the correct activities; their usage was more interrelated and that there was an advantage in separating out the activities concerned with Skills and Culture into a separate Step. On a number of occasions the team of analysts found that they were feeding back results into activities already addressed which lead to a more iterative analysis than was

indicated by the method as it was defined. Also the activities concerning Skills and Culture needed to be grouped to ensure consistency of analysis and output.

Consequently the method was revised into a 5-Step approach, with a Skills and Culture Investigation becoming the extra Step. Additionally the description of the each Step became a "route map" of the activities, instead of a list, so the flow, relationships and feedback between the activities could be described. The project therefore produced information by which the method could be again revised. The revisions produced the current state of the method Which is described in detail in Chapter 5, Section 5.2.

4.8 Summary of Results

The 6 projects which provided the research platform, were done in 3 phases.

1st Phase: NORWEB and YEG

2nd Phase: UKLF and ESKOM

3rd Phase: ESKOM (implementation) and Eastern Energy

These are the three iterations which were described in Diagram 1.6 in Section 1.5. The way the method evolved through the three Phases is summarised below in Table 4.1.

Phase	Inputs	Results
1	• Results of review of earlier SISP methods (diagrams 4.1 and 4.3) • Theoretical Strategic Alignment method and model from MIT90s (diagram 4.2)	• Revised Strategic Alignment model (diagram 4.6) • "15 - Step" method (diagram 4.5)
2	• Model and method resulting from Phase 1.	• Extended Strategic Alignment model (diagram 4.8) • "4 - Step, 28 Activity" method (diagram 4.7)
3	• Model and method resulting from Phase 2.	• No further developments to the Strategic Alignment Model • "5 - Step" method (Chapter 5, diagrams 5.2 and 5.4 to 5.8 inclusive)

Table 4.1

From Table 4.1 it can be seen that the model was developed into a state that needed no further development at the end of the Phase 2 studies and research However it required the Phase 3 studies and research to develop the method to the same state of completeness. This is a not entirely unexpected result because the model just contains the information collected about the organisation, whilst it is the method that determines how the information is collected and analysed. It is always necessary to determine the "what" before the "how".

The research has been able to develop a new method for I.S. Strategy Planning that is proven to deliver results that organisations will use to develop their I.S. infrastructure and capabilities. That the research method tested the results iteratively to evaluate and prove them has enabled the end result to be a proven method as opposed to a theoretical one. This has been of significant benefit in getting Strategic Alignment adopted by ICL as its standard I.S. Planning methodology. (See Addendum).

Chapter 5. The Model and Method

5.1 The Framework of Strategic Alignment

The results of the projects indicated clearly that it was not practical to attempt to carry out a Strategic Alignment project as a single activity. Dividing the study into five self contained Steps, as shown in Diagram 5.1 below; each having its own outputs, was found to be the most practical and effective approach. The research evidence that led to this conclusion has been discussed in Section 4.6.

STRATEGIC ALIGNMENT PROCESS

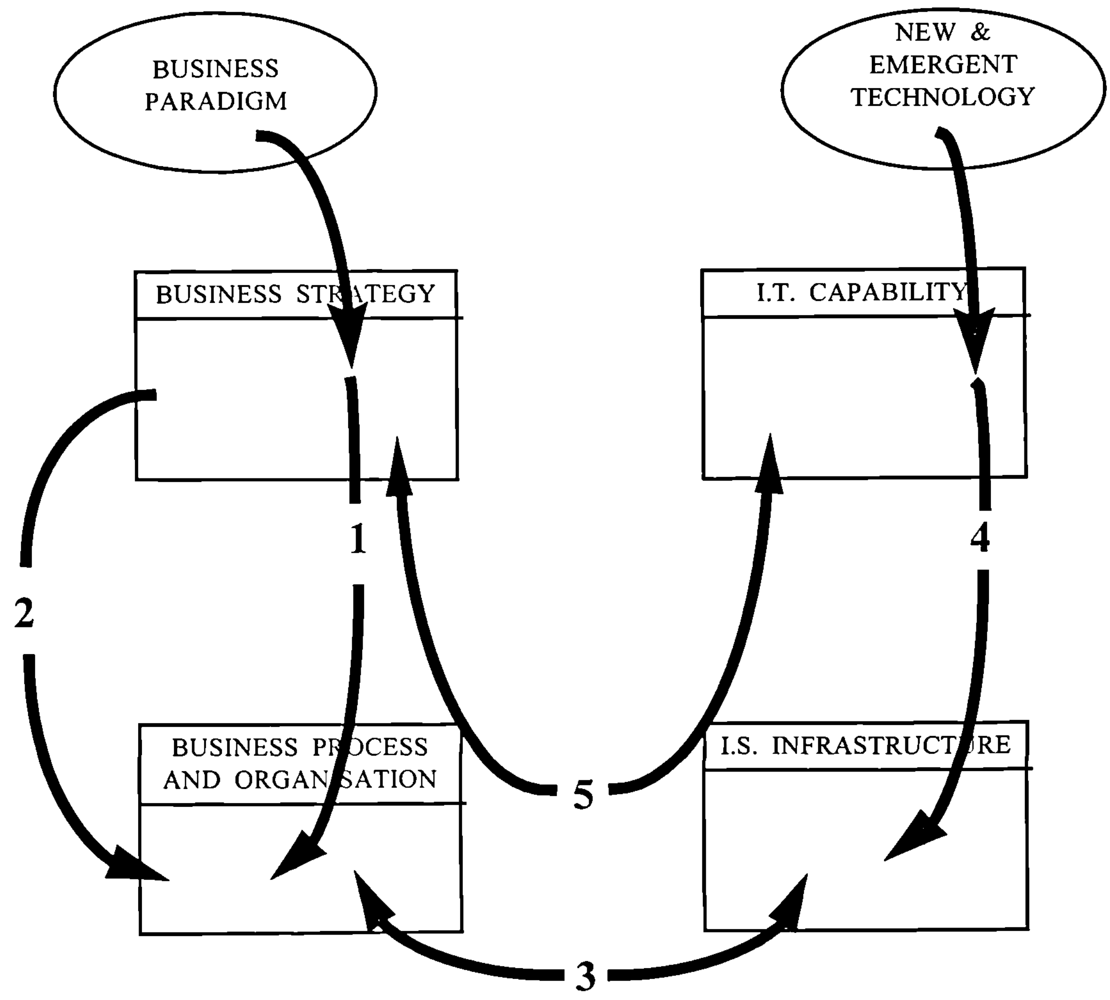


Diagram 5.1

The first four Steps populate the 4 domains of the Strategic Alignment Model; whilst the fifth produces the alignment and the resultant I.S. Strategy Plan. The scope of each Step as it relates to the model is also shown in Diagram 5.1. As can be seen from the diagram, Steps 1 and 4 explore external factors. Also each Step does not map to a single domain. This point was discussed in Section 4.6.

The 5 Steps have been given the following titles:

1. Enterprise Investigation

2. Skills and Culture Investigation

3. Architectural Modelling

4. Technology Investigation

5. Model Iteration and Analysis

Although each Step has its own set of outputs, there are nevertheless interdependencies between the steps which determine the sequence in which the steps have to be started. This sequence is shown in Diagram 5.2 overleaf. As the first four steps populate the model, they logically must be done first. Their sequence is determined by the fact that Step 1 and Step 4 collect some information that has origins which are external to the organisation and from which other objects are derived. Similarly the objects in Step 2 and Step 3 are derived from objects in Steps 1 and 4.

The diagram reflects both the sequence in which the 5 Steps must be started and also the fact that there is a high degree of overlap. It has been found that the Steps can be carried out with a degree of concurrency. The exact amount of concurrency is dependant on the size of the resource available to carry out the project. "Resource" in this context refers not only to the project members, but also the user community who will provide input to the project team.

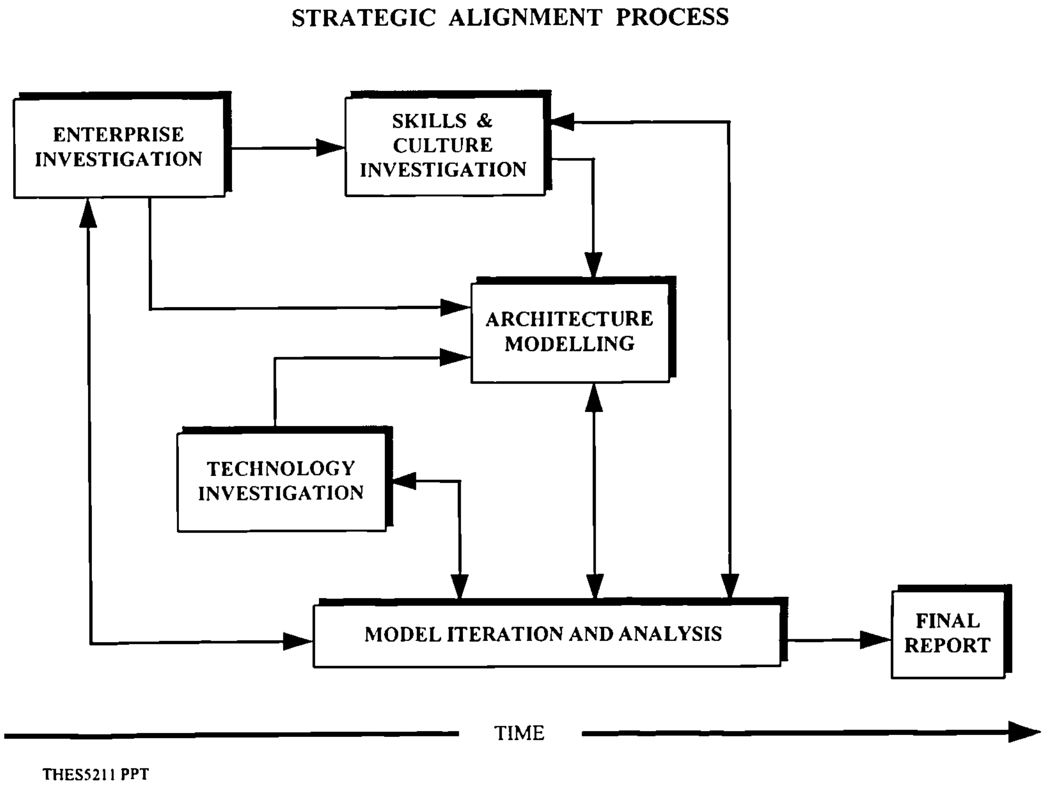


Diagram 5.2

Strategic Alignment consists of a Method, the five steps shown in Diagram 5.2 above, and the model, shown in Diagram 4.8 in Section 4.6.2. These form the core of Strategic Alignment. To use the method to populate the model, create alignment and derive the I.S. Strategy Plan is a complex process and, together with determination of the object types in the model, is the result of the research. This Chapter is devoted to describing and explaining the method, the object types and the structure of the I.S. Strategy Plan.

5.2 The Method

5.2.1 Introduction

As has been discussed in Section 5.1, a Strategic Alignment project consists of 5 Steps, each Step has its own set of activities which form the route map of the step. There are dependencies between the activities within a step and between the steps. There is also feedback within and across the steps. The following Sections; 5.2.2, 5.2.3 and 5.2.4, describe the method for each Step and how it was developed from the results. Section 5.2.2 is a description of the Steps. Section 5.2.3 contains the detail of the route map, the individual activities, their inputs and outputs and finally the tools and techniques available to execute them. Section 5.2.4 contains the detailed description for creation of alignment and explains how the method was developed.

5.2.2 Definition of the Major Steps

Each of the five steps is a set of activities with its own output. The purpose and functionality of the Steps is described below:

Step 1: Enterprise Investigation

The overall purpose of this group of activities is to define what the organisation wants to achieve. This is achieved by populating the objects of the Business Strategy domain. The approach is to start by investigating the business paradigm in which the organisation operates, including any potential paradigm shifts that may occur and could have an impact on the organisation. Definition of the paradigm leads into an objective assessment of the organisation's current position in the paradigm and identification of the drivers, both positive and negative that will cause that position to change. From these analyses a mission statement for the organisation can be postulated and the strategies and objectives, which need to be adopted to achieve the mission, defined. For some organisations these already exist, so the activity focuses on checking their practicality in relation to the paradigms.

The next activity is to complete population of this domain by identification, for each business strategy and objective, the metrics by which they can be measured. Metrics are those quantifiable measures, also known as key performance indicators, KPI's, which determine an organisations performance. Use of critical success factors, CSFs, to determine what is important is an appropriate way of approaching this analysis. This is because CSFs have a fundamental input in the determination of the set of value processes that are required to support achievement of the business strategies. Identification of the set of value processes is the penultimate activity of this group. It is done at this time because value processes are business strategy dependent, they provide the link into the next group and assist with the boundary and scope definition of the organisation. Value processes are defined as that set of mission critical processes on which the success of the organisation is totally dependent. Typically an organisation has between seven and eleven, rarely more, value processes at any time.

The process of Enterprise Investigation commences by examination of the external environment and then moves to inward looking analysis by relating the organisations external position to its characteristics. The result is a Business Strategy domain model plus the links into the Business Process and Organisation domain that is the essential input for the next group.

Step 2: Skills and Culture Investigation

Thus far the investigations have focused on hard objects within the Strategic Alignment model. There are also soft objects in the model that have to identified and aligned. These objects are skills and culture. In certain respects they are internal drivers and so belong within the driver object set in the Business Strategy domain. However such is their range, complexity and impact on other objects, that it has been found better to treat them as objects in their own right and place them in the Business Process and Organisation domain.

To be able to implement change requires a change in the skill set and often that the organisation adopts different attitudes and beliefs. The rate at which an organisation will comfortably accept change is also an issue that needs to be understood and built into the model. There are 4 inputs to the process of defining the skills and cultural objects. The direct inputs are the value processes and the business strategies. IS and IT are indirect, since their impact is often via the processes. However when the input is Technology, as opposed to IT, the impact is direct. This is because it was discovered in the ESKOM project that introduction of two new technologies, Sulphur Hexafluoride Transformers and vehicle GPS, caused acceptance resistance from field based staff. This had to be overcome before the opportunities to introduce new processes that these technologies offered could be taken.

The method used is to assess, for each input object, what the skills requirements will be to deliver it and also what will be the cultural impact of building these skills. The resulting list of skills and cultural requirements can be matched against the current level of capability in the organisation. Areas of blockage are thus identified and their impact on the development of the processes and IS opportunities assessed. At this level of analysis the skills and cultural objects should be confined to broad descriptions as opposed to fine detail. The detail will be defined when process enactment and system implementation is planned. At this stage the purpose is to find areas of blockage and opportunity that contribute to the model.

Step 3: Architecture Modelling

The purpose of this set of activities is to devise a set of high-level architectural models covering value processes, information systems and data. Implicitly all 3 architectures support the business strategies and mission. In principle the approach used is to devise the process architecture from the information contained in the Business Strategy domain, then devise the systems architecture sequentially from the process architecture and finally devise the data architecture from the two previously developed. In practice however, a more practical approach is to execute all three activities in parallel, frequently mapping and matching the architectural models to check for completeness, consistency and integrity. This approach is preferred because there are often existing data models and systems that provide valuable input into the modelling process. Furthermore, as data architectures tend to be far less volatile than process and to a lesser degree, systems architectures, they provide a valuable checking mechanism.

The degree of detail in the three architectural models is only as much as is necessary to complete alignment and act as referential models for the subsequent development activities. However as these models do provide input to, and governance of, the development activities; architectural modelling methods that conform to established standards should be employed.

For the process architecture, each value process needs to be decomposed to a further level of detail, normally six to twelve subprocesses, and the logical sequence in which the subprocesses are done is defined. Once all the value processes are decomposed; the interactions between them, at the subprocess level, should be investigated and specified. At this point it is useful to map the decomposed value processes back to the business strategies to determine the level of support given by the value processes to each business strategy. This analysis will enable an initial prioritisation of the value processes.

The process architecture will provide the input to determine the information systems required to support it. At this level of modelling, a list of IS opportunities plus a brief description is all that is required. What is necessary, however, is an analysis of the support that each IS opportunity gives to each value process.

The next activity is to derive the high-level data model that will support the processes and the I.S. opportunities. For Strategic Alignment, only the major data types need be identified together with their logical relationships. To ensure completeness and consistency it is essential to map the data types to the processes and to the I.S. opportunities. The purpose is to identify data types that don't map to I.S. opportunities and vice versa, so inconsistencies and omissions can be resolved. Also the mapping results will determine the relative importance of the data types and any data dependencies which impact on the development sequence of the I.S. opportunities.

Mapping data types and value processes enables a check to be run of the subprocess' logicality and sequence, both inside the value process and across value process boundaries.

Step 4: Technology Investigation

This group of activities is primarily concerned with identifying technology, which is new or emergent, that can be used to positively impact on achievement of the business strategies. It has been found that the majority of technologies that have this kind of impact tend to information technologies, providing this is expanded to include networking and communications. Consequently whilst most investigation should focus in this area, there should be some research into other technologies that could be of potential value. This is best achieved by limiting the search to those areas to technology that already are known to have relevance to the organisation and focusing on developments in these areas. Whilst totally lateral investigation may bring out something revolutionary, the chances of it happening are very remote.

The first activity is to determine the organisations capability to successfully exploit new technology. If it has a track record of being an innovator, then it will tend to accept new technology readily. If it is a follower or laggard, then new technology will only be acceptable if the tangible benefits heavily outweigh the risks. This evaluation helps place constraints round the extent of the search activity. In this case research is carried out by a search of "worlds best practice" case studies, examples from different industries and technology publications. From this a list of possibilities can be derived. Each possibility then has its potential role and impact assessed. For information technologies the object is to assess how it will impact on information systems in terms of their capability and also their development. For other technologies the object is to look for general business impact, particularly in terms of "quick-hits". If time permits and the information is available, cost-benefit analyses can be done.

The result is a prioritised list of technology opportunities, from which a subset for use can be selected. For the IT elements, selection should be based on the conformance of the technology to an agreed IT architectural standard as well as the IS impact. This may already exist for the organisation. If it doesn't, then it will be necessary to formulate at least the principles as part of the study.

Step 5: Model Iteration and Analysis

The four proceeding sets of activities have been sequential, starting at Step1 and moving through to Step 4. This group by its iterative nature can be started as soon as there is sufficient information available from the other activities and will be done more than once as the model is developed. It also repeats some of the analytical activities found in the other groups to ensure completeness.

The purpose of this group of activities is threefold. The first is to harmonise all the objects in the model to ensure that they logically and consistently support each other in terms of achieving the mission of the organisation. The second is to ensure that there is a technical harmonisation of all the objects such that all the dependencies are satisfactorily resolved. Finally, and of probably most importance, the model is analysed to identify and define all the opportunities to enhance and change the business strategies and even the mission. This final purpose is achieved by exploring how early introduction of IT and IS can change the scope and delivery timescale of the processes, which in turn has the impact on the business strategies.

Other activities included in this group are identification of "quick-hits", where this has not already been done and definition of the next set of steps; which will normally development planning and detailed architecture modelling.

5.2.3 The Individual Activities

The five Steps described in the previous section each consist of a large quantity of work. To manage this work requires that the steps are themselves broken down into a set of individual activities. However to ensure that alignment is achievable and that the activities are consistent, it is necessary to formulate them into a logical sequence. This sequence creates the "route map" of the methodology. Each activity has a set of inputs and outputs. It is executed by use of one or more tools or techniques. For a number of the activities there is a choice of tool or technique. The Strategic Alignment methodology is deliberately not prescriptive, choice is provided to allow the analyst to employ the most suitable tool or technique. Suitability depends on a number of factors which include the experience and preference of the analyst, and the degree of complexity of the organisation being studied. The important thing is that the outputs from each activity are delivered in sufficient detail to enable the next one to be analysed rigorously.

Furthermore whilst the activities in each of the five Steps create a logical sequence, which if followed rigorously will deliver an accurate result; the level of detail to which each activity is executed is allowed to vary to respond to the overall needs of the project. In some projects it is only necessary to investigate an activity at a trivial level, whilst in others a full analysis is required. This need is determined by the complexity of the project, its purpose and its terms of reference.

The research has shown however that as an activity is executed factors can emerge which will have an impact on previously executed activities; (Section 4.6.1). Feedback or reiteration activities are therefore built into the route maps to handle this occurrence. These feedback loops have two further advantages in the creation of the initial model:

1. They act as a consistency checking mechanism

2. They enable the analyst, if required, to carry out an overview investigation and pull out key issues which can then be investigated in detail.

If the study is being undertaken in an organisation where there has been no previous work then to use the second point creates a serious risk that the model will be incomplete. But if there is work already available, for example an existing data architecture or set of critical success factors, to carry out an overview investigation to quickly get to the point in the study where they become relevant and then work back to fill in the gaps can be a valid approach. Finally this approach is especially valid when an existing model is being reviewed; (Section 5.5.1).

Functional descriptions of the five Steps have been given in Section 5.2.2, of this document. The following five sections provide a full definition of the Steps. This is achieved by creating three things for each Step:

1. A route map of the activities within each Step. This shows the individual activities, their sequence and their interdependencies. It also contains the information external to the Step that is required to initiate it. In the route maps, activities are shown as rectangles and external information is shown as ovals. The route maps are shown in Diagrams 5.4, 5.5, 5.7, 5.8 and 5.9.

2. A matrix which defines the tools and techniques that can be used to complete each activity. The matrices are contained in Tables 5.1, 5.3, 5.5, 5.7 and 5.9.

3. A table which defines the data and information needed to execute each activity (inputs) and the data and information that is produced by each activity (outputs). The details of the inputs and outputs and shown in Tables 5.2, 5.4, 5.6, 5.8 and 5.10.

5.2.3.1 Enterprise Investigation Activities

These activities populate the Business Strategy domain of the model and identify the Value Processes that reside in the Business Process and Organisation domain. Since Strategic Alignment is not primarily a Business Strategy Planning method, the activities focus on collecting information that confirms the strategies and objectives as they exist; then adding the qualitative and quantitative information necessary to create alignment.

The primary tools for achieving this are Criteria Based Interviewing to gather the baseline information, Facilitated Workshops to feedback results and gain agreement and Best Practice Comparison to provide external examples to provoke thought and discussion. When using Best Practice Comparisons, case studies from other industry types can often provide stimulation to more radical thinking. For example the changes in the financial services industry, particularly with regard to customer services, have provided useful input to the utilities industry where organisations were presented with regulated standards for customer service which they had to achieve.

Criteria Based Interviewing occupies a large proportion of the effort required to complete an Enterprise Investigation. It is necessary to first agree with the project sponsor who will be interviewed. Once this is done then the content of the interviews have to also be agreed with the sponsor. There may be issues that have to be specifically raised or omitted. These need to be identified. Despite these constraints the questionnaires have tended to be similar. A example questionnaire is in Appendix 2. This was the one used for the Eastern Energy Project.

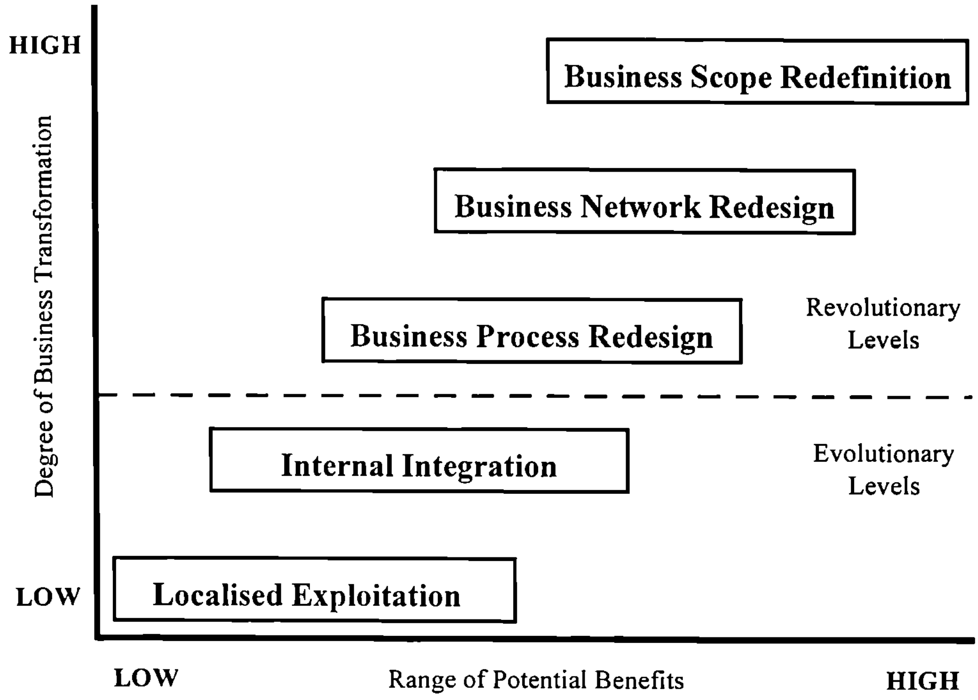
The other tools and techniques tend to be used to back up the primary tools. They are there to provide a more detailed analysis capability if required to resolve complex issues, for example, System Dynamics and Scenario

Modelling; or they provide a means of presenting and analysing information, for example, Model of Competitive Forces and Strategic Staircases.

To identify the Mission Critical or Value Processes the extended value chain is a useful start point. The original value chain concept as defined by Porter [Porter and Miller, 1985] considered process within a standard set of organisationally based activities inside the organisations boundaries. This had two limitations; it failed to consider that additional value could be achieved by integrating processes across the activity groups and it failed to consider that potentially even more value could be added by integrating processes between organisations. This latter idea leads to the extended value chain and the concept of process invasion. The 5-Layer Model developed by Venkatraman [Venkatraman, 1991] formalises this approach by considering the benefits that can be gained from each level of process engineering. This is shown in Diagram 5.3 overleaf. Use of these two techniques and input of the CSF and Objective definitions leads to the identification of the six to eleven Value Processes. It is important to remember that the Value Processes do not cover all the processes that the organisation has to carry out. They are concerned only with those that will contribute most to achievement of the Objectives.

It is at the two highest levels, Business Network Redesign and Business Scope Redefinition, where process invasion is introduced. At these levels process engineering looks beyond the organisations boundaries to investigate possible opportunities. At the Business Network Design level the opportunity is to use I.T. to integrate the organisations processes with those of its suppliers and customers to generate benefits. At the Business Scope Redefinition level the opportunity is to exploit new technologies, most often I.T., to completely change the dynamics of an industry and so create benefit by forming a new operational paradigm.

VENKATRAMAN 5-LAYER MODEL



after Venkatraman

Diagram5.3

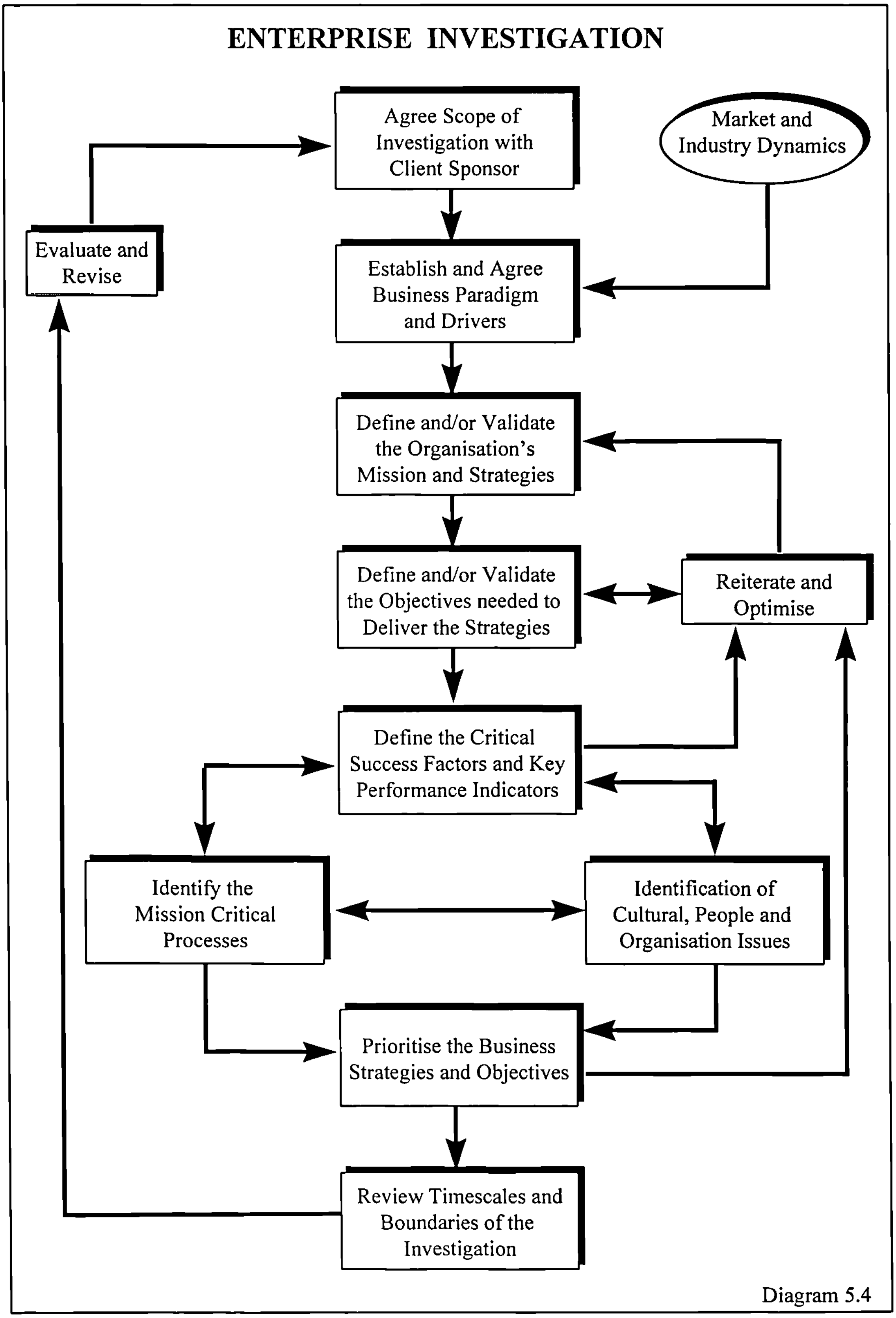

ENTERPRISE INVESTIGATION
Agree Scope of Investigation with Client Sponsor
Market and Industry Dynamics
Evaluate and Revise
Establish and Agree Business Paradigm and Drivers
Define and/or Validate the Organisation's Mission and Strategies
Define and/or Validate the Objectives needed to Deliver the Strategies
Reiterate and Optimise
Define the Critical Success Factors and Key Performance Indicators
Identify the Mission Critical Processes
Identification of Cultural, People and Organisation Issues
Prioritise the Business Strategies and Objectives
Review Timescales and Boundaries of the Investigation
Diagram 5.4

Table 5.1: STRATEGIC ALIGNMENT PROCESS - STEP 1

ENTERPRISE MODELLING ACTIVITY	**TOOLS and TECHNIQUES**									
	Criteria Based Interviewing	Facilitated Workshops	Matrix Analysis	Model of Competitive Forces	System Dynamics	Scenario Modelling	Best Practice Comparison	Strategic Staircases	Extended Value Chain	5-Layer Model
Scope Definition	*						*			
Business Paradigm Evaluation	*	*		*	*	*				
Mission/Strategy Definition / Validation	*	*		*		*				*
Objectives Definition	*	*		*			*			
CSFs / KPIs Definition	*	*	*	*			*		*	
Mission Critical Process Identification	*	*		*	*		*		*	*
Skills/Cultural Issue Identification	*	*			*		*			
Strategy Prioritisation		*	*	*		*	*	*	*	*
Boundary and Timescale Review					*	*	*	*	*	*
Iteration and Optimisation			*		*	*	*	*	*	*

STRATEGIC ALIGNMENT PROCESS - STEP 1 ENTERPRISE MODELLING		
ACTIVITY STEP	INPUTS	OUTPUTS
Scope Definition	Clients requirements, concerns, and issues. Clients timescales and budgets. Consultancy methods, capabilities and resources.	Project terms of reference including: - business areas to be investigated. - boundaries of the project. - deliverables and timescales. - resources to be committed. - review and reporting mechanisms.
Business Paradigm Evaluation	Interview results. External industry information and best practice models. Possible future scenarios. Industry trends; both known and potential.	Definition of industry paradigm. Definition of organisation's position. in the paradigm. Definition of the business drivers. acting on the organisation and their impact.
Mission Strategy Definition / Validation	Interview results. Business drivers. Existing mission statements and strategies being followed. External best practice examples. Possible future scenarios	Agreed Mission Statement Agreed set of business strategies - existing ones being pursued. - future ones to be adopted.
Objectives Definition	Interview results Agreed set of business strategies and their priorities. Business drivers. External best practice examples.	Set of agreed and prioritised business objectives.
CSFs / KPIs Definition	Interview results. Business objectives. Organisation boundaries. Business drivers. Industry value chain.	Set of agreed and prioritised CSFs. Set of agreed and prioritised KPIs for each CSF.
Mission Critical Process Identification	Interview results. Organisation boundaries. Business drivers. CSFs and KPIs. External best practice examples. Industry value chain.	Set of mission critical processes (usually 6 -10) with an agreed definition of each.
Skills/Cultural Issue Identification	Interview results. CSFs and KPIs. Mission critical processes.	Skills shortages and surpluses. Cultural blockers and opportunities. Change acceptance estimate.

Table 5.2

STRATEGIC ALIGNMENT PROCESS - STEP 1 (contd.) ENTERPRISE MODELLING		
ACTIVITY STEP	INPUTS	OUTPUTS
Strategy Prioritisation	Business drivers. Agreed strategy and objectives. CSFs. Mission critical processes. Skills and cultural issues. Organisation's position in the industry paradigm.	Prioritised set of business strategies.
Boundary and Timescale Review	Terms of reference. Business drivers. Agreed strategy and objectives. CSFs. Mission critical processes. Skills and cultural issues. Organisation's position in the industry paradigm.	Revision to scope of the project.
Iteration and Optimisation	All outputs from preceding steps. External best practice examples.	Revisions to the outputs. Consistency check results.

Table 5.2 (contd.)

5.2.3.2 Skills and Culture Activities

The activities in this Step seek to identify and define any skills and culture issues and populate the object types in the Business Process and Organisation domain. Much of the input will come from the results of the Enterprise Investigation and the Criteria Based Interviews. The purpose is to identify the issues, then for each issue ask three questions:

1. Is this Issue of sufficient impact to require that it is addressed immediately or can it be ignored because it will not impact on the implementation of the Objectives and, by implication, the I.S. strategy Plan and the Value Processes?

2. If the Issue is of sufficient impact, is it something that can be addressed within the terms of reference of this project or is it necessary to bring in specialist skills?

3. If specialist skills are needed, can they do their work in parallel with the Strategic Alignment, or does the study have to be suspended while they work, or can their work wait until the study has been completed?

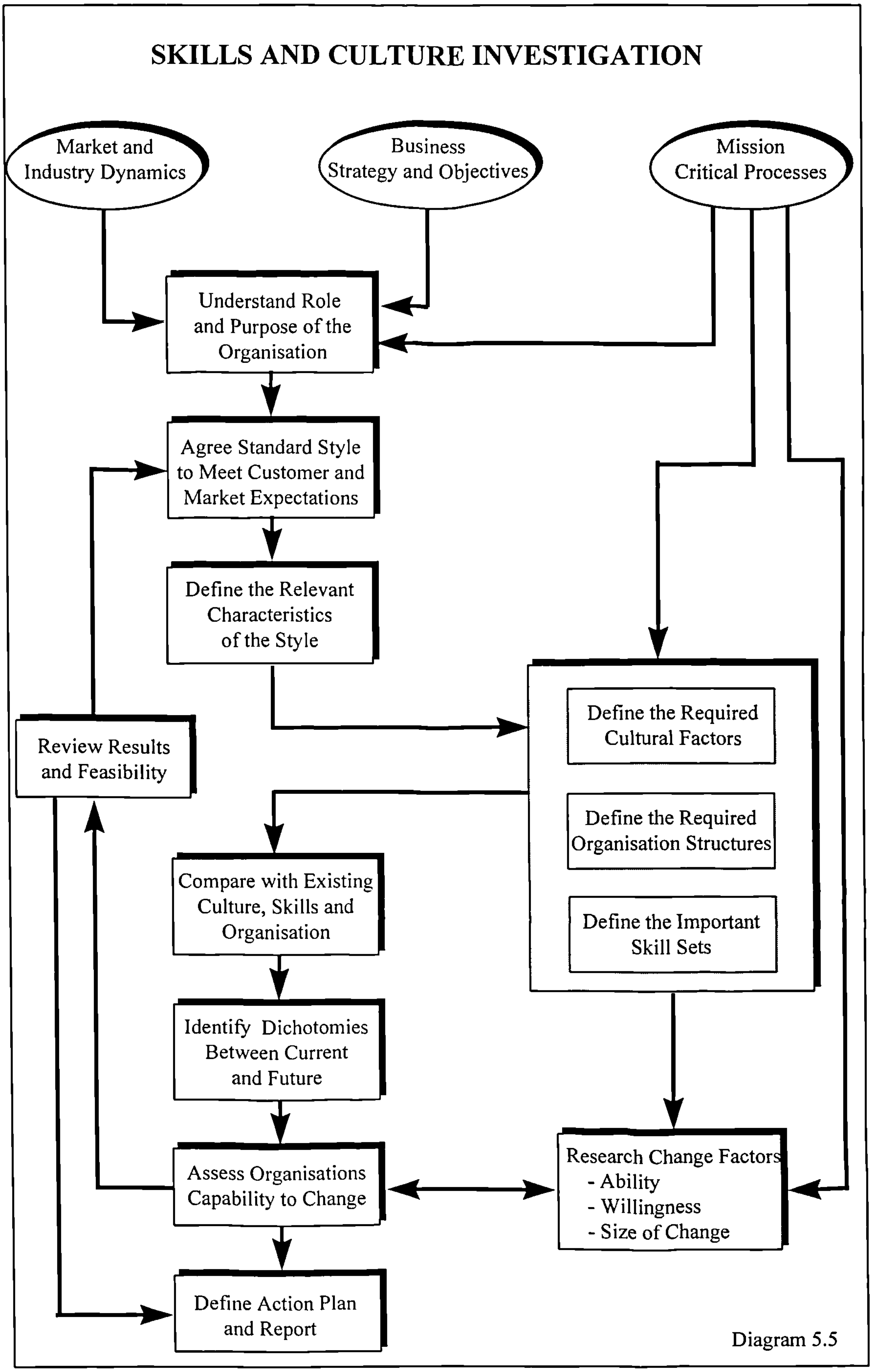


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Table 5.3: STRATEGIC ALIGNMENT PROCESS - STEP 2

SKILLS AND CULTURE INVESTIGATION	TOOLS and TECHNIQUES								
	Criteria Based Interviewing	Facilitated Workshops	Best Practice Comparison	Culture Question-naires	Management Style Analysis	Attitude Survey	Industry Change Survey	Organisation Modelling	Skills Analysis
Understand Role and Purpose	*		*				*		
Agree Standard Style to Meet Expectations		*	*						
Define the Required Cultural Factors	*		*	*	*		*		
Define the Required Organisation Structures		*	*		*			*	
Define the Important Skill Sets	*		*	*		*	*		*
Compare with Existing Culture Skills and Organisation	*	*		*		*		*	*
Identify Current to Future Dichotomies		*							
Assess Organisations Capability to Change		*							
Research Required Change Factors			*	*	*	*	*	*	

STRATEGIC ALIGNMENT PROCESS - STEP 2 SKILLS AND CULTURE INVESTIGATION		
ACTIVITY STEP	INPUTS	OUTPUTS
Understand Role and Purpose	Best practice examples. Possible future scenarios. Industry trends; both known and potential. Business strategy and objectives. Mission critical processes.	Direction and expectation statements.
Agree Standard Style to Meet Expectations	Culture questionnaire results. Direction and expectation statements. Interview results Management and organisational style models.	Organisational style definition.
Define Relevant Style Characteristics	Organisational style definition. Management and organisational style models.	List of required style characteristics.
Define the Required Cultural Factors	List of required style characteristics. Best practice examples. Culture questionnaire results.	List of required cultural factors.
Define the Required Organisation Structures	Organisation style definition. List of required style characteristics. Best practice examples. Interview results.	Organisation structures.
Define the Important Skill Sets	Mission critical processes. List of required style characteristics. Organisation structures.	Required skill set.
Compare with Existing Culture, Skills and Organisation	Skills shortages and surpluses. Cultural blockers and opportunities. Required skill set. Organisation structure. Interview results.	Current culture, skills and organisation differences.

Table 5.4

STRATEGIC ALIGNMENT PROCESS - STEP 2 (contd.) SKILLS AND CULTURE INVESTIGATION		
ACTIVITY STEP	INPUTS	OUTPUTS
Identify Current to Future Dichotomies	Current culture, skills and organisation differences. Future business strategies. Industry trends. Possible future scenarios.	Potential future culture, skills and organisation differences.
Assess Organisations Capability to Change	Change acceptance estimate. Industry trends. Culture questionnaire. Attitude survey results.	Change capability estimate.
Research Required Change Factors	Change capability estimate. Industry trends. External best practice estimates. Current and potential future culture, skills and organisation differences.	Changes required. Action plan to enable required changes to be made.

Table 5.4 (contd.)

5.2.3.3 Architectural Modelling Activities

There are three deliverables from these activities:

1. The Value Process Architecture
2. The Data Architecture
3. The I.S. Architecture

The Value Process Architecture is of high significance to Strategic Alignment Process because it is the fulcrum for the harmonisation of the Business and I.S. Strategies (see Sections 1.4.1.2, 4.6.1 and 4.7.3). From the Enterprise Investigation the Value, or Mission Critical, Processes had been identified and an initial definition had been produced. In these activities each Value Process is engineered to generate a process model and then the models are integrated to produce the Value Process Architecture. There are a number of aspects relating to these activities which are worthy of individual discussion.

As was discussed in Section 4.6.2.2, Value Processes fall into one of two types. There are Operational Value Process which deliver added value to the customer and Infrastructure Value Processes which are enabling processes. The principle is shown in Diagram 5.6 overleaf. This is an example taken from the ESKOM Distribution Engineering project.

There are four Operational Value Processes, shown as the horizontal arrows, and three Infrastructure Value Processes, shown as the vertical arrows. The HQ UK Land Forces project derived a similar structure of the two types of Value Process and the classification has proved very useful in two ways:

1. Guidance and clarification of the process identification steps.
2. Explanation and discussion in workshops.

Operational and Infrastructure Value Processes

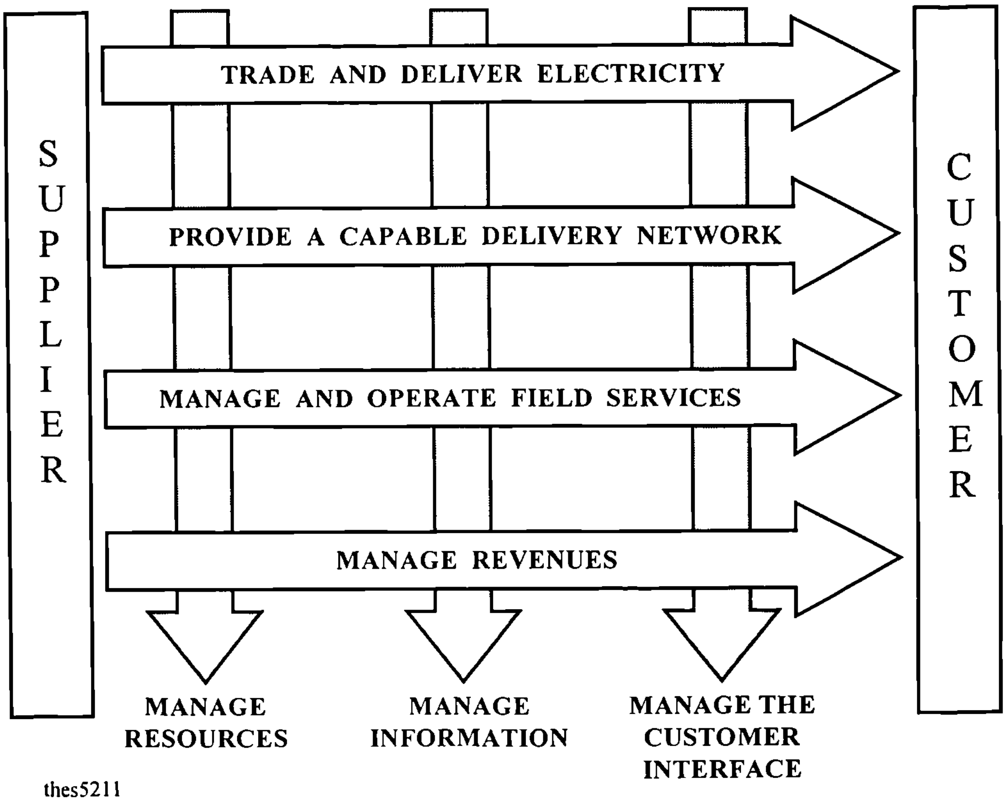


Diagram 5.6

A difficulty found on all the projects has been the "blank piece of paper" syndrome. In other words, how to start the process engineering step. One approach is to construct an "as is" model of the existing processes and then use that as the basis to engineer the new "to be" process. The danger of such an approach is that the imaginative thinking needed to develop the "to be" model is constrained by a detailed knowledge of what is current practice. It has been found that a more effective approach is to use an extended value chain and best practice as the initial inputs. The extended value chain is derived from the original Porter Value Chain [Porter and Miller,1985] except that it looks beyond the organisations boundaries to include those activities of the supplier and customer that link to the organisations own activities (see Section 4.7.3). Using these two inputs a "to be" value process model can be constructed and then compared with existing processes afterwards as a mechanism to ensure nothing has been omitted.

The tools and techniques available to build a process model are numerous. It has been found that each Value Process is normally only decomposed by one level. This gives a model of sufficient richness to support development of an I.S. Strategy Plan. Occasionally it is necessary to go down to a second level for part of the model that is extremely complex or where the interfaces are difficult to analyse. To do this modelling simple drawing tools are more than adequate. To use a sophisticated process engineering tool is not necessary. Also the models can be constructed using process decomposition techniques.

Where the models do become extremely complex and difficult to understand, System Dynamics [Wolstenholme, 1994] has been successfully used to model the complexity. This technique which has been developed from the softer end of Operational Research tends to treat the process holistically and seeks out its logical boundaries. This, coupled with its requirement to collect quantitative data about the process, explore the variables that have an impact on each activity and to build in feedback, make it a very powerful technique which can be relied on to sort out high degrees of complexity.

Once all the Value Process Models have been engineered individually, they are integrated into a single Process Architecture. The question that needs to be addressed in this step is where and how do the Value Processes interact. In some respects this is little different from constructing the individual Value Process models. All the subprocesses in each Value Process are known. By asking the question “what does this process need to have available to it to be executable?”, the information needs can be determined. The source of the information can be identified from examination of the subprocesses and thus the interactions can be identified.

To produce a Data Architecture either Entity Attribute Relationship modelling or Object Oriented modelling can be used. Object Oriented Modelling provides a richer picture that fits more cleanly with the Process Architecture. However many organisations have yet to adopt object oriented methods and so an Entity Relationship model will be more familiar to them. As with the Process Model, in Strategic Alignment it is done at a high level with a logical model that identifies the important data types and their relationships. The prime input to the modelling process are the Value Processes which provide the information to determine the data requirements. Once again best practice, often in the form of standard industry models, provides both valuable input and a checking mechanism.

The third deliverable is the Information Systems Architecture. This is a model that contains 3 things:

1. A definition of all the logical I.S. Applications.
2. The data dependencies that exist between them
3. The logical sequence in which the I.S. Applications have to be developed.

The model is developed by bringing together the data architecture the process architecture and legacy I.S. architectures to establish the logical applications groupings from the data and process perspectives and validating them by reference to best practice and existing I.S. architectures.

ARCHITECTURAL MODELLING

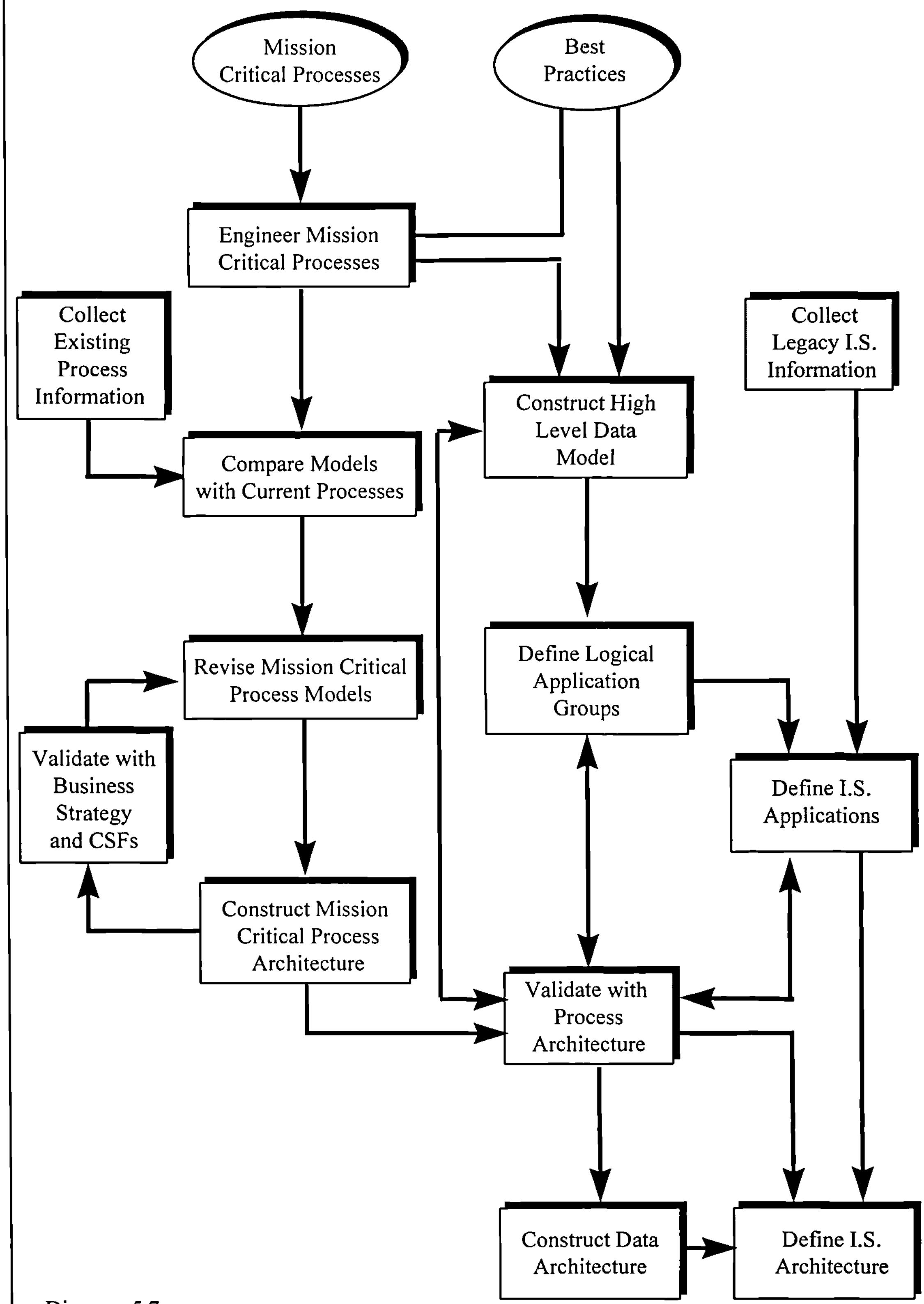


Diagram 5.7

Table 5.5: STRATEGIC ALIGNMENT PROCESS - STEP 3

ARCHITECTURAL MODELLING	TOOLS and TECHNIQUES									
	Criteria Based Interviewing	Facilitated Workshops	Best Practice Comparison (Industry Std Models)	System Dynamics	Value Chain Modelling	Process Decompos-ition	Process Engineering	E.A.R Modelling	Data Flow Analysis	Object Oriented Analysis and Design
Engineer Mission Critical Processes	*	*	*	*	*	*	*			
Collect Existing Process Information	*	*				*	*		*	
Compare Models With Existing Processes		*			*	*	*			
Revise Mission Critical Process Models				*	*	*	*			
Construct Mission Critical Process Architecture				*		*	*			
Validate with Business Strategy and CSFs		*			*					
Construct High Level Data Model	*	*						*		*
Define Logical Application Groups			*					*	*	*
Collect Legacy I.S. Information	*	*						*		
Define I.S. Applications		*	*		*		*	*	*	*
Validate with Process Architecture		*		*	*			*	*	*
Construct Data Architecture								*	*	
Define I.S. Architecture								*	*	

STRATEGIC ALIGNMENT PROCESS - STEP 3 ARCHITECTURAL MODELLING		
ACTIVITY STEP	INPUTS	OUTPUTS
Engineer Mission Critical Processes	Interview results. Mission critical processes Best practice examples Industry value chain.	"To be" models of mission critical processes. Process model boundary definitions.
Collect Existing Process Information	Interview results. Existing process models and documentation.	Summary models of existing processes.
Compare Models With Existing Processes	"To be" models of mission critical processes. Process model boundary definitions. Summary models of existing processes.	Differences and inconsistencies.
Revise Mission Critical Process Models	"To be" models of mission critical processes. Process model boundary definitions. Differences and inconsistencies.	Revised "to be" models of mission critical processes. Revised process model boundary definitions.
Construct Mission Critical Process Architecture	Revised "to be" models of mission critical processes. Revised process model boundary definitions.	Process architecture.
Validate with Business Strategy and CSFs	Process architecture. Business strategies. CSFs and KPIs	Inconsistencies and omissions in the process architecture. Validated process architecture.
Construct High Level Data Model	Validated process architecture. Best practice examples. Interview results. Existing data models.	High level entity-relationship or object oriented data model. Data flows.

Table 5.6

STRATEGIC ALIGNMENT PROCESS - STEP 3 (contd.) ARCHITECTURAL MODELLING		
ACTIVITY STEP	INPUTS	OUTPUTS
Define Logical Application Groups	High level entity-relationship or object oriented data model. Data flows. Validated process architecture. Best practice examples.	Set of logical application groups.
Collect Legacy I.S. Information	Existing documentation and specifications. Interview results.	Summary of existing information systems.
Define I.S. Applications	High level entity-relationship or object oriented data model. Data flows. Best practice examples. Set of logical application groups. Summary of existing information systems.	I.S. application list and high-level definitions.
Validate with Process Architecture	Validated process architecture. I.S. application list and high-level definitions.	Revised I.S. application list and high-level definitions.
Construct Data Architecture	I.S. application list and high-level definitions. High level entity-relationship or object oriented data model. Data flows. Best practice examples.	Data architecture.
Define I.S. Architecture	Validated process architecture. Data Architecture. I.S. application list and high-level definitions.	I.S. Architecture.

Table 5.6 (contd.)

5.2.3.4 Technology Investigation Activities

There are two deliverables from these activities:

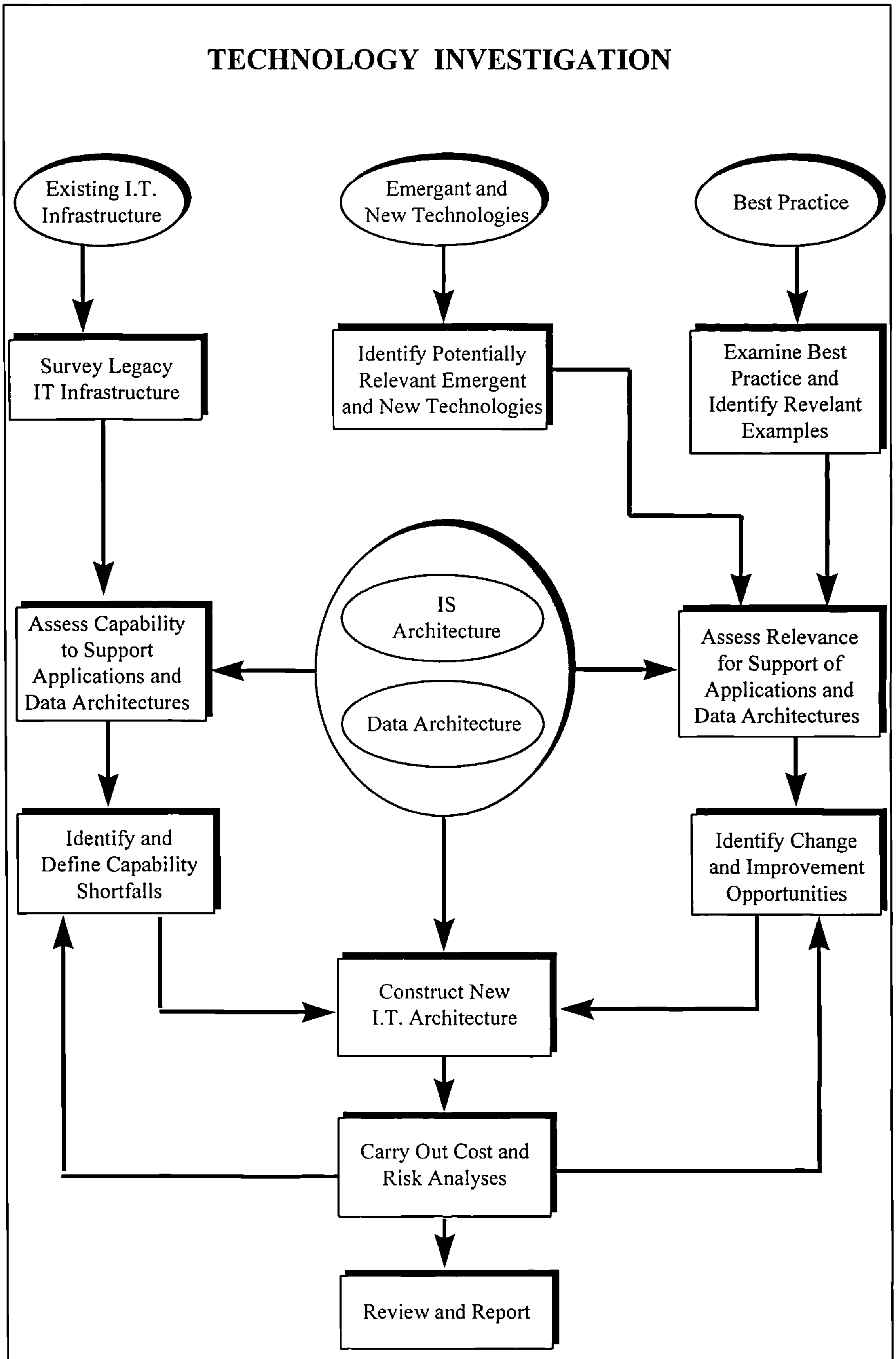
1. The definition of the I.T. Architecture that will be needed to support all the I.S. Applications.
2. A list of all the new technologies that will be potentially of use to deliver the I.T. Architecture, the I.S. Applications and the Business Objectives.

It is almost an inevitability that there will be some form of existing I.T. Architecture and the suitability of this to support new applications has to be assessed. If a new architecture is found to be needed then standard architectural types can be evaluated for suitability. In most cases this will be some form of Client Server Architecture so most effort will go into determining the exact nature of client server needed. A standard set of I.T. Architecture Models such as is contained in ICL's OPEN*framework* is the way to proceed. [ICL, 1995(1)].

New and emergent technologies can be either I.T or non-I.T. The approach is to carry out a technology search to identify anything that may be relevant. Once a list of opportunities has been collected, each item on the list is subjected to three tests:

1. What will be the contribution to the I.S. Strategy or Business Objectives of the technology?
2. What are the risks associated with its introduction?
3. Are there any conflicts with existing technologies and architectures?

To address the second question a technique such as Information Economics has found to be particularly useful. [Parker et al, 1988].



TECHNOLOGY INVESTIGATION
Existing I.T. Infrastructure
Emergant and New Technologies
Best Practice
Survey Legacy IT Infrastructure
Identify Potentially Relevant Emergent and New Technologies
Examine Best Practice and Identify Revelant Examples
Assess Capability to Support Applications and Data Architectures
IS Architecture
Data Architecture
Assess Relevance for Support of Applications and Data Architectures
Identify and Define Capability Shortfalls
Identify Change and Improvement Opportunities
Construct New I.T. Architecture
Carry Out Cost and Risk Analyses
Review and Report

Diagram 5.8

Table 5.7: STRATEGIC ALIGNMENT PROCESS - STEP 4

TECHNOLOGY INVESTIGATION	**TOOLS and TECHNIQUES**							
	Criteria Based Interviewing	Facilitated Workshops	Best Practice Comparison	Client Server Modelling	Technology Survey	Open-*framework* Architecture	Information Economics	Risk Analysis
Survey Legacy I.T. Infrastructure	*							
Identify Emergent and New Technologies			*		*	*		
Examine Best Practice and Identify Relevant Examples		*	*			*		
Assess Capability to Support Architectures	*	*	*		*	*	*	
Assess Relevance for Support of Architectures		*						
Identify and Define Capability Shortfalls			*	*	*	*		*
Identify Change and Improvement Opportunities		*	*	*	*	*		
Construct New I.T. Architectures				*		*		*
Carry Out Cost and Risk Analyses			*			*	*	*
Review and Report						*	*	*

STRATEGIC ALIGNMENT PROCESS - STEP 4 TECHNOLOGY INVESTIGATION		
ACTIVITY STEP	INPUTS	OUTPUTS
Survey Legacy I.T. Infrastructure	Interview Results. Existing I.T. architecture definitions and specifications.	Summary of existing I.T. architecture.
Identify Emergent and New Technologies	Technology searches and reviews. Interview results.	List of potential technologies.
Examine Best Practice and Identify Relevant Examples	Best practice examples. List of potential technologies	Relevant examples of I.T. architectures.
Assess Capability of Legacy I.T. to Support Data and Applications Architectures	Data architecture. I.S. Architecture. Summary of existing I.T. architecture.	Capability statement.
Assess Relevance for Support of Applications and Data Architectures	Data architecture. I.S. Architecture. Relevant examples of I.T. architectures. List of potential technologies.	Outline description of proposed I.T. architecture.
Identify and Define Capability Shortfalls	Data architecture. I.S. Architecture. Capability statement.	Capability requirements.
Identify Change and Improvement Opportunities	Outline description of proposed I.T. architecture. Proposed I.T. architecture. Cost and risk estimates.	Improvement and change opportunities.
Construct New I.T. Architectures	Capability requirements. Improvement and change opportunities. Data architecture. I.S. Architecture.	Proposed I.T. architecture.

Table 5.8

STRATEGIC ALIGNMENT PROCESS - STEP 4 (contd.) TECHNOLOGY INVESTIGATION		
ACTIVITY STEP	INPUTS	OUTPUTS
Carry Out Cost and Risk Analyses	Proposed I.T. architecture.	Cost estimates. Risk estimates.
Review and Report	Cost and risk estimates. Proposed I.T. architecture	I.T. architecture report.

Table 5.8 (contd.)

5.2.3.5 Model Iteration and Analysis Activities

This is the final step and all the activities are designed to create alignment and develop an I.S. Strategy Plan. This is the Step which creates alignment and develops the I.S. Strategy Plan. The route map, the techniques and the inputs and outputs are contained in this section. The detailed method for the creation of alignment is discussed in Section 5.2.4 and the structure of the I.S. Strategy Plan document is contained in Section 5.3.

Creation of alignment between the business and information systems is the objective of the method. Whilst the first four steps populated the Model; it is Step 5 where alignment is done and the I.S. Strategy Plan formulated. This is therefore most important single Step which is why it is discussed in more detail in Section 5.2.4.

MODEL ITERATION AND ANALYSIS

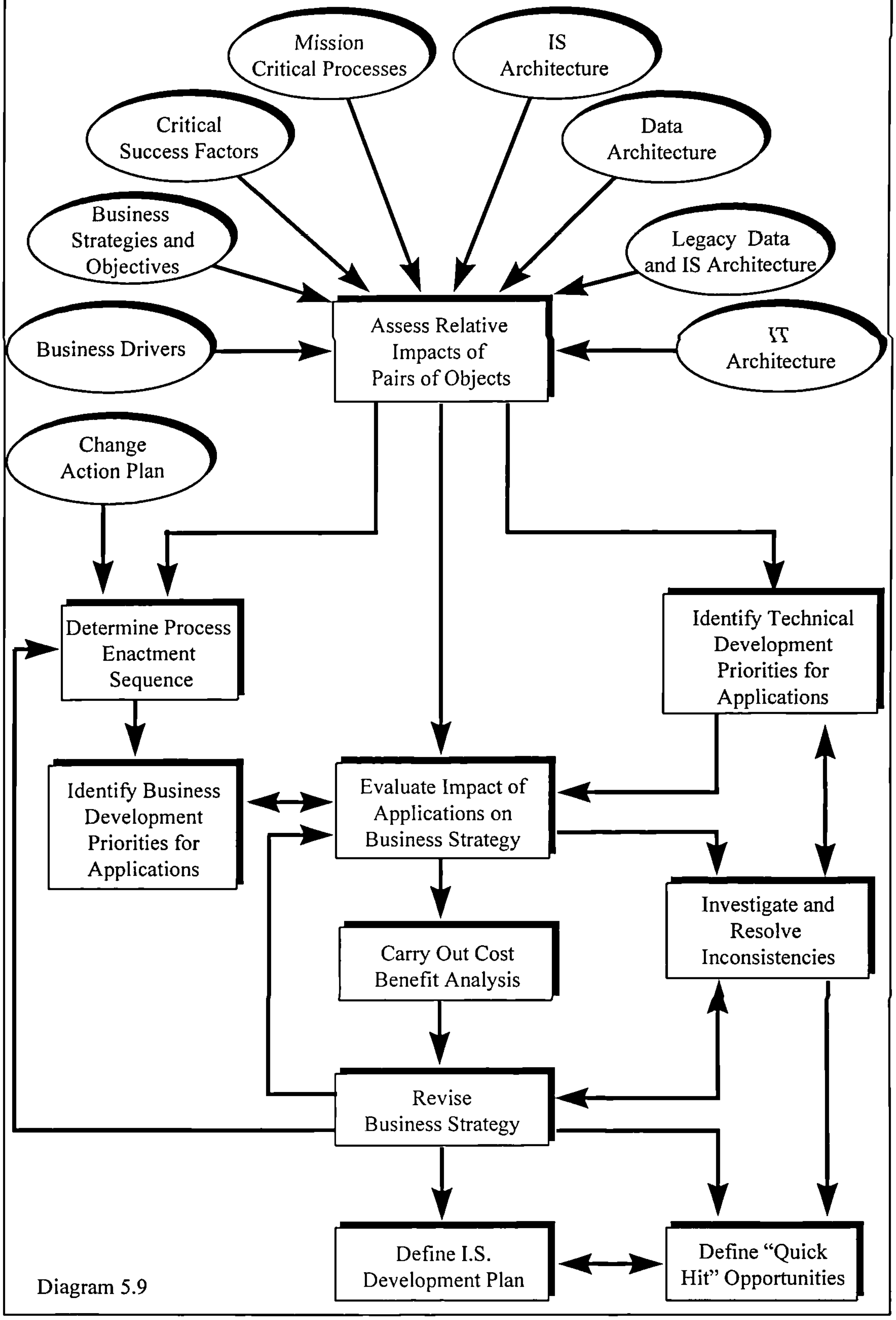


Diagram 5.9

Table 5.9: STRATEGIC ALIGNMENT PROCESS - STEP 5

MODEL ITERATION AND ANALYSIS	TOOLS and TECHNIQUES								
	Criteria Based Interviewing	Facilitated Workshops	Best Practice Comparison	Matrix Analysis	Information Economics	Quality Function Deployment	Open-*framework* Benefit Analysis	Return on Investment Calculations	Risk Analysis
Assess Relative Impact of Pairs of Objects		*		*					
Determine Process Enactment Sequence		*		*					
Identify Business Devt. Priorities for Applications		*	*		*		*		*
Identify Technical Devt. Priorities for Applications		*	*		*		*		*
Evaluate Impact of Applications on Business Strategy		*			*	*		*	*
Carry Out Cost Benefit Analysis					*		*	*	*
Investigate and Resolve Inconsistencies		*	*	*	*	*	*		
Revise Business Strategy		*							
Define I.S. Development Plan			*	*	*	*	*	*	*
Define "Quick - Hit" Opportunities	*	*						*	*

STRATEGIC ALIGNMENT PROCESS - STEP 5 MODEL ITERATION AND ANALYSIS		
ACTIVITY STEP	INPUTS	OUTPUTS
Assess Relative Impact of Pairs of Objects	Business drivers. Business strategies and objectives. CSFs. Mission critical processes. I.S. & applications architectures. Data architecture. I.T. architecture. Technology opportunities.	Analysis of interactions and dependencies of objects.
Determine Process Enactment Sequence	Analysis of interactions and dependencies of objects. Change enactment plans.	Process enactment sequence.
Identify Business Devt. Priorities for Applications	Process enactment sequence. Business strategies.	Application development sequence (business).
Identify Technical Devt. Priorities for Applications	Analysis of interactions and dependencies of objects.	Application development sequence (technology).
Evaluate Impact of Applications on Business Strategy	Analysis of interactions and dependencies of objects. Application development sequence (business). Application development sequence (technology).	Outline I.S. development plan.
Carry Out Cost Benefit Analysis	Outline I.S. development plan.	Cost benefit analysis. Risk analysis model.
Investigate and Resolve Inconsistencies	Outline I.S. development plan. Cost benefit analysis. Application development sequence (technology). Risk analysis model.	Revised Outline I.S. development plan.
Revise Business Strategy	Revised Outline I.S. development plan. Cost benefit analysis. Business strategies.	Changes to business strategies.

Table 5.10

STRATEGIC ALIGNMENT PROCESS - STEP 5 (contd.) MODEL ITERATION AND ANALYSIS		
ACTIVITY STEP	INPUTS	OUTPUTS
Define I.S. Development Plan	Revised Outline I.S. development plan. Cost benefit analysis. Changes to business strategies. Risk model.	I.S. development plan.
Define "Quick - Hit" Opportunities	Cost benefit analysis. Changes to business strategies. I.S. development plan. Process architecture. Change action plan. CSFs. Risk models.	List of possible "Quick Hits".

Table 5.10 (contd.)

One of the activities is to carry out a cost benefit analysis. A cost benefit analysis is a major undertaking which is an essential part of any I.S. planning activity. In Strategic Alignment the cost benefit analysis is done at a high level. At this point in the overall development process, the benefits are known from the work done on the Enterprise Investigation Step, but as the decisions on exactly what the information systems will be has not been taken, the costs cannot be known in detail. Therefore the cost benefit analysis need only be done at the level to establish whether the benefits are greater than the costs for each application system identified. This analysis is used to provide three things:

1. Initial estimates as to the overall financial viability of the plan.
2. Identification of applications which cannot be cost justified.
3. Information on which financial prioritisation for development can be made.

Once the I.S. Strategy Plan is accepted and development commences, then a detailed cost benefit analysis will be done as part of the requirements analysis and design steps. This issue is discussed further in Sections 6.4.2 and 7.1.

5.2.4 Creation of Alignment

The fifth Step of Strategic Alignment, Model Iteration and Analysis, is concerned with the harmonisation of all the objects identified in the other four Steps. Although this Step has activities which are carried out concurrently with activities in the other Steps, there comes a point in the Strategic Alignment Process when it is necessary to formally align these objects as a specific task. The two activities which do the formal alignment; "Assess the Relative Impact of Pairs of Objects" and "Evaluate Impact of Applications on Business Strategy", require a major analysis effort. The purpose of these activities is to formally create the alignment which is at the heart of the model. From this analysis there are four key deliverables:

1. Validation of the completeness and consistency of the Model.

2. The priority and sequence of development of the I.S. Applications and enactment of the Value processes.

3. The opportunities to use I.T. to enhance or change the Business Strategies.

4. Derived from the second deliverable, the I.S. Strategy Plan.

The approach adopted is that of Matrix Analysis. Pairs of object types are selected and the impact of the occurrences of the first object type on the occurrences of the second object type is assessed, according to pre-defined parameters or criteria. There is a standard set of nineteen linkages of object types which form the matrices, these are discussed in Section 5.4.3. These pairings were identified from all the possible linkages by using the following principles:-

1. That there is a logical linkage between the object types

2. That the linkage between the object types is readily definable

3. That the objects types are in the same or adjacent quadrants of the Model.

4. That the matrices include all the major object types in the Model.

The research that reduced all possible linkages to the subset of the 19 proposed as part of the method was done as part of the projects. On the initial projects, when the numbers of objects in the model was less (see Section 4.4.2), attempts were made to compare each object with all the others. This was the approach proposed by Henderson in the MIT90s programme [Henderson, 1989 (1 and 2)]. These attempts failed for many of the pairs because no linking factors could be found that had any meaning. It was therefore recognised that the first 2 principles had to be applied to any pair of objects. In subsequent studies, as the model was expanded, the third principle was observed to exist consistently and was therefore included. The fourth principle was added as a check and balance to make sure that all the object types in the model were adding value and were being included in the analysis. The rationalisation of the matrices to the 19 used in the method was therefore based on observation and experience from usage.
When considering the nature of the linkage (point 2 above), for any single matrix it has to be unidirectional; that is the impact of object type A on object type B. However as the purpose of this analysis is to complete alignment, then it will often be necessary to consider as well the reverse impact; that is the impact of object type B on object type A. This will create a different matrix.

The last point implies that there is a sequence for creation of the matrices. This does in fact turn out to be the case. The sequence is to move round the model in an anti-clockwise direction, then return in a clockwise direction. The logic behind this approach is that it enables answers to the fundamental Strategic Alignment questions of "What is the I.S./I.T. which will be required to achieve the Business Strategies?" and "How can I.S./I.T. enhance or change the Business Strategies?" to be developed. Additionally, as will be seen when the matrices are described, the results of some matrices are essential input to other matrices, thereby creating dependencies which cause the sequence.

5.2.4.1 Definition of the matrices

Producing the matrices is essentially a group activity; controlled by a facilitator. Empty matrices have their scores and, where required, weights assigned by open discussion and consensus agreement. Such an approach is the most effective since it achieves maximum buy-in from the group. However with up to nineteen matrices to be completed and each matrix having potentially many hundreds of cells; the task can be lengthy and onerous. Furthermore if the group dynamics are poor or group members have individual agendas, then satisfactory completion of the task may become very difficult to achieve. Consequently alternative approaches need to considered:-

1. Break the group into smaller teams and have each team complete a limited number of matrices. The results are then presented to the whole group and points of contention discussed and resolved through facilitation.

2. Have smaller teams or individuals complete some or all of the matrices, then the facilitator collates the output and presents a composite output as the de facto result, or for discussion.

3. The facilitator discusses the approach and principles with the group. Out of the group environment, the facilitator discusses the matrices with individuals, concentrating on those areas where the individual has expertise. The facilitator then completes the matrices and presents the results to the group to discuss and agree.

All three alternatives described above have been used successfully in Strategic Alignment projects and each approach has its own merits. The first two alternatives retain elements of group work and consequently buy-in from the organisation is more readily achieved. However even though they involve less commitment than the full workshop, there is nevertheless a significant effort required. This may be excessive, particularly when the organisation is under pressure from other directions. This leads in many cases to adoption of the third approach. This approach has the most effective use of time, at the risk an initial lower level of buy-in, as the result represents an external view. However it has been found that where the facilitator is respected by the organisation and has been working on the project from its beginnings, then the result will be of high quality and will be accepted, provided it is thoroughly discussed and the organisation is given the opportunity to amend it.

In the table below, and continued overleaf, nineteen matrices are described. The number of the matrix corresponds to the sequence in which it is analysed, the axes are the two objects being compared and the purpose gives a brief description of the matrix. In the axes column, the first object is the one that is being prioritised, whilst the second object is the one providing the comparative data.

STRATEGIC ALIGNMENT MATRIX DEFINITION		
Matrix Number	**Axes**	**Purpose and Description**
1	Drivers vs Impact	Define the comparative importance of the business drivers The impact parameters are size and time.
2	Objectives vs Drivers	Determine relative priorities of the business objectives The Drivers will be weighted by the results from matrix 0.
3	CSFs vs Objectives	Definition of the overall importance of each CSF in terms of its total impact on the objectives The objectives can be weighted by the results from matrix 1.

STRATEGIC ALIGNMENT MATRIX DEFINITION (contd.)		
Matrix Number	**Axes**	**Purpose and Description**
4	Value Processes vs CSFs	Prioritisation of the Value Processes in terms of support given to each CSF.
5	Skills vs Value Processes	Definition of the relative importance of the Skills in the context of the requirements of the Value Processes.
6	Applications Portfolio vs Value Processes	Definition of business priorities of the Application Portfolio in terms of the support given to the Value Processes
7	I.S. Architecture vs Applications Portfolio	Definition of the relationship between the individual applications and the elements of the I.S. Architecture.
8	Data Architecture vs I.S. Architecture	CRUD analysis to determine logical dependencies of IS Architecture.
9	I.T. Architecture vs I.S. Architecture	Definition of the I.T. needs of the I.S. Architecture.
10	Technology Opportunities vs I.T. Architecture	Assessment of the impact of Technology on the I.T. Architecture to identify opportunities to enhance or change it.
11	I.S. Architecture vs I.T. Architecture	Determine impact of revised I.T. Architecture on the IS Architecture. Specifically to establish how I.T. can improve the functionality and enable earlier development. This reviews and revises matrix 9.
12	I.S. Architecture vs Data Architecture	Review matrix 8 to establish new data requirements that will revise the Data Architecture.
13	Applications Portfolio vs I.S. Architecture	Using the result of matrix 11 to establish the possible revisions and enhancements to the Applications Portfolio.
14	Value Processes vs Applications Portfolio	Determine how IS can enable improved enactment of the Value Processes The weighting is based on the results of matrix 13.
15	Value Processes vs Skills	A review of matrix 5 to establish changes to Skill requirements based on the results of matrix 14.
16	CSFs vs Value Processes	Assess how value processes can change CSF achievement The weighting of the value processes is based on the results of matrix 14.

STRATEGIC ALIGNMENT MATRIX DEFINITION (contd.)		
Matrix Number	**Axes**	**Purpose and Description**
17	Objectives vs Value Processes	Assess how value processes can enhance objective achievement in terms of time and degree, using the results from matrix 14.
18	Objectives vs CSFs	A mechanism to check matrices 16 and 17, It also radically rethinks the Objectives to see if new Objectives can be adopted.
19	Strategy and Mission vs Objectives	Using the new Objectives derived by matrix 18, the opportunities to change the Strategy and mission are identified and assessed.

Table 5.11

Matrices 1 - 7 determine which Applications are required to support achievement of the Business Objectives as they are currently stated.

Matrices 8 to 11 consider the logical technical development sequence of the IS Opportunities in terms of the data requirements and the opportunities presented by new and emergent technology (both IT and non-IT). This may identify new IS Opportunities which are added to the matrix.

Consequently there may be a conflict between the priority for IS Opportunity development resulting from the analysis of the matrices at this point.

The purpose of Matrices 12 - 19 is to remove this conflict in a positive and pro-active way by working back through the matrices to produce priorities based on exploitation of technology and IS Opportunities. The result will be two things:-

1. A possible new sequence in terms of priorities for achieving objectives, both in terms of time and degree.

2. Identification of possible new objectives and strategies which the organisation could pursue which are enabled by implementation of IS and technology.

If the output from Matrices 12 to 19 does produce the results postulated in the above point, then it will be necessary to re-iterate back through Matrices 1 to 11 to ensure consistency and accuracy of the analysis. As the basic work of the analysis has already been done the re-iteration will not be an extensive task.

To achieve a full alignment with which there is total agreement may take two or more iterations.

There are two other points of detail concerning the matrices.

1. To produce sufficient detail and granularity of analysis, it is normally necessary to analyse the Value Processes at their first level of decomposition.

2. The weightings of the impacting object type can be changed to produce multiple versions of the same matrix. This gives the analyst an opportunity to carry out "what-if" analyses on the model and explore alternative scenarios. Whilst such a capability should only be used in a controlled manner during development of the first Strategic Alignment Model, it becomes particularly valuable as a mechanism to assess change and update the Model to ensure that it remains accurate.

5.2.4.2 Populating and scoring the matrices

There are many different scoring regimes which can be used to assess the impact of one object type occurrence on another. Experience has shown that a simple numeric score in the range 0 to 5 is the most effective. This has been further simplified to just four values, 2 and 4 are excluded. This simplification has been found to expedite the scoring activity without any loss of granularity. The values allowed are then given the following definitions:

0 = no impact at all

1 = little impact

3 = significant impact

5 = critical impact

"impact" is used as the generic term for whatever each specific assessment parameter is used on the individual matrix.

On occasions the above scoring mechanism produces a close or similar score for each of the object type occurrences; thereby not producing a clear ranking or priority for the object type occurrences. This can be resolved effectively by replacing the value of "5" with a value of "9".

A further point concerning scoring is that during the scoring process it was found on more than one occasion that the teams in the workshops were able to add up the total scores as the process was executed. The result was that bias crept into process as the teams members "favoured" their own operational areas. To resolve this issue an alphabetic scoring regime was introduced. For example:

N = no impact at all

L = little impact

S = significant impact

C = critical impact

The facilitators then translated the scores at the end of the workshop. This approach effectively resolved the issue.

Having assigned a score to each cell in the matrix, the scores for each object type occurrence are added up to produce a total score. This total score produces the ranking which is the result of the matrix.

Weighting provides an extra degree of refinement to the scoring process. In its basic form the process assumes that each impacting object type occurrence has equal importance in terms of its impact on the object type occurrences being scored. This clearly in many situations is not the case. For example when scoring Critical Success Factors by their support of Business Strategies, the relative priority of the Business Strategies may be an important factor. In such a case, weighting the Business Strategies would give additional value to the scoring process. As with scoring many regimes are possible. It has again been found, through experience, that a simple 1 - 9 weighting scale is as good as any. Unlike scoring all possible values are used, because the number of things to be weighted is comparatively much smaller than in the scoring process and the higher degree of granularity has a significant impact on the final result. The principle is that a weight of 1 equals lowest importance and a weight of 9 equals highest priority. Object type occurrences can share the same value.

Whilst the task of scoring the matrices is a very small part of the overall method, it is nevertheless critical to the success of the method. The task itself can last for a week on large projects. As stated above it can also be affected by bias which will potentially invalidate the results and the project. The approach described has been developed from the experiences of all the projects in which over 100 people contributed. The exact numbers are listed in Appendix 1, Section 1.8.

Having assigned a weight to each of the impacting object type occurrences; the matrix is populated by completing the scoring. The individual scores are then multiplied by their relevant weights to produce a weighted score in each cell of the matrix. These are then totalled as before to determine the final score and ranking.

There is one matrix which cannot use this scoring and weighting mechanism. This is the matrix which aligns I.S. Applications and Data Entities. For this matrix a Create, Read, Update and Delete, CRUD, analysis is used.

5.2.4.3 Definition of the I.S. Strategy Plan

An I.S. Strategy Plan is, for most Strategic Alignment projects, the ultimate objective of the project. The purpose of Strategic Alignment is to ensure that the I.S. Strategy Plan does two things:

1. That it defines the applications needed to support the organisation.

2. That it identifies opportunities to exploit I.T. and other technologies to improve the strategies of the organisation.

These two statements cover a whole set of other issues that need to be addressed by the I.S. Strategy Plan. These include:

- The order in which applications should be developed.

- The technology dependencies of the applications.

- The data and information dependencies of the applications.

- The business strategy dependencies.

- The interactions between the processes and the applications.

- The implications of the new skills requirements.

- The rate at which change can be successfully introduced into the organisation.

- The potential impact of new technologies during implementation of the strategy plan.

- The potential impact of business change during the the implementation of the strategy plan.

The factors included in the above list can be seen, even after cursory examination, to be potentially in conflict. For example; the data and information dependencies will create a logical sequence in which applications have to be developed. This sequence may require that applications which have less impact on the business strategy be developed prior to applications which have significant impact on the business strategy. An example of this which has occurred in all the studies carried out on Distribution Engineering businesses is that of the Plant and Circuits application. This application has little application functionality in its own right. Consequently in terms of its direct support of business objectives it has a low priority. However a large number of other applications, such as Work Planning, Maintenance, Network Analysis, Fault Management and Load Forecasting are all dependant on the data captured and maintained by this application.

The matrix analyses, described in Section 5.2.4.1, will have identified many of these conflicts as part of the alignment process. In some cases there is limited scope for choice. For example in the Plant and Circuits case above, or, as has befallen a number of UK organisations; because Regulation has made development of an application a legal requirement. In other cases there is significant choice and it is the options identified and qualified by the Strategic Alignment process that create the information by which decisions and I.S. Strategy Plans can be formulated.

It has been found that in all the studies done to date that there is a natural sequence in which business strategies are pursued. Superimposing the logical development sequence of the applications on this will mean that there are delays in achieving the strategies. In ESKOM for example, the Improve Business Efficiency Strategy would be largely delivered by implementation of new Work and Maintenance Management applications. However they could not be implemented until after the Plant and Circuit and Geographical Information System, GIS, applications had been developed. The results of the Strategic Alignment project gave ESKOM the information necessary to accept that the delay to achievement of this business strategy, due to the need to develop the other applications first, was justified.

Strategic Alignment therefore enables an I.S. strategy plan which answers all the above issues to be produced. A fundamental part of it is a Strategic Staircase which defines the sequence in which the strategies are to be addressed and therefore the Process, Applications and I.T. implementation sequence. This is discussed in the next section.

At this stage of its development Strategic Alignment only addresses Risks, Benefits and Costs at a high level. The reasons are discussed in Sections 6.4.2 and 7.1.

5.2.4.4 Use of Strategic Staircases

The principle of Strategic Staircases was introduced and discussed in Section 4.4.1. In Strategic Alignment the principle is used more as a display mechanism to present results than as an analysis tool. The reason being that the analysis has already been done by matrix analysis. Nevertheless its importance as a mechanism to present results to senior management cannot be understated.

The idea is that in order to retain business focus, an organisation should pursue its strategies in a sequential as opposed to concurrent manner. Furthermore there is dependency between the strategies which determines the logical sequence in which they must be addressed. To move outside this sequence will result in any strategy potentially being achieved to a much lower degree, if at all. This has been found to be the case with the ESKOM Distribution Engineering and Eastern Energy projects.

The use of the Strategic Staircase is to present the results and also provide an external reference point in the report. The model creates an opportunity to present visually in the I.S. Strategy Plan the following things:

- The sequence in which the strategies should be addressed.

- The mapping of the sub processes from the Value Processes to each strategy and thereby the sequence in which they should be engineered and enacted.

- Mapping of the organisation's specific strategies back to a generic industry model.

- The ability to set relative expectations about what each strategy will achieve.

- The ability to set expectations about timescales and review points for implementation of the I.S. Strategy Plan.

From the start point of a general staircase model, a model specific to the organisation can be produced using the results of the matrix analysis exercise. As an example of its use, the models produced for ESKOM Distribution Engineering are contained in Appendix 4. The general model is shown overleaf in Diagram 5.10

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Generic Electrictiy Distributor Strategic Staircase

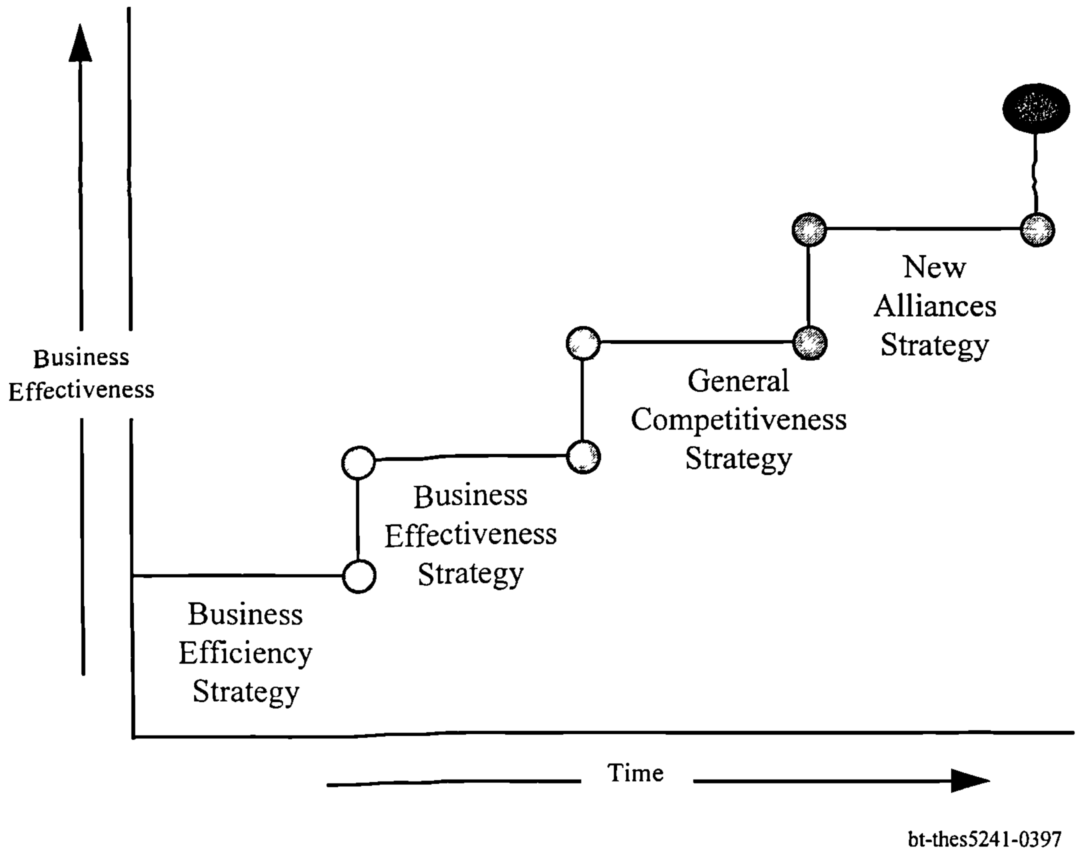

Diagram 5.10

This shows the four generic strategies that are being pursued by privatised Electricity Distributors in the UK, South Africa and Australia. For individual organisations the exact wording of each strategy may differ but the essence is common. Also the sequence is common. What will differ is the nature and alignment of the processes which contribute to the achievement of the strategy.

The second thing that will differ is the impact of the strategy on the achievement of the mission. In the ESKOM Distribution Engineering project it was realised that the third strategy, to create competitiveness by introduction of new products and services, would only happen when the South African Electricity Supply industry was privatised and new players entered the market. The result would be a downturn in achievement. See Diagram 5.11 overleaf. The evidence for this came from the analysis work but was a difficult finding to present and gain acceptance. Presentation of it as a Strategic Staircase proved effective in creating understanding and consequently acceptance. The approach has been used on subsequent projects and has continued to be effective. For this reason it is included in the method.

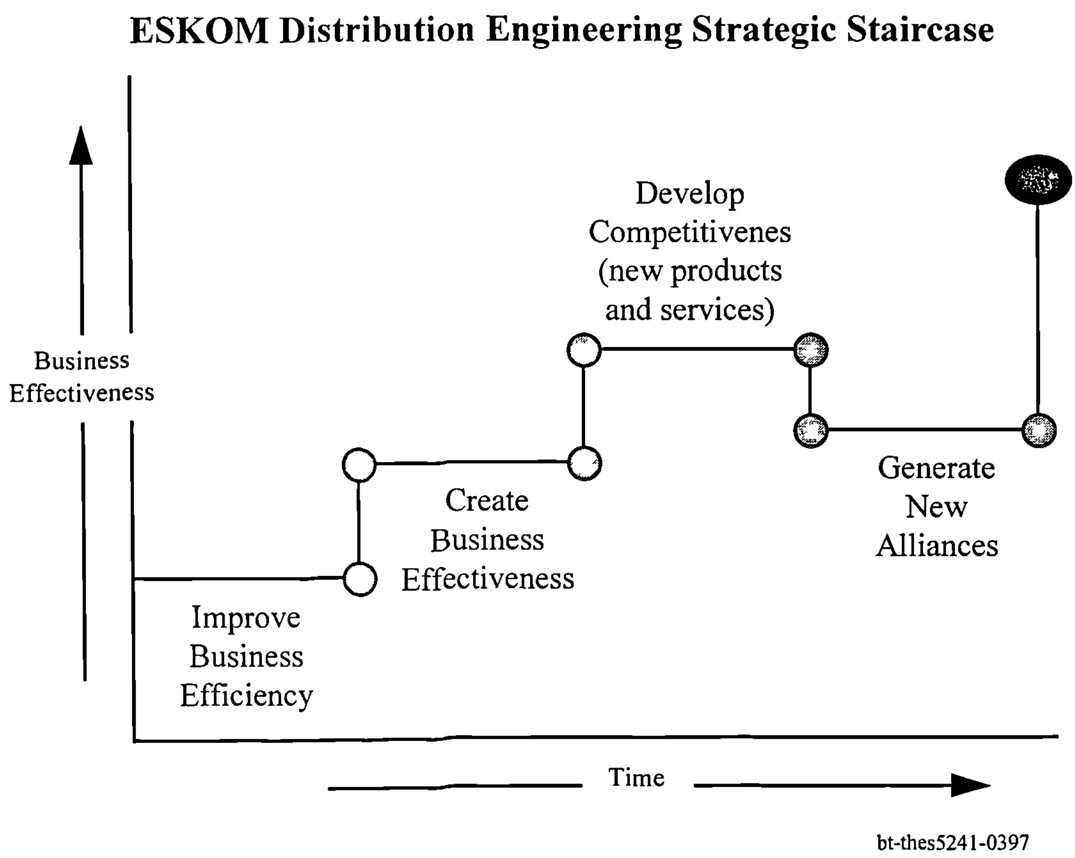

Diagram 5.11

5.3 Reporting in a Strategic Alignment Project

5.3.1 Introduction

The I.S. Strategy Plan is the final report of the project. It brings together all the work and results and presents a plan which includes the answers to "what Information Systems are needed?", "why are they needed?" and "how are they developed?". However between starting a project and reaching the end many things can be discovered which require reporting. Intermediate reports must therefore be produced. In Section 5.3.2 the reasons for having intermediate reports is discussed and their typical content suggested. Section 5.3.3 describes a structure of the final report; the I.S. Strategy Plan.

5.3.2 Intermediate Reports

The intermediate reports cover the results of the first four Steps. They are produced for five reasons.

1. To report the results produced from each one of the four Steps.

2. To provide formal information to the organisation to enable a review of the findings to objectively take place.

3. To report on progress against the terms of reference of the project.

4. To enable the organisation to revise and re-orientate the direction of subsequent Steps if appropriate

5. To enable the analysts carrying out the project to raise issues that may result in changes to the subsequent work.

Of the four reports it is usually the first, which covers the Enterprise Investigation Step, that has most impact and is therefore most important. This is because it is the first report and so often reflects a degree of uncertainty between the analysts and the organisation. The organisation may still not be quite sure what it is expecting from the project and the analysts may not be quite certain what the organisation wants. Also it has been found on a number of studies that it is in this first Step that the unexpected results are most likely to turn up. The reason for this is that the Enterprise Investigation is focused on the Business Strategy domain which is where the issues likely to have most impact on the organisation are first encountered.

The Enterprise Investigation Report covers the following subjects:

1. Definition of the Drivers.
2. Confirmation of the existing Mission and Strategy statements.
3. Definition of the Objectives.
4. Creation of a set of Critical Success Factors.
5. Definition of the Key Performance Indicators.
6. Inconsistencies and anomalies
7. Comment on the proposed next activities.

The Skills and Culture Investigation Report discusses the findings of this Step in terms that answer the following questions:

1. What are the skills and cultural issues that will have an impact on achievement of the business strategy?
2. Are these issues of sufficient importance to warrant a separate investigation using specialist resources?
3. If a separate investigation is needed, can it be carried out in parallel with the Strategic Alignment Project?
4. If a separate study is not needed, how should the issues identified be addressed?

The Architectural Modelling Report contains the following items:

1. Value Process Architecture Model.
2. High-level Data Architecture Model.
3. Applications Architecture and Definitions
4. Comparison of the three above architectures with existing architectures.
5. Recommendations for resolution of differences between the architectures.

.**The Technology Investigation Report** discusses the following things:

1. New and Emergent technologies and their relevance
2. The proposed I.T. Architecture and its benefits
3. The benefits of any proposed non-I.T. technologies and how they can be introduced.

5.3.3 Final Report (I.S. Strategy Plan)

The final report contains all the information and analysis produced by the project. In a large project this can run to many hundreds of pages and so is unlikely to be read. A general structure is therefore proposed overleaf which allows the lower levels of detail to be put in Appendices and also reflects that much information is already contained in earlier reports.

The structure proposed as stated above is a general which has been derived from the studies undertaken with the organisations mentioned in Chapter 4. Inevitably each organisation has its own house style which has an impact on the report structure and also the terms of reference of the project will have an influence on the content of the final report.

INFORMATION SYSTEMS STRATEGY PLAN

Strategic Alignment Project Report

CONTENTS

6 (contd.)

Description of the Data Architecture

Application dependencies on the Data Architecture

Benefits from the I.S. Applications

Proposed Development Priorities and Sequence

7. Information Technology Architecture

Relevant New Technologies

Proposed I.T. Architecture

Non-I.T. Technologies to be Considered

8. Issues

Discussion of Business Strategy Issues

Issues Arising from the Alignment Activities

Development Options

9. Quick Hit Opportunities

Description of the Quick Hits

Benefits of the Quick Hits

10.Proposed Next Steps

Appendices

1. Overview of the Strategic Alignment Method
2. Strategic Alignment Model Contents
3. Strategic Alignment Matrices
4. I.S. Application Functional Requirement Overview

5.4 Structure and Content of the Supporting Model

5.4.1 Description of the Model

Chapter 4. Described the development of the model from the results of the research. This Section adds additional detail for completeness and to provide additional explanation of the reasoning. The model still comprises the 4 domains which were described in Section 4.4.2. and are shown in Diagram 5.12 below.

STRATEGIC ALIGNMENT DOMAINS

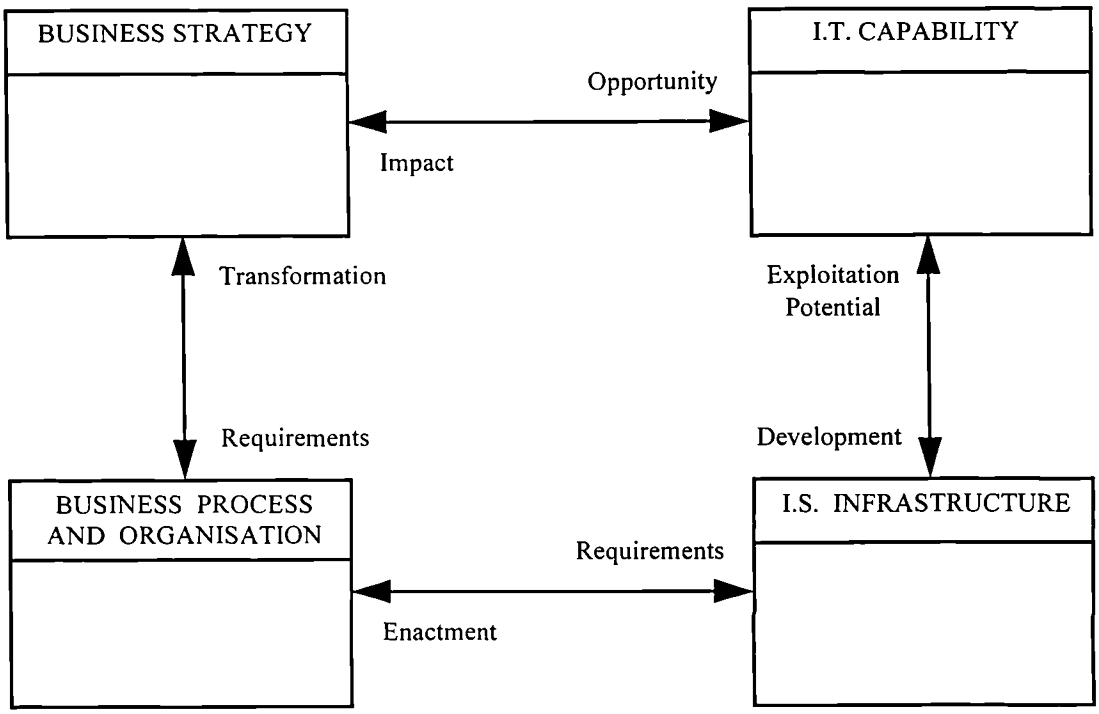

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Diagram5.12

The Business Strategy domain contains a description of the mission and strategies of the organisation. These descriptions are qualified and quantified by the other objects in this domain. The Business Process and Organisation domain contains descriptions of the value processes of the organisation together with definitions of all the softer factors that are needed to ensure their effective enactment. The I.S. Infrastructure domain contains descriptions of all the data needed to support the processes and how that data forms into information systems and the application portfolio. Lastly the I.T. Capability describes the technologies that will be required to implement the information systems. It is noted that this domain also records any other technologies that have been identified to be of relevance.

5.4.2 Definition of the Object Types

The object types in each of the 4 domains are those which were derived from the second projects and proved by their use in the ESKOM Distribution Engineering and Eastern Energy projects, see Sections 4.6 and 4.7. The allocation of the objects to the 4 domains is shown in Diagram 5.13 overleaf, which is a repeat of Diagram 4.8.

Each object type is defined in terms of its usage in Strategic Alignment. These definitions are to be found in Section 4.6.2.

5.4.3 Linkages Between the Object Types

The 4 domains of the Strategic Alignment model have linkage, this is what creates the alignment in the model. The linkage however is modelled at the object level within the domains not at the domain level. This was found to be necessary to give the required level of granularity in the model so the analysis needed to derive an I.S. Strategy plan could be carried out. In addition, linkage

STRATEGIC ALIGNMENT OBJECTS

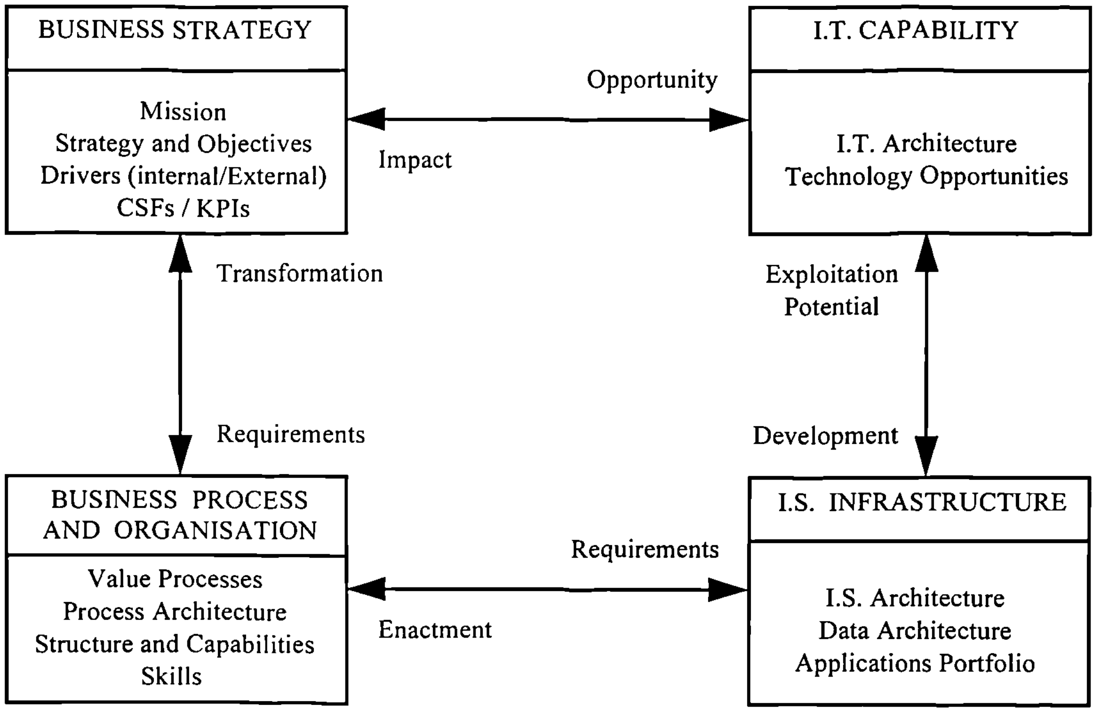

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Diagram 5.13

exists between objects within a domain, as well as between objects that exist in adjacent domains.

Given that there are 15 objects in the model then the potential number of linkages is 210. Clearly to model and analyse this number of links is a totally impractical task. However the work done on the projects indicated that for most of the objects there is no logical relationship and that for others the relationship is sufficiently tenuous to make analysis effort nugatory. The workshops which attempted to create alignment found that it was not possible to define a logical set of parameters which would create a definable linkage for most of the object pairs. The workshops were therefore used to produce the information that would enable the linkages that were needed to create alignment to be defined. The result was that 19 linkages were identified. The workshops were then used to test that these were in fact those were that needed to create alignment. These points have also been discussed in Section 5.2.4. It should be noted that it is these linkages that form the pairs of matrices and each matrix is an object type linkage.

The 19 linkages between object types, identified as necessary, are as follows:

1. The relative impact of the Drivers
2. The impact of Drivers on Objectives
3. The impact of Objectives on CSFs
4. The impact of CSFs on Value Processes
5. The impact of Skills on Value Processes
6. The impact of Value Processes on I.S. Applications Portfolio
7. The impact of I.S. Applications Portfolio on I.S. Architecture
8. The impact of I.S. Architecture on Data Architecture
9. The impact of I.S. Architecture on I.T. Architecture
10. The impact of Technology Opportunities on I.T. Architecture
11. The impact of I.T. Architecture on I.S. Architecture
12. The impact of Data Architecture on I.S. Architecture
13. The impact of I.S. Architecture on the I.S. Applications Portfolio

14.The impact of I.S. Applications Portfolio on on Value Processes

15.The impact of Value Processes on Skills

16.The impact of Value Processes on CSFs

17. The impact of Value Processes on Objectives

18.The impact of CSFs on Objectives

19.The impact of Objectives on Strategy and Mission

Table 5.11, in Section 5.2.4, contains the definition of the nature and purpose of each linkage.

Whilst other pairs of object types do have a logical linkage it has been found that these nineteen are the ones that are normally required for the successful completion of a Strategic Alignment model. Even so to create alignment and a resulting I.S. Strategy plan may not require all nineteen linkages to be fully investigated and defined. This was discovered in the ESKOM and Eastern Energy projects (see Sections 4.5.3 and 4.7.2) where a reduced number of linkages was found to be sufficient.

Linkage 1 is the exception. It is a relative assessment of a single object type. The reason for this is that the analysis has to start somewhere and this has been found in the ESKOM and Eastern Energy projects to be the most effective start point.

It can be seen from the list of linkages that the first nine work progressively round the model in an anticlockwise direction. By this approach the way that I.T. will support the Mission and Strategy of the organisation. The last ten work back round the model in an clockwise direction. This addresses the question of how I.T. can be used to change or enhance the Mission and Strategy of the organisation.

Although the linkages are those which are needed to create alignment there is one exception. This is the linkage between Value Processes and Data Architecture. This linkage is clearly logical; it defines the data needed to support the enactment of the processes. However, it has been found in the projects completed to date, that this is a level of detail that is only needed if the linkage between the Value Processes and the Applications Portfolio does not give sufficient information to formulate the I.S. Strategy plan. The other issue is whether the Skills and Capability object type should be analysed against Value Processes and Skills. This to date has not been found to be necessary. As the softer aspects of the model become increasingly important in the future, however this will be an area that is worth further research.

5.5 Managing a Developed Model

5.5.1 A Strategic Alignment Dictionary

A Strategic Alignment Model when fully populated creates a very large volume of information. This is added to by the process of alignment when the matrices are created. Control of this information in a project therefore becomes a significant issue. It becomes even more significant when time is taken into consideration.

A complex study can take between 4 and 6 months to complete. During this period there will be change to model as it is first populated then refined. Once the model is complete and the organisation moves into an I.S. development phase there will be further change. This change is caused by a number of factors which include:

- New business drivers appearing and existing ones changing in significance.

- New technology becoming available.

- Implementation of I.S. applications

- Enactment of new processes.

- Changes to the skills and cultural profile.

Any and all of the above factors can change the Strategic Alignment Model and consequently have an impact on other objects in the model. If the model is not kept up to date to reflect the changes, then it is probable that a set of applications will be developed which no longer fully support business strategies.

To manage this issue requires two things. First that the model is reviewed at regular intervals and second that this review process is quick and efficient. The first point is discussed in the next section. To address the second point needs the Strategic Alignment Model to be documented in some formal way. The intermediate and final reports from the projects obviously provide a manual mechanism. This to date has been found to be adequate if a little time consuming. However if use of the method is to become more widespread and projects employ teams to carry out the study; then an automated mechanism will save time and more importantly will help maintain consistency. Furthermore if a study is reviewed after a period of six months, then to be able to access a single source of information about the project will save much effort and ensure that there is consistency of understanding and comprehension.

For all the above reasons a Strategic Alignment Dictionary would be a major asset. Its primary functions would be as follows:

- To record definitions of all occurrences of each object type in the model.
- To define the logical linkages between the object type occurrences.
- To record all assumptions and decisions made during the project.
- To record all other project documentation.
- To record changes and the reasons why they were made.
- To maintain all the above information securely.

Such a capability is discussed in more detail in Section 6.3.

5.5.2 Reviewing Change and Progress

An important part of the method is its capability to review change and progress to keep everything in the model in step during the lifetime of the I.S. development and implementation programme. An inability to do this easily and effectively has been one of the major weaknesses of earlier approaches to I.S. Strategy Planning. (See sections 1.4 and 2.1.)

Once a project is completed and the final report accepted, there is a natural tendency to pay no further attention to the work. However, as was clearly identified by the Management in the Nineties programme, (See Section 2.2), turbulence in business is going to continue and probably increase. Even if modern development methods and application package solutions are employed, an I.S. development programme is likely to take a number of years to complete. During this period things will inevitably change, there could even be paradigm shifts. Any change will have some impact on the Strategic Alignment model and, as a consequence, the I.S. Strategy Plan. The kind of changes that can occur were identified in the previous section. Examination of that list shows that change can be caused by internal factors (for example: enactment of new processes, implementation of I.S. applications or development of new skills) as well as by external factors (for example: emergence of new drivers or evolution of new technology). Consequently, progress in implementation of an I.S. Strategy plan based on a Strategic Alignment model is in itself a cause of change.

The result of the changes can also be variable in its significance. At one end of the spectrum it could cause a major change in business strategies, whilst, at the other end, it may be the reduction in the need for a certain skill. The important thing is that the change must be identified, analysed for its impact and opportunity and a response formulated.

The Strategic Alignment model provides the mechanism to do the above things. It contains all the relevant information about the object type occurrences that are changing and the connections that they have to other objects, so their impact can be assessed. If the change is a new object type occurrence then this can be inserted into the model and its impacts identified and assessed.

To carry out a review is therefore a logical set of actions which use the current Strategic Alignment model as the baseline:

1. Identify all changes that have occurred since the last review.

2. Specify the changes as revisions to existing object type occurrences or as new object type occurrences.

3. Update the model with all the changes.

4. Assess the impact of the changes by reworking the matrices affected.

5. Inspect the results of the reworked matrices.

6. Revise the I.S. Strategy Plan.

The review is therefore a repeat of the 5 Steps described in Section 5.2.3. However as only those parts of the model affected by change are considered, the process is very much shortened. Nevertheless with the model and the process available, any change can be explored to the level of detail necessary to fully understand it.

The frequency of review is the final consideration. Clearly if a change is of serious importance then a review can be initiated as soon as it is identified. But experience has shown that this is rarely the case. It is more normal to carry out a general review every six months. Carrying out reviews at this frequency on ESKOM Distribution Engineering was found to be optimal for two reasons:

1. It gave sufficient time to allow things to happen which created the need for a review and justified the effort.
2. It was at a frequency that did not give the project time to go significantly off track and so make revisions to the plans hard to achieve.

Chapter 6. Discussion of the Results

6.1 The Applicability of Strategic Alignment

6.1.1 The Applicability of the Model

There are 2 questions to be addressed. First, whether the 4 domains of the model and the object types contained within each domain are relevant to meet the objective of developing and supporting an I.S. Strategy Plan. Second, does the model and its objects support harmonisation of business and I.S. strategies.

To answer the questions it is necessary to consider the results of the projects which used Strategic Alignment. The first projects did not produce I.S. Strategy Plans that were very different from that which could have been produced by existing methods. The response of both organisations was that the work had delivered a plan but did not give clear advice as to the priorities and the benefits of the I.S. applications in the plan. From these responses it could be deduced that although this Strategic Alignment Model was applicable to its purpose, it did not deliver radical improvement.

Investigation of the model and the objects within it, showed that it was lacking in two areas: Depth and Logicality. The model lacked depth in that it failed to describe the business, process and systems architecture to a level that was sufficient to explain how they related to each other. Consequently the logic of why an I.S. strategy plan would bring benefits, by enabling a business strategy, could not be shown. This was the most probable reason why the I.S. strategy plans produced were not a radical improvement on those that would have been produced by existing methods. I.S. Strategy Plans that were little more than lists of applications that might support an organisation's drive to improve its efficiency were not uncommon. The approach where a departmental problem was solved by automating its tasks with an I.S. system was a well trodden path and, even if they were done at all, cost benefit analyses were very superficial.

The Strategic Alignment Model after the first two projects therefore appeared not to deliver the intended improvements. To address the two areas of weakness; depth and logicality was essential. The clue to doing this lay in the realisation that the model had the same problems as existing methods. To be able to quantify a set of business objectives was essential. Also quantification had to extend to the process and systems architectures. To achieve this would clearly require analysis at greater depth. It would not be possible to skim across the surface any longer. If a model was to be produced that would stand up to examination, then detail was required. The detail would be provided by new objects:

- Critical Success Factors and Key Performance Indicators would provide detail in the Business Strategy domain.
- Process Architecture and Skills would provide detail in the Business Process and Organisation domain.
- Data Architecture and I.S. Architecture would provide detail in the I.S. Infrastructure domain.

Attention was also placed on the I.T. Strategy domain. The purpose of this domain had been difficult to determine. Clearly Emergent I.T. was an important change enabler, but the problem lay in connecting it into the other domain objects. The only logical way was to link it with I.T. Groups, but this was an object that did not sit easily in the I.S. Infrastructure domain. A rethink was required to redefine the domain.

Analysis carried out at the end of the first projects indicated that a description of the I.T. Architecture that was needed to support the I.S. Applications was important. This would define the hardware, infrastructure software and networking requirements. The logic behind this need came back again to the processes. Enactment of a process required data that was delivered by the application. Additionally the delivery of that application in the form that the process required placed dependencies on the structure of the I.T. Furthermore it was known [ICL, 1994(2)] that the structure of the I.T. created opportunities to build I.S. Applications in a number of ways. This therefore created options to define and enact the processes. Since it was I.T. that was evolving most rapidly it was logical to put the I.T. Architecture object type in this domain.

Additionally it had been discovered by the research that there were other, non-I.T., technologies that could also have a impact.

For example in the Electricity Distribution Industry new materials were being introduced that reduced or eliminated maintenance needs. (For example the coolant sulphur hexafluoride in transformers). Introduction of these materials provided an opportunity to rethink maintenance processes.

Therefore a further object type, Technology Opportunities, was created for this domain. Whilst this object type never had a major impact in a Strategic Alignment project, it was useful for the purposes of completeness and making sure that the analyst investigated beyond I.T..

The object types in the model were therefore rethought and extended between the first and second projects.

The I.S. strategy plans produced for ESKOM and Eastern Energy used this revised model. In both projects the models produced an I.S. Strategy Plan that the organisations accepted and proceeded to implement. In this regard the model could therefore be said to meet the objective of developing and supporting an I.S. Strategy Plan.

Turning to the second question of whether the model supported harmonisation of Business and I.S. Strategies, once again the evidence from the research indicates that this is indeed the case. The objective was to show how I.S. applications could support achievement of a business strategy. The research had revealed two things of vital importance to the model and its object types:

1. It was necessary to be able to measure a business strategy in order to be able to determine whether or not it was achieved.
2. That I.T. and I.S. did not directly enable achievement of business strategies. I.T. enabled construction of I.S. applications which in turn

enabled processes to be enacted. It was the design of improved processes which had the direct impact on the business strategies.

Consequently I.S. and Business strategies could only be harmonised through the process architecture object. A spine, shown in Diagram 6.1 below, therefore ran through the model which enabled harmonisation.

Critical Linkages in the Strategic Alignment Model

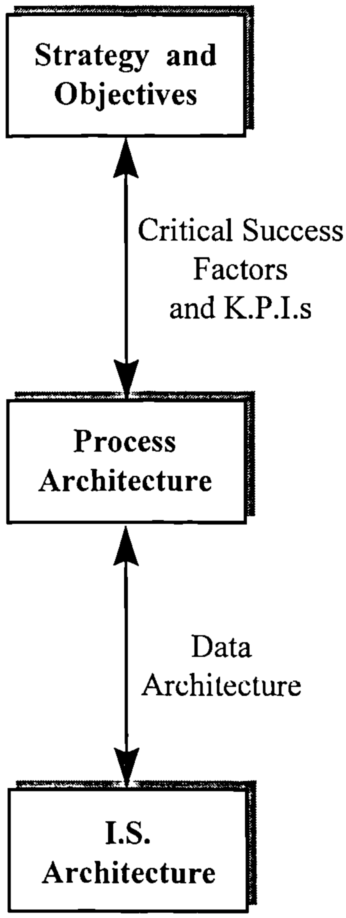


Diagram 6.1

This way the capability of I.S. to support a Business Strategy could be explained and the opportunities for I.S. to change a Business strategy could be explored. The model therefore supported harmonisation of Business and I.S. Strategies. The linkages were via the process architecture object type. The links were dependant on understanding and defining the Critical Success Factors and Key Performance Indicators and developing a Data Architecture.

A final facility that the model had was that it could be analysed and examined in both directions. This was one of the requirements discussed in Chapter 2. It was necessary to be able to define both the I.S. applications needed to support the Business strategies and how the I.S. applications could enhance the Business strategies. Only if this were possible, could the impact of I.T., as an potential agent of change, be examined. Once again, with the linkages shown in Diagram 6.1 in place, a bi-directional analysis was possible. For it to be achieved fully the I.T. architecture object has to be included. The way the linkages are examined is by the matrix analysis activity and this is discussed in the following section.

6.1.2 The Applicability of the Methods

In Section 2.3.2., four requirements were identified which the method had to satisfy if it was to deliver an improvement over existing methods. These were:

- **A method to link the Business Strategy with the Process, I.S. and I.T. Architectures.**
- **A method that supported the feedback requirement which would enable the opportunities to use I.S. and I.T. to induce business change.**
- **A method that would be quick and easy to use as well as producing a result that was rigorous.**
- **A method that would support on-going change and enhancement to the model.**

The method that was finally defined and then tested is fundamentally different from the previous methods discussed in Chapters 1 and 2. These differences are discussed in Section 6.1.2.1 below. Furthermore the method is different from the suggestions contained in MIT90s, see also Section 6.1.2.1. Development of the method proposed in Chapter 5 took three iterations before it met the requirements specified. Each iteration was more comprehensive than the previous one, in that it contained more activities but, at the same time, grouping the activities into the 5 Steps made the whole thing more controllable. The capability of the method to meet each of the requirements is discussed in Sections 6.1.2.2 to 6.1.2.5.

6.1.2.1 Differences from Earlier Methods

The fundamental differences from earlier I.S. Strategy Planning methods are scope and comprehensiveness. Methods developed in the 1980s tended to ignore process and sought to link business strategy directly with data and I.T. architectures. Strategic Alignment uses process as the fulcrum to create the linkages between business strategy and these architectures as was shown in Diagram 6.1. In this sense it is more comprehensive in that it has this mechanism to address the issues of why a specific business strategy needs the defined I.S. applications and how the I.S. applications will support the business strategies. As regards scope, Strategic Alignment is not a linear process, unlike many of its predecessors. It is iterative and supports feedback. This means that it considers the model in two ways. The first being to establish what I.S and I.T. architectures are needed to support the business strategies and the second being to establish how new I.S. and I.T. capability can change existing business strategies. This second way is using I.S. and I.T. as the catalyst for a radical rethink. The process of Strategic Alignment forces the analyst to work round the model, first in one direction then in the other. The first pass establishes the I.S. and I.T. architectures needed to support existing business strategies. Whilst the second pass brings into the model potentially new I.S. and I.T. capability then works back to establish the potential changes that they can deliver. It is this second feedback pass that is a major difference from earlier methods.

MIT90s recognised the need for all the differences mentioned above and proposed Strategic Alignment as the means by which they could be addressed. However the method proposed and developed by this work is fundamentally different from that proposed by in MIT90s. It was discovered in the first projects carried out that the approach of "Domain Triangles", described in Section 2.2.4 could not be used to achieve alignment. The reasons were that the information in the domains was insufficient to create the linkages and, without the linkages being established, the impact could not be defined. Consequently it proved not possible to define an I.S. Strategy Plan that could be justified. Furthermore the direct link between the Business and I.T. Strategy domains did not appear to exist in reality. The linkage was found to be indirect through the two other domains. It was to overcome these problems that firstly additional object types were added to the model, see Section 6.1.1, and that the process was totally rebuilt into the five Steps described in Chapter 5. However for the purposes of creating alignment it only the activities in the fifth step that should be compared with the use of Domain Triangles. Whilst Domain Triangles seek to explore the impacts at the domain level; this method explores impact at the object type level. It does this for selected pairs of object types, firstly to establish alignment within a domain, then to establish alignment across domain boundaries. This is the fundamental difference that this approach has over the approach suggested in MIT90s.

6.1.2.2 Linking Business Strategy to I.S. Architecture

Linkage is at the heart of Strategic Alignment. Whilst it is relatively straightforward to populate the object types within the model; understanding and defining the linkages is more complicated. The approach used to populate the model and define the linkages has been described and discussed in Chapter 5. The projects used for the input to the methodology development explored and evaluated the linkages. From this work the nineteen linkages that were most significant were identified. These have been described in Section 5.2.4. The projects revealed two important facts:

1. That linkage has to be between specific pairs of objects types. Attempting to link more than two objects in the same analysis exercise becomes too complicated and unmanageable.

2. Linked pairs of object types have to be either in the same domain or adjacent domains. Linking within the same domain provides the mechanism to establish the logicality and consistency of a domain. Linking across domains creates the alignment that is being sought.

It was these findings that caused the fundamental changes to the original Strategic Alignment model. Attempting to link the Business Strategy Domain with the Business Process and Organisation Domain at the domain level proved to be nugatory. The links were at such a high level that their definition was so general to be meaningless. It was possible to state that a link existed but not possible to quantify its nature or importance. Similarly the same thing happened when attempting to link non-adjacent object types. It was possible to identify, for example, that a specific Value Process would need to have a certain I.T. Architecture, but the reasons and benefits could not be quantified.

Once these points were realised the process of creating linkages became feasible.

It also became possible to "read" a Strategic Alignment Model which had benefit in explaining the results. "Reading" a Strategic Alignment Model is done in the two directions and is as follows:

- **If the Mission of my organisation is M_1 , then to achieve it I will have to adopt Strategies S_1, S_2 and S_3.**
- **To achieve Strategy S_1 the following Objectives, O_1, $O_2$and O_3 must be achieved.**
- **Achievement of Objective O_1 is dependant on the Critical Success Factors, CSF_1, CSF_2 and CSF_3 and each Critical Success Factor is measured by the following Key Performance Indicators, KPI_1, KPI_2 …… KPI_n.**
- **To be achieved, the Critical Success Factor CSF_1 requires the Value Processes VP_1, VP_2 and VP_3 to be enacted.**
- **To enact Value Process VP_1 requires the following Skills and Capabilities C1, C_2 and C_3 and the Applications A_1, A_2, and A_3 to be in place.**

- **The Application A_1, maps to the I.S. Architecture elements I_1, I_2 and I_3.**
- **To build the I.S. Architecture element I_1 requires the I.T. architecture elements T_1 and T_2.**

In this way the linkages and dependencies can be explained and the I.S. and I.T. Architectures needed to support a Business Strategy defined. In the other direction the model "reads" as follows:

- **The I.T. Capability T_1 will enable development of the Applications A_4, A_5 and A_6.**
- **If Application A_4 is developed then I can re-engineer Value Processes VP_5 and VP_6 B or develop a new Value Process VP_4.**
- **To enact these value processes will additionally require the Skills and Capabilities C_4 and C_5 to be developed.**
- **If value process VP_4 is enacted then it will enable the Critical Success Factors CSF_2 and CSF_3 to be improved and / or new CSF_4 to be introduced.**
- **This means that I can change adopt new Objectives O_4 and O_5.**
- **If Objective O_4 becomes achievable then Strategy S_4 can be adopted.**
- **With Strategy S_4 being followed, I can improve and/or change the organisation's Mission from M_1 to M_2.**

This shows how improvements to an organisations Mission and Strategy can be delivered by introduction of new I.T. Capability.

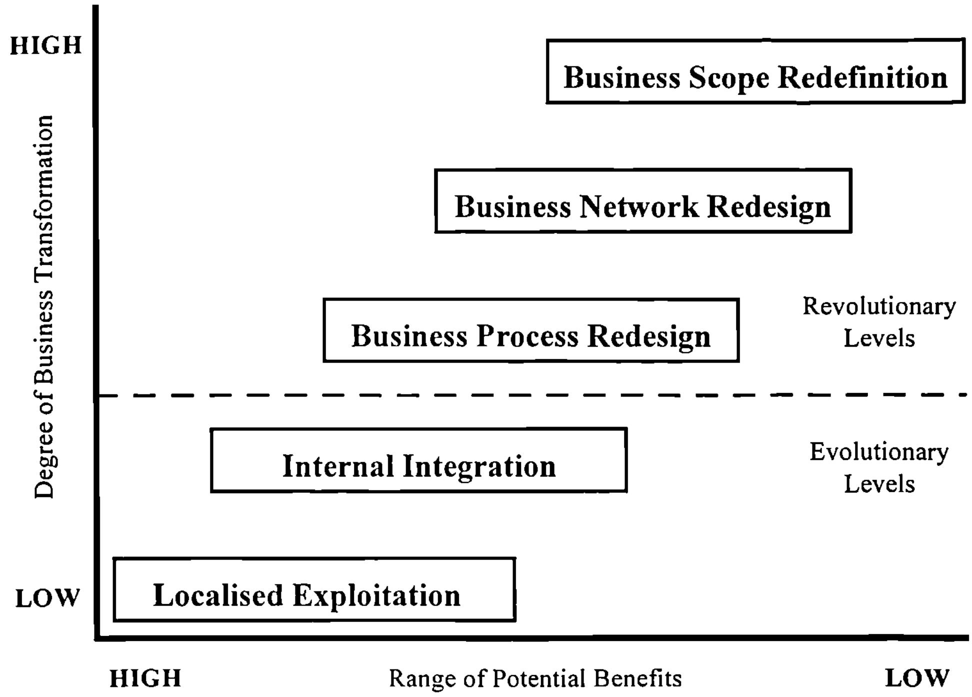
From the above discussion it can be seen that Strategic Alignment can be used to define the linkage between Business Strategy and I.S. Architecture. This linkage can only be created when the Value Processes are defined and linked in two directions: to the Business Strategy and to the I.S. Architecture. Additionally to understand the linkages it is necessary to use CSFs, KPIs and the Data Architecture as is shown in Diagram 6.1.

Once these linkages are in place and defined, an I.S. Strategy Plan can be produced and, with the evidence and information that is gained from defining the linkages the plan can be explained and justified.

6.1.2.3 Support of I.S. Induced Business Change

The issue of what I.S. Induced Business Change really is needs first to be considered. The concept stems from the Venkatraman 5 Layer model [Venkatraman 1991] which was discussed in Section 5.2.3.1. and is shown again below in Diagram 6.2.

VENKATRAMAN 5-LAYER MODEL



Venkatraman suggests that is when I.S. is used to achieve the three revolutionary levels that I.S. induced business change really happens. This is because it is at these three levels that the benefits become significantly great to cause fundamental change. At the two lower levels all that is happening is that existing processes are being made more efficient.

Strategic Alignment as has been seen will identify the potential use of I.S. and I.T. to deliver an existing strategy or enable adoption of a different one. In this sense it supports the concept of I.S. induced business change. But there are a number of potential limitations which need to be explored.

- The first is where the organisation is starting from. Using the 5-Layer model as a reference; if it is at the bottom layer then to jump to layer three or higher may be too great and a planned evolution to layer two may be adequate. In the ESKOM study it was found that some of the new I.T. that could radically change the way work was carried out in the field, for example introduction of mobile computing, was beyond the capability of the organisation to accept it.
- The second is that of change within the industry sector. In a sector that is not rapidly changing then the need to introduce radically different ways of doing things is questionable. In the case of Eastern Energy, privatisation was causing a radical change in the sector. The organisation needed to compete to survive and so radical change was essential. For this reason I.S. that could carry out market analysis of the needs and behaviour of the organisations customers was a very high priority. It was known that this kind of system was new and so could enable the organisation to do things differently.
- The third is the use of the Strategic Alignment Model itself. The model is not an instant solution. It will only allow definition of an I.S. Strategy Plan. This plan has then to be implemented. To implement the Plan requires that a development programme be set up and managed.

Considering the first two limitations, it was apparent that the organisations had an informal comfort zone within which change could occur. Go outside the comfort zone, as in the ESKOM example, and there is a risk that change would fail. However a paradigm shift in the industry sector, as in the Eastern Energy example, could force the organisation to move outside the comfort zone in order to survive. This concept is shown in Diagram 6.3. overleaf.

The question arises therefore as to what are the factors that determine a comfort zone in respect of its willingness to accept change. Strategic Alignment does not measure this and therein possible lies a limitation in the model which is an opportunity to carry out further work. (See Section 7.1) Consideration of the material produced by the studies gives some clues.

- Change is caused by enactment of new processes and the reason why many new processes fail is due to insufficient attention being paid to the skills and culture issues
- The two RECs, YEG and NORWEB, that were the subject of the first two studies had very different cultures that could be related to the style of the CEOs of these organisations.
- ESKOM had a culture that discouraged skills development and learning. When faced with change opportunities there was serious resistance.

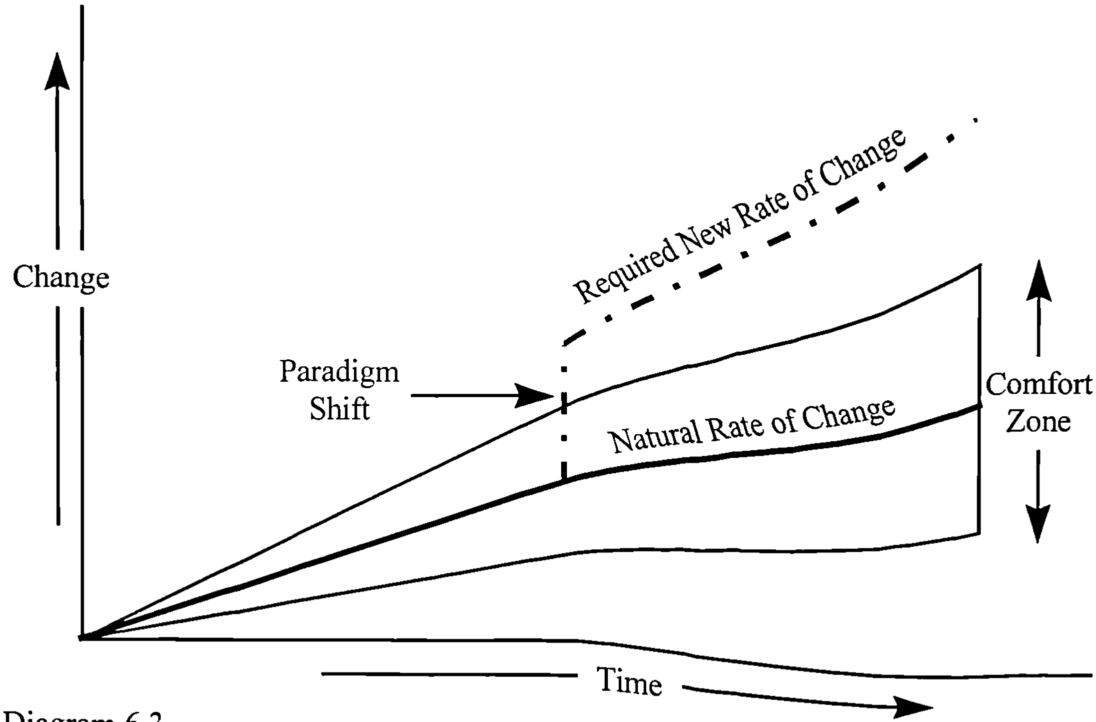


Diagram 6.3

This evidence, which is incidental because the issue was something which was not at the centre of the work, leads to the idea that skills and culture are the important factors in ensuring that change can happen.

It can be concluded therefore that Strategic Alignment supports the identification and definition of I.S. induced change. However it does not deliver the change and furthermore the model is incomplete in that it does not explore the skills and cultural implications, even though these are object types in the model.

6.1.2.4 Speed and Ease of Use

Five studies were carried out in the course of the development of the methodology. Each study had the objective of using Strategic Alignment to produce an I.S. Strategy Plan for the client. Four of the studies covered the same industry sector; The Electricity Supply Industry. The fifth was conducted to establish whether the method was generally applicable. Success in all five studies was acceptance of the I.S. Strategy Plan by the client.

Concerning speed and ease of use, the following comments can be made.

The two initial studies used a method that was not easy to follow, see Section 6.1.1. However by the time the Eastern Energy study was started the method had been made considerably easier to use. The reasons for this were:

1. The method was divided into five steps and each step contained a set of defined activities. This made the overall process logical and easier to follow.
2. The method could be explained to the client and the members of staff assigned to study. This removed uncertainty and achieved positive support.
3. The steps and activities provided control and review mechanisms through the logical milestones.
4. Existing work once identified could be mapped to the process and incorporated into the model.
5. The matrix analysis technique provided a mechanism to quantify the analysis steps. This was something that all the people concerned with the studies found easy to use and reassuring when it came to accepting the conclusions.
6. Two other techniques that were particularly important in the method were Criteria Based Interviews and Facilitated Workshops. Both of these, like Matrix Analysis, produced a tangible output that was easy to understand and debate.

Whilst it can be concluded from the above discussions therefore that the method is now easy to use, there are still some limitations.

1. The method requires an experienced analyst or consultant to lead the project. It cannot be delivered by someone who does not have experience

of I.S Planning and a sound general knowledge of business strategy. On two occasions, once with Eastern Energy and once with ESKOM, analysts, whose primary skills were technology design, found themselves in situations where their lack of the skills specified above meant that they were unable to complete tasks. In this sense the method is not easy.

2. The initial activity always is collection of information. This is lengthy and consumes a lot of effort. However it is the quality and rigour of this work that identifies many of the issues that lead to the innovative ideas. It appears that this is an activity that cannot be deskilled or reduced.
3. Developing the matrices is also a lengthy task. Currently it a manual exercise. Consequently once a set of matrices has been produced that are accepted as accurate, there is little inclination to revisit them to explore alternatives. This area does lend itself to automation and a piece of software that managed the matrices and supported definition and evaluation of alternatives would be most useful. (see Sections 6.3.2 and 7.1.3).

The method does appear to have general applicability. It was successfully used in the HQ UKLF study. Training another analyst who had military experience, as well as I.S. Planning expertise, was straightforward and the resulting plan was implemented by the client.

The final point is that of the time taken to carry out a study. There is no doubt that it is still a lengthy undertaking. The Eastern Energy study had an elapsed time of six months and required eighteen man months of effort. There are two factors contributing to this duration:

1. The amount of work that has to be done.
2. Access to Directors and Senior Managers

There is however the view that six months work is not an excessively long period of time to develop a plan that, for Eastern Energy for example, will take over four years to implement and cost in excess of £25 million. That the 5 Steps break the study into five discrete phases, each having its own deliverable does help. It keeps the attention of the sponsor focused on the project and the output provides a means to ensure that the overall study is proceeding in a direction that is acceptable.

The timescales could be reduced by greater use of best practice and shortening the scope and depth of the interviews. However the risk is that things will be missed and the results will become less rigorous.

My opinion is therefore that a six month elapsed time to study an organisation in depth to enable production of an I.S. Strategy Plan has to be acceptable.

6.1.2.5 Support of On-going Change

There was a tendency when using earlier methods for the I.S. Strategy Plan once produced to be used to justify initiation of some I.S. development programmes then put to one side and forgotten. To find an organisation which measured progress against the plan and reviewed its continued relevance was rare.

One objective of Strategic Alignment was to prevent I.S. Strategy Plans becoming shelfware. It was decided that the approach would be to encourage the organisation to formally review the plan every six months to reassess its relevance. The reason for this was the MIT90s finding that the rate of business change would continue to increase [Scott Morton, 1991(2)]. Consequently in a relatively short period of time any of the object types in the model could change and so impact on the logic of the I.S. Strategy Plan.

An example of such a change was observed in the ESKOM study:

> Privatisation of the organisation was a major driver which had a significant impact on the model and was reflected in the priorities the marketing and energy trading applications. Within one six month period the South African government deferred all privatisation plans. Consequently the priority of these applications reduced.

The review process was only tried out on the ESKOM study and the method described in Section 5.6.2 was applied. This method was applied on the two reviews that were carried out. Each review took two weeks to complete. The first review identified the example above, but this caused only a small change to the overall plan as the applications concerned had not started development. The second review caused a more fundamental change. It identified that a set of value processes, now fully designed, would require a significant change in working practice in order to enacted them. The staff involved did not possess the skills needed. To train them would require a major investment and take two years to complete. A further factor was that the government had changed the labour laws which limited the organisations options. All these issues were workshopped and the results used to amend the model and redefine the I.S. Strategy Plan. The result was that the applications supporting the processes were reprioritised to allow the ones that did not require the skills in question to be implemented later. Additionally other applications supporting different processes were put forward in the develop plan to maintain overall progress.

It can be seen therefore that Strategic Alignment will support on-going change by using the method described in Section 5.6.2. The method appeared to work well for four reasons:

1. The documentation form the original study was comprehensive and still available.
2. The same people were used to carry out the review who worked on the original project.
3. The review used the same tools and techniques as the original study.
4. The matrix analysis tables produced by the original study could be reused and only the changed objects needing to be reworked.

6.2 The Usability of Strategic Alignment

6.2.1 The Usability of the Methods to Develop a Model

Examination of the five tables of tools and techniques in Chapter 5 will reveal that there is a high degree of commonality in that the same tool is used repeatedly and that the majority of the tools are well established and so do not require specialist skills. This was a deliberate policy to attempt to make the method as useable as possible. A further feature of the method is that it requires specific inputs to each activity and each activity produces specific outputs. This provides control over the whole process by ensuring that progress can be measured and monitored. It has a further advantage of enabling existing work to be evaluated and integrated, thereby avoiding "re-inventing the wheel".

The risk is that the control becomes too great making the process overly prescriptive. If this happens original thought and innovation will be stifled and the risk of missing the more radical opportunities increases. It is to minimise this risk that a number of tools are offered for each activity. This permits the analyst to select those tools that are most suitable to the specific needs of the study or those with which he is most comfortable. To further reduce the prescriptiveness of the method the outputs are specified not defined. Analyst can thereby tailor their content to the requirements of the study and the organisation.

A further issue is whether all the activities have to be executed or whether some can be omitted. The evidence is that none can be omitted. This is because all of them provide some input to at least one other activity. If one were to be omitted the rigour of the results would have to be questioned. However there is the question of degree of execution. As was previously stated, many organisations will already have some of the information already collected and documented. In such circumstances the task to execute the activity becomes one of validation and reporting. Furthermore it may also become apparent that when an activity is commenced the value of executing it in detail is nugatory because there already is something in place which the organisation will not change. Consequently it can be minimised. An example of this point occurred in the HQ UKLF study. Four months prior to the study starting a decision concerning their office automation and networking strategy had been made. Even if alternatives that delivered improved performance were identified; it was made clear that no change would happen. The study accepted this decision and minimised the effort spent on activities that were concerned with these object types.

From the above discussion it can be seen that the method has to balance prescriptiveness with flexibility. This has been done by creating a framework in which the analyst has to work whilst allowing choice within that framework.

There is however one tool where it is essential that the method is rigorously followed. This is Matrix Analysis. This tool brings together all the information collected and harmonises it. If the inputs to and process of doing a matrix analysis are not precise and controlled then the model and I.S. Strategy Plan are at risk. The risk is that the if the relative impacts between objects are not understood and accurately scored then the priorities derived will be incorrect and the plan therefore becomes invalid. It was found on both the ESKOM and Eastern Energy studies that the process was lengthy, each matrix taking two to three hours to complete and agree. However by running it as a workshop the process became a discussion and debate which prevented tedium.

In conclusion, it can be suggested that the process and methods are useable and are a fair balance between flexibility and prescription.

6.2.2 The Usability of the Methods to Maintain a Model

The importance of using the same methods to carry out the six monthly review of the model and the changes has been discussed in Section 6.1.2.5. Given that they are useable for creating the initial model, it is not an automatic conclusion that they are equally useable in the review and maintenance role. On a review and maintenance exercise the purpose is to identify and evaluate change without having to go through the whole analysis process again. The important factors in such an exercise are therefore those of speed of use and focus. An organisation will, at the time of a review, be developing the applications specified in the I.S. Strategy Plan. To have to put a large effort into reviewing and updating the plan will not be helpful.

Focus will be achieved by being able to identify what has changed and fitting the change into the model. Identification of the changes is achieved by interview of the key members of the organisation and review of the progress reports of the development programme. To fit the changes into the model requires that the changes are applied to the existing model using the same analysis techniques. Use of the same techniques is necessary to ensure consistency.

In such an approach speed will be achieved having available comprehensive documentation of the original model. This includes not just the reports but also all the analysis outputs as well. Of prime importance here are the matrix analysis tables. These tables enable the weighting and scoring of object types to be easily amended in line with the identified changes. The identification of a new object type occurrence is dealt with by inserting a new row or column into the appropriate table.

From the practical evidence of the ESKOM study it can be concluded that Strategic Alignment will support model review and maintenance; provided comprehensive documentation of the study, including the results of earlier reviews, is available, and the same tools and techniques are employed to carry out the review as were used on the initial study.

6.3 The Requirement for Software Support

6.3.1 Automating Documentation and Analysis

In its present form Strategic Alignment is a largely manual process. There are no facilities to automate documentation of the five Steps nor automate the analysis process. The negative effects of this situation are:

1. The effort to maintain consistency of the definitions and linkages of the object types becomes burdensome.
2. Matrix analysis becomes lengthy and tedious.

In the second effect the amount of time and effort required to carry out an analysis makes justification of definition and evaluation of alternatives very difficult.

The above observations do exclude use of tools such as word processors to produce the reports and drawing software to produce the architecture diagrams. Both of these were used extensively on the ESKOM, UKLF and Eastern Energy projects. The observations refer to the requirement to do five things:

1. Document all the object type occurrences in a data dictionary.
2. Automate the matrix analysis process by use of a spreadsheet.
3. Generate pro forma reports.
4. Integrate the above three modules to be able pass information between them.
5. Extract data to create duplicates studies to enable "what if" evaluations.

The capabilities described above would enhance the usability of Strategic Alignment. They would not add to the functionality of the method, but would be an improvement to its efficiency. The specification for such a system is described in the next section.

6.3.2 Strategic Alignment Scoring and Ranking System

From the discussion in Section 6.3.1 it may be concluded that a system to support the Strategic Alignment Process would be of much assistance to the analyst. Any system that would support Strategic Alignment would have to support the five requirements suggested above. In addition a capability to produce architecture diagrams from the information held in the object data dictionary would be useful. The system would also need to be able to hold a number of studies, both different versions of the same study and different studies. Finally it would require system management and security functions to manage the data and reports.
The system has to support an analyst executing the activities of a Strategic Alignment study. The support however from the system needs to be indirect for the activities in the first four. This is because in these Steps the activities are concerned with collecting, and correlating information. In the fifth Step the system will take an active role in managing the matrix analysis activity. The process that the system will have to support is shown in Diagram 6.4 overleaf. The process "Populate Object Types" will be used to support all the activities ii Steps One to Four of the Strategic Alignment process. The processes "Create Analysis Matrices" and "Score Matrices" will support the activities in Step Five concerned with creating alignment. The other feature of the support process is that it will support the creation and exploration of alternative models within a study and also the review and revision of models in the maintenance phase. Such support will improve the flexibility and efficiency of the Strategic Alignment process which was identified as a limitation.

To construct a system will require the design and development of the modules shown in the Application Architecture model in Diagram 6.5. It would be my intention to develop the whole system on a Windows environment. The advantage of this would be that Windows provides the tools necessary to create the graphical user interface, interworking of the modules and system management, thereby reducing the need to write complex programs.

STRATEGIC ALIGNMENT SUPPORT PROCESS

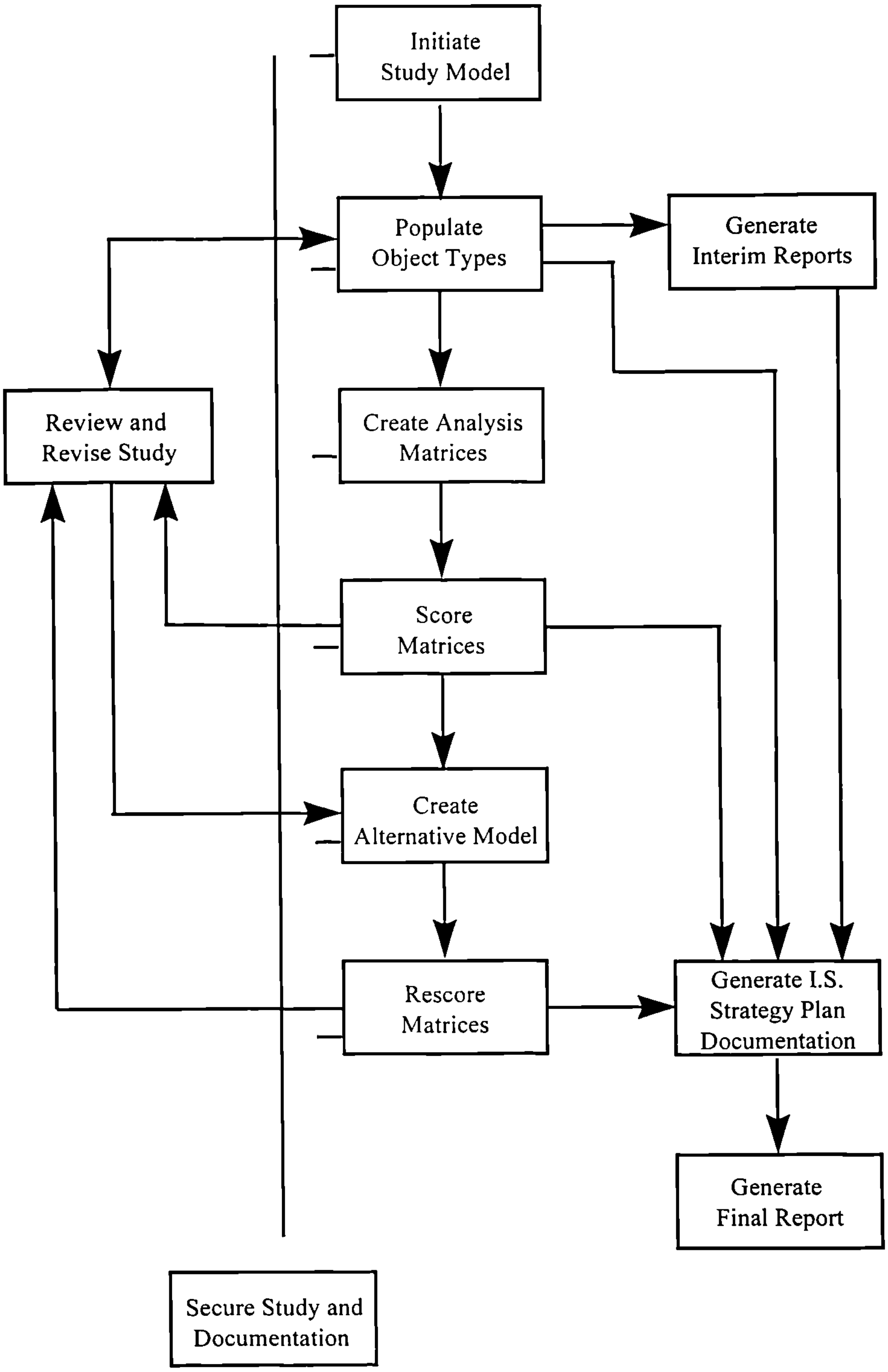


Diagram 6.4

In addition the standard Microsoft Office products could be used to construct the application modules, further simplifying the development process. The specific software proposed is shown overleaf in the Table 6.1.

STRATEGIC ALIGNMENT APPLICATION ARCHITECTURE

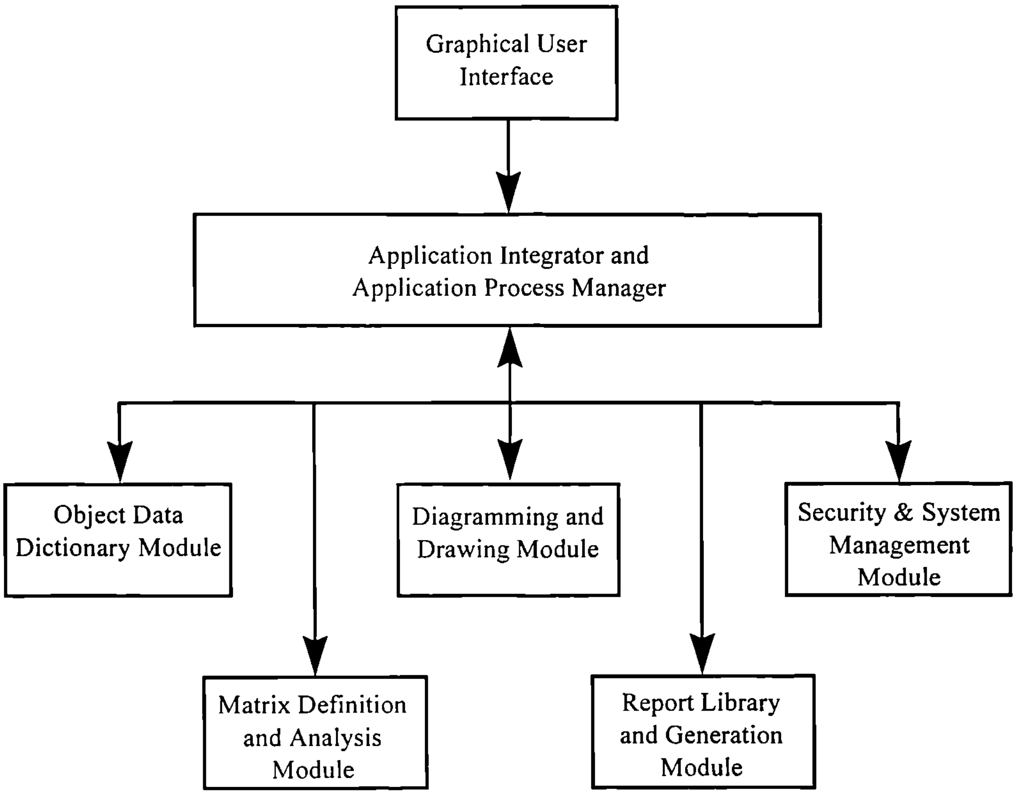


Diagram 6.5

MODULE	SOFTWARE PACKAGE
Object Data Dictionary	Microsoft Access
Matrix Definition and Analysis	Microsoft Excel
Diagramming and Drawing Module	Microsoft PowerPoint (Note: a more sophisticated tool such as Visio may be needed in the future)
Report Library and Generation	Microsoft Word
Security and System Management	Visual Basic plus standard Windows tools
Application Integrator and Application Process Manager	Visual Basic plus standard Windows tools

Table 6.1

6.4 The Relevance of Strategic Alignment

6.4.1 The Scope of the Model

Comparison of the content of a Strategic Alignment model with the content of its predecessors, see Chapter 4, shows that it contains more elements than are found in any of the earlier methods. It furthermore contains much more than the original Strategic Alignment model postulated in MIT90s. [Henderson, 1989(1) and Henderson, 1989(2)]. The model suggested is therefore a very rich and comprehensive one. In its present form it contains the objects needed to produce a model from which an I.S. Strategy Plan can be derived. This conclusion is reached from the evidence that the studies which contributed to the research produced I.S. Strategy Plans that the organisations were able to implement successfully.

In its present form its scope is therefore sufficient. Nevertheless there are areas in which it may be improved that have already been identified. These are discussed in Section 7.1.

6.4.2 The Rigour of the Methods

Examination of the results of the two studies, ESKOM, Eastern Energy, where the final method was used and the business domain analysed was the same showed that the same set of applications were identified. Where the priorities of these applications were different is attributable to different sets of objectives. These results are shown in the Table 6.2 overleaf. Examination of the table shows that both organisations had sixteen applications in common and that the priorities are very similar if not identical. There is one application that is more than four places different. This is Energy Supply and Trading. The reason is that the competitive market in Australia was being introduced in 1995, whereas in

I.S Application	Application Priority	
	ESKOM	**Eastern Energy**
Plant and Circuits	1	1
Work Planning (5 Year)	2	6
SCADA	3	4
Geographic Information Systems	4	3
Integrated Work Management	5	7
Load Forecasting	6	N/A
Network Analysis	7	5
Control Room Automation	8	N/A
Materials Mgmt. and Procurement	9	10
Project Management	10	7=
Contract Management	11	7=
Distribution Management (inc. Demand Side Management, DSM)	12	11=
Fault Management	13	11=
Budgeting and Cost Control	14	13=
Energy Supply and Trading	15	2
Revenue Management	16	13=
Decision Support	17	15
Executive Information	18	16

Table 6.2

South Africa it would not be introduced until 1999 at the earliest. As can be seen from the comparative table, Table 6.3, overleaf, Eastern Energy were adopting a strategies which would require the Energy Trading system much sooner than would be the case for ESKOM in response to this driver. Otherwise the strategies show a similar business direction and set of priorities. From this it can be inferred that the method has rigour.

However more evidence from further studies would be useful to provide additional material to validate more fully this conclusion.. However this may be hard to gather. The Electricity Supply Industry world-wide is undergoing such rapid change that the drivers, even one year after the work on these two organisations was completed, are very different. Consequently a different model would be developed which would not be comparable with the previous work.

	ESKOM Strategies	**Eastern Energy Strategies**
1	To improve organisational efficiency, by making the processes cheaper and quicker.	To maximise the return on Assets to 15.9% and reduce operating costs by $9m in the year 1995/6.
2	To develop organisational effectiveness by the introduction of different processes.	Protect the business position by minimising risk in the energy market by improving contract cover to 95% and increasing the share of the contestable market from 19% to 21%
3	To create competitiveness in the organisations dealings with the external world in response to change.	To increase customer satisfaction levels from 85% to 90% in the year 1995/6.
4	To develop new alliances by exploiting ESKOM's strengths and position which will expand the business in both existing and new markets.	To double the size of the business from $500m to $1,000m in 5 years.
5		To improve the company's external quality assessment from 302 to at least 700 in 3 years.

Table 6.3

Nevertheless, the acceptance of the results by the organisations, and their willingness to invest in I.S. development programmes each costing in excess of £25 million which implement the plans produced; is direct evidence of the quality of the results. To be precise though it is only additional indirect evidence of the rigour of the method.

Contributing additionally to the issue of rigour is the finding that Process is the fulcrum of the model. It has been explained previously that it is process that links the Business Strategy with the I.S. Strategy. This point emerged on all the projects and is very important. Recognition of the fact focuses attention in the analysis onto the key area of the study. This is to make sure that there is accurate definition of the Value Processes. Gaining agreement that the Value Processes as proposed are right in terms of supporting the business objectives and that the data they require is precisely defined are activities that can be made measurable and provable. This will provide rigour by creating a strong and accurate spine to the model as was shown in Diagram 6.1.

A further way in which rigour is improved is by incorporation of feedback into the Step 5 activities. These activities produce the matrices and the approach is to work round the model in an anticlockwise direction then work back in a clockwise direction. Whilst the original intention was to identify the business change opportunities provided by new I.T. and I.S., such an approach inevitably will throw up inconsistencies. If when doing the clockwise analysis the results are radically different the question "why" can be asked. The approach to the creation of alignment provides the opportunity to check for consistency and in doing so will make the method rigorous.

There is one area, Cost Benefit Analysis, where the method as it currently exists does not go into an in depth analysis. Strategic Alignment in Step 5 contains a cost benefit analysis activity. This activity is carried out at a high level. This means that the analysis seeks to identify from the information gathered in the model population steps what the business benefits will be from implementation of the value processes and the costs of implementing them. At this level the information can only be estimates rather than fully quantified. For example; as the specific application packages will not have been selected nor the low level work flow of the processes defined, full quantification of costs and benefits is not possible. However it is not really necessary either. Strategic Alignment is a planning method that seeks to determine what has to be done and only address the how it should be done in terms of priority and sequence. The follow on work will do the detailed design and planning, at which time the full cost benefit can be done because the information needed will be available. In Strategic Alignment it is only necessary to know what the overall benefits will be and have a view of the costs in order to establish whether the plan is viable.

The above argument is not a justification of a weakness. All the studies discussed costs and benefits and not one organisation required anything other than the broad answer. Additionally all the earlier methods discussed in Chapters 1 and 2 also did not do detailed cost benefit analysis at the strategy stage. The reason being that the information needed is not collected until later in the development process. Once again this reason is not entirely solid; it only reinforces the evidence gained by questioning the studied organisations

Consequently it is concluded that in Strategic Alignment only the high level cost benefit analysis is required to produce the I.S. Strategy Plan from an aligned model. However it is an area of the method that is still a little grey which could benefit from further research.

In conclusion, the results produced and consideration of the methods used demonstrate that Strategic Alignment is a rigorous method.

6.4.3 The Support to the Organisation

The discussion in the previous sections has sought to show how the method will support development of an I.S Strategy plan for an organisation. There are three other areas where the original aims of the research were also directed. These are discussed in the following sections

6.4.3.1 Development of Information Systems

A problem with many of the earlier methods was that, once the I.S. Strategy plan had been produced and applications developments started, the plan itself tended to be ignored. Consequently applications tended to be developed in isolation and their interworking with other applications not considered. As a result there was much duplication of development effort and data. Strategic Alignment prevents this from happening. This has been achieved in the methodology by the activities which do the following things:

- Build corporate Data, I.S. and Process Architectures.
- Define the linkages between these Architectures.

These architectures are specified at high level and in the subsequent I.S. development programmes have to be broken down into much more detail. Nevertheless they provide the essential framework to understand how and where the data, applications and processes have dependencies and interwork. This knowledge will improve the efficiency of the development phases by addressing the problems identified above.

The second area where Strategic Alignment helps I.S. development is in the management of change. This point was discussed in detail in Section 6.1.2.5. The issue is that whilst applications take time to develop there is always the risk that the requirements will change during the development phases and the resultant application starts not to meet the business requirement. The Strategic Alignment review process addresses this issue. There is a risk however that reviews can lead to continually change of application specification and consequently nothing gets built. To avoid this problem requires first awareness of the risk and second a change management process to exercise control and ensure that the development phase still delivers the application.

6.4.3.2 Enablement of Radical Rethinking

Radical rethinking attempts to find fundamentally different ways of achieving a strategy. This is normally achieved by enactment of new processes. It is requires an organisation to operate at levels three, four and five in the Venkatraman model. [Venkatraman 1991]. As has been shown in Chapter 5, Strategic Alignment will identify how I.S. and I.T. can enable different processes to be enacted. If the I.T. is new then logically the process will enable new processes to be derived. However it doe not do this process automatically. The analyst is still required to work out how the technology can be applied.

Strategic Alignment will therefore provide the opportunity and the environment of the study in which radical rethinking can take place. It will also provide the mechanism to evaluate radical ideas. It will not do it automatically.

6.4.3.3 Identification of Paradigm Shifts

Paradigm shifts are those fundamental changes in the business environment and technology that cause organisation to have to do things different to survive or provide the opportunity to make a far reaching change to their strategies. Examples include privatisation in the Utilities Sector and the development of the personal computer. Spotting a paradigm shift in a Strategic Alignment study is like finding the mother lode when prospecting for gold.

In Strategic Alignment the activities which focus on this are "Business Paradigm Evaluation" in Step 1 (see Section 5.2.3.1) and "Identify New and Emergent Technologies" in Step 4 (see Section 5.3.2.4). However, as with Radical Re-thinking, they will not do it automatically. Identification of paradigm shifts is dependant on the knowledge of the analyst of the industry sector and technology. It is also dependant on the analysts skills in gathering information and applying it to define the impact of the paradigm shift.

So again whilst Strategic Alignment will provide the opportunity and environment to identify and evaluate a paradigm shift, it will not do it automatically.

Chapter 7. Conclusions

7.1 Further Work

7.1.1 Potential New Object Types

The current set of object types is considerably extended from the set that was used in the initial research. The extensions were made to make the model more rigorous and useable. This has been achieved and the current set provides the information necessary to harmonise Business and I.S. Strategies. The question therefore is whether new object types would add to the richness of the model and what would the richness be.

A number of possibilities have been identified though discussion with colleagues and organisations collaborating in the research. These are:

- **Business Strategy Domain**

  An object type that forces a more detailed investigation on benefit quantification.

- **Business Process and Organisation**

  A full review and extension of the Skills and Capability object types to extend the functionality of the model.

  This is the domain where the modelling is weakest; its purpose being only to identify if problems exist. Recent research [Gartner 1995] indicates that the primary reason for the failure of Process Re-engineering programmes is failure to consider the softer and cultural issues. This indicates that this may be an important area to consider further work.

- **I.S. Infrastructure Domain**

  As with the Business Strategy Domain, an object type to force closer examination of the costs and benefits of the I.S. Applications. Additionally the Data Architecture object type does not specify whether an object oriented or entity model should be derived. As object orient development becomes more widely used it may become necessary to specify this type of model.

A further issue that could be of value is to explore whether an object oriented data model maps more precisely with a process model than an entity model. Logic would seem to dictate that it does but as yet there appears to be no formalisation.

- **I.T. Capability Domain**

  The possible extension here is to break down the I.T. Architecture object into a set of objects. For example Hardware, Communications, System Software. This would extend the model but the risk here is that it would begin to encroach into areas that need only be explored during the development phases.

From the above ideas it can be seen that there is potential to extend the object types. My own view is the areas that would be most profitable to research are:

- The addition of more financial data to the domains. Whilst there are methods in the in the toolset that will carry out cost benefit analyses and other financial analysis; there is no prescription about having to do them.
- Extension of the model to explore the skills and culture issues in more detail.
- Mapping the process architecture to an object oriented data architecture.
- Extension of the model to enable a more detailed risk analysis to be carried out.

Whilst the other ideas are of possible use, they are all addressing issues that are ordinarily addressed in the development phases and to do them in Strategic Alignment would only extend the timescales without adding to the richness of the model.

7.1.2 Extensions to the Methods

To carry out the activities in the five steps, 30 tools and techniques are suggested. Some of them are used to support many activities, whilst others are specific to a single activity. In practice the analyst will chose a subset which experience has shown will give a good result. The others will be kept in reserve for use when complexity or the organisation requires more extensive investigation or analysis. Therefore to add new methods unless there is a real need is nugatory.

There are however some real needs that have been identified. These are the three points identified in the previous section and to be able to simulate the model to explore different scenarios which is discussed in Section 7.1.3.1. In all but one of these needs the methods to support them have already been defined. The exception is the need to explore the skills and cultural issues in more depth. To do this will require methods other than those already specified. What they are is a matter for further investigation.

Concerning simulation, System Dynamics is a proven approach with proven supporting software. This is discussed below. To do the financial analysis the techniques are already included in the toolset. The issue to resolved is to find a means to ensure that these analyses are carried out as a standard part of the study. To do the mapping between a process and object oriented data architecture will require the development of a suitable method and supporting software.

The other areas identified are those of risk and cost benefit analysis. Whilst the need to do cost benefit analysis at nothing more than a high level has already been discussed, see Section 6.4.2, there is still an opportunity to adapt the method to force collection of more data at an earlier stage to be able to do these analyses in detail. The advantage would be better information on which to build the I.S. Strategy Plan. which would derisk things anyway. The disadvantage would be that certain decisions; for example on what application packages and what technologies to adopt would have to be made earlier. By making these decisions earlier the plan could lose flexibility which could mean change opportunities might not be exploitable. There are potential benefits and disadvantages which need to be researched and assessed before a decision can be made either way.

7.1.3 Developments to the Supporting Software

7.1.3.1 Model Simulation

The software to support Strategic Alignment (see Section 6.3) is specified to support the documentation and reporting of a study and automate some of the analysis processes. It is not capable of simulating a Strategic Alignment Model. That is taking a model and running it over time to see the result, then changing the variables and then rerunning the model to see if a different result is produced.

It seem to me that to provide such a capability would be a major enhancement to Strategic Alignment. My approach would be to attempt to build a model using System Dynamics. The first step would be to derive a set of causal loop diagrams [Senge1990] which described the interactions of the Strategic Alignment objects qualitatively. These would then be built as a System Dynamics Model using a software tool such as iTHINK. The application would be used to assess the exact impact of the objects, including their sensitivity, from which their mathematical relationships could be postulated.

Once successfully tested, this model would be used to simulate any Strategic Alignment model. Its advantages would be to allow alternative strategies to be defined and assessed quickly and the relative importance of any object occurrence in a model to be defined.

7.1.3.2 Integration with Software Generation Tools

A second development for the software would be to link it with tools that generate application software.

The process and data architecture models are not at a level of detail from which applications can be developed. My idea is to automatically input these models into application generators as an initial step. The applications development systems that use these generators would build on the models to create the level of detail necessary to generate applications.

The advantage of this capability would be one of consistency. All the thinking and analysis that created the Strategic Alignment Model would be automatically passed into the next stage of the development process.

7.2 Strategic Alignment

7.2.1 The Model and the Methodology

The research has developed a model and methodology that has been shown to be capable of defining and delivering an I.S. Strategy Plan that is accepted by the organisation for whom it was produced. In comparison with earlier approaches, Strategic Alignment has overcome the weaknesses in these methods by incorporated the positive features of the earlier methods with new capability.

The new capability lies in three areas:

1. Strategic Alignment provides the means to assess the opportunities that new I.S./I.T. brings to radically change business strategy, as well as determining what I.S./I.T is needed to support the existing business strategies.
2. The model is able to review and maintain the I.S. Strategy Plan during the development phases. This gives a capability to manage change, both business and technology, during the lifecycle of the of the development programme.
3. Unlike earlier methods of I.S. Planning, it is iterative. It enables feedback to be included in the modelling process. This important because it enables the first and second new capabilities to be enacted.

To be able to support the above three new capabilities, Strategic Alignment has a number of characteristics:

Complex: The number of object types in the model, plus their linkages create a detailed view of the organisation and the I.S./I.T. it requires. Such a level of detail is necessary to produce the richness in the model necessary to make sure all the issues and options are explored.

Comprehensive: To develop an accurate model that fully reflected the organisations needs and direction required the activities in the methodology to be carried out.

Non-Prescriptive: To provide flexibility in the methodology, choice within a framework of activities is a feature of the approach. The resultant non-prescriptive method can therefore be adapted to meet the specific conditions of a study.

Rigorous: It is essential that any user of Strategic Alignment is confident that the result will be rigour and stand up to examination.

Straightforward: The method has been made straightforward by the development of the route map of Activities for each Step.

Modular: By breaking the method into Steps and Activities, deliverables can be produced at predefined milestones. Additionally, by definition of inputs and outputs for each Activity, the Activities become self contained so they improved as new tools and techniques become available.

Practical: Strategic Alignment has produced results that are being used by the organisation to manage multimillion pound I.S. development programmes.

Extensible: Its modular structure will support change to the model and methods as the existing objects and methods become obsolete or require better approaches. It would be ironic if Strategic Alignment, a methodology designed to capture and model business change were unable to change itself.

7.2.2 It's Importance and Contribution

I.S. Planning fell into disrepute in the late 1980's. However in the more recent past its need has recurred. If an organisation is going to spend tens of millions of pounds on I.S. systems to support its mission critical operations; it is sensible to ensure that it has the right systems, developed in the right order, and delivering defined benefits. This is why I.S. Planning is important. But as the earlier approaches failed to deliver the expected benefits, then a new approach, which addressed and solved the problems of the past, was necessary. Strategic Alignment is that new approach and that is why it is important.

The contribution of Strategic Alignment lies in four areas in addition to the remarks above concerning its importance:

Integration: It brings together a number of elements of earlier approaches and combines them to develop a new method that contains proven techniques from the past and new approaches. It is therefore a logical evolution from earlier methods.

Innovation: Strategic Alignment took the radical ideas from MIT90's and when it had proved that they were not practical, totally revised and redeveloped them to create a new approach that is different and in advance of other methods.

Platform for Development: I.S. Planning is not a static method. It cannot be as business and technology continue to change then the approaches to modelling them need to change as well. Strategic Alignment because it is modular and non-prescriptive provides a platform for incremental development of the method.

Experience: the model and methods have been developed from practical research which attempted to build I.S. Strategy Plans as part of the process. That these projects were successful has provided a wealth of experience to support the approach and which can be used to train others in the methodology.

The final question is that of the approach used to do the research. At the outset there were a number of options. Essentially the choice was between a broad approach which investigated a large number of organisations from a number of sectors, or, at the other end of the spectrum, to investigate in a great deal of detail a small number of organisations from a single sector. The latter approach was chosen because, in order to produce a methodology that was rigorous, detailed results were required. The risk was, that by focusing on a small group of homogenous organisations, important factors could be missed. One study, UKLF, from a different sector was used to minimise the risk. In the event the risk was minimal, though to carry out a series of studies using Strategic Alignment in different industry sectors to further evaluate the methodology would not be nugatory.

It is interesting to consider the general point here. If the object of a piece of research is to develop a method or similar that will have general applicability, then detailed investigation would appear to be essential. On the other hand, if the object is to identify trends or review general issues, then a broader approach would seem to be more appropriate. These comments are not new, the research carried out just reinforces this view. Consequently for the objectives of the work the approach was right and I do not think that if I were to start again I would adopt a different approach.

Where things could be improved is in the timing of the research activities. Only two had any degree of parallelism. This was helpful because it provided an instant check whenever there was an issue or finding that needed further exploration. However it is also necessary to recognise that any research of this type needs significant input and commitment from the participating organisations. For them to deliver this is increasingly difficult. Downsizing and competitive pressures have left organisations with very little spare capability to make such commitments. Ironically as well the very turbulence that Strategic Alignment helps address further prevents commitment to assist with research. To gain the commitment it was necessary to adapt the structure.

7.2.3 The Value of the Research Method

At the start of the research, an observational approach was proposed. This was quickly replaced by a more experiential approach. The reason was pragmatism. The organisations invited to provide the research environment were only willing to do so if they were going to get something tangible from it themselves. This was a reflection of the commercial realities of the early 1990s. Organisations had downsized themselves in a drive to cut costs so that they no longer had time or resources to do anything other than focus precisely on the core and short term business.

The method used was in response to this situation. Examining it at the end of the research the following conclusions can be drawn concerning its advantages and disadvantages:

- The method worked in that it delivered a result that met the objects of the research. Whether an observational approach would have delivered a better or worse result is not possible to predict.
- The method forced the research to remain focused; opportunities to explore tangential issues, for example the possible use of System Dynamics, had to noted and put to one side. Focus was an advantage it kept the work on track; the disadvantage was that the results may be less rich than would have been possible.
- In order to deliver results in a timescale that satisfied the organisations being researched, the size of the projects had to be constrained to manageable sizes. For example with ESKOM the first investigatory activities covered the whole of Distribution, this was rapidly scoped back to just Distribution Engineering to ensure deliverables met the organisation timescales. Once again the result was focus with a potential loss of richness.
- The need to deliver results to organisations (i.e. I.S. Strategy Plans) at frequent intervals was an advantage. It enabled the development of the method to be reviewed and evaluated at regular intervals. This created an environment in which progress towards the objectives to be assessed and any deviation from this path identified and correctly. As the objectives of the research were clear it was an advantage, if they had not been known it would have been a disadvantage.

- By delivering results, considered to be valuable by the organisations, the relationships created were strong and positive which in turn created credibility. It will make further research proposals easier to win.

In summary I consider that the use of an experiential method to have been an advantage. It kept the research on track and focused. However as I had strong and defined objectives of what I wanted to achieve the approach was supportive. If it had been less well defined then the approach may have been to restrictive and a number of areas and opportunities might have been missed.

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Addendum: The Adoption of Strategic Alignment

Since completing the research activities for this thesis, there have been a number subsequent activities to adopt and implement the methodology within ICL.

- In January 1995 Strategic Alignment was introduced to ICL's consultancy community. It was delivered as an 8 hour module in the Advanced Consultancy Course. Between 1995 and 1997, over 100 consultants have received this module. During this time the module has had 2 updates to reflect the changes to the methodology.

- In January 1997 a 3 day workshop to give consultants who had been through the Advanced Consultancy course a more detailed understanding of the methodology was designed and delivered. From this workshop, ICL consultants working in the Local Government and Central Government sectors have undertaken 4 studies which successfully used the methodology.

- In June 1997 ICL created a number of working groups to define common services for the ICL Group. One group was tasked to look at consultancy services. This group recommended that Strategic alignment be adopted as the common methodology for I.S. Strategy Planning. This recommendation was accepted.

- Leading on from the previous activity, a formal training course and manual for Strategic Alignment were requested. The first version of the manual was produced and published on ICL's internal web site in December 1997. A 5-day training course structure was specified at the same time and the first event will be delivered in January 1998.

Appendices

Appendix 1: Description of the Research Projects

1.1. Selection of Participating Organisations

The ESI had already been selected as the industry sector in which the research would be carried out for reasons discussed in Section 3.2. There now remained the question of which organisations in the sector could be requested to co-operate with the research. It had already been decided that to study all of an Electricity Distributor would be too broad an undertaking. A division would provide sufficient range of activities and yet would not be too diverse to prevent detailed study. Therefore the criteria used to select potential collaborators were:

1. Organisations who were existing research collaborators with Brunel University .
2. Organisations where there was a relationship at director level.
3. Organisations with whom I had a track record of previous work.

The first criterion immediately constrained the possibilities to the Distribution Operations Divisions. The Brunel Institute of Power Systems was the only part of the university which had collaborations with this sector and all of them were with Distribution Operations. Together the criteria reduced the list down to four organisations. The first two to be approached, North West Electricity Board, NORWEB, and Yorkshire Electricity Group, YEG, accepted immediately. Consequently projects were defined and initiated. They commenced July 1992 and the final reports were presented in April 1993. The results and the Strategic Alignment model and process were published in May 1993 in the ICL Technical Journal [Thurlby, 1993]. This paper is contained in Appendix 3.

During the two projects notes and observations were made to record the process of undertaking the project. Although a route map was used (see Section 4.3.1) it was known beforehand that one of the research objectives of the project was to try to define a method for carrying out a Strategic Alignment project. However it was decided that this objective would be made invisible to the staff of NORWEB and YEG except the sponsors of the project. The reasons were firstly, that it was necessary to make the project as real as possible in order to gain accurate results. Secondly it was felt by both of the project sponsors that if the staff involved new that it was an research exercise then they would not put in sufficient effort to deliver useful results. The projects had as their commercial objective the delivery of an I.S. Strategy Plan.

The methodology design work was therefore carried out away from the participating organisations and used the observations and notes made during the activities carried out with the staff.

1.2 The NORWEB Project

The project interviewed the Operations Director, all his direct reports and the key technical staff in the Division, primarily principal engineers in the Operations, Control and Planning functions. NORWEB decided that it was in their interests to learn as much as possible from the project so they assigned a Senior Engineer to work on it as well. This proved of immense value in two areas:

- **Interviewing:** Having an experienced member of staff present helped focus the interviews and avoid the pitfalls of following tangential lines of questioning.
- **Analysis**: This work was greatly assisted by the extra presence, because it was possible to discuss ideas and issues directly, thereby avoiding the need to return to the interviewees or other staff to resolve the points in question.

The NORWEB project only held one workshop. This was towards the end of the project when a one-day workshop was run to present the models and get comment and feedback. Significantly this workshop was not as successful as was expected. Whilst the necessary feedback was gained, it was difficult to achieve. The reason, discovered later, was cultural. NORWEB staff were not used to being put in an environment where they were asked to carry out tasks in small groups and report back. They preferred to have all the information given to them as a completed result and then comment on the detail. They were uncomfortable with the approach of asking them to consider alternatives.

The NORWEB project also focused more on process than on data and applications. Although for many of the staff process modelling was an entirely new concept, they picked up the concepts very quickly and became very comfortable with their use. This was the first evidence of the importance of Value Processes in the model.

At the end of the project the report was presented. It was accepted as a useful contribution to NORWEB's Strategy Plans, but there was no direct follow up. Any disappointment, however, was unjustified because when NORWEB decided to invest in a new set of Information Systems for Distribution Operations in 1995, they commissioned an I.S. Strategy Plan, specifying use of the Strategic Alignment Model.

1.3 The YEG Project

The YEG project followed a set up and interviewing programme in exactly the same way as had happened for the NORWEB project. This was to be expected as their business functions were identical and the organisation structures were very similar. Carrying out the work was more difficult because no-one from YEG was assigned to the project other than administrative support. Consequently ideas and problems had to be formally played back to the staff responsible for the functions to which they pertained. Whilst the response was always excellent, progress was inevitably slower.

The plus point from YEG was their approach to workshops. The staff actively encouraged as many of these as possible. They preferred to be given a set of options to consider and evaluate, as opposed to being asked to comment on a single recommendation. As a result ideas were presented much earlier in their development. This in fact enabled analysis towards the end of the project and model building to go at a much faster rate than was the case at NORWEB.

Unlike NORWEB, YEG did not have the same affinity with process. They were much more comfortable with I.S. and data. Consequently the report and model reflected this preference, focusing on a sequence for developing Information Systems that had received little input from the Value Process definitions. When this was compared with the NORWEB model, it showed that the alignment between the Business Strategy and the I.S. Infrastructure domains was far less logical and tangible. At this point the importance of the Value Process object was further reinforced and the existence of the diagonal linkage in the model came to be questioned.

As with the NORWEB project, a report was successfully produced and presented. Whilst the project was completed at this point, YEG used the report to provide the basic architecture for their Distribution and Asset Management system, DAMS, development programme. DAMS is a set of I.S. applications which support the Control, Asset and Work Management activities in that organisation.

1.4 Headquarters U.K. Land Forces Project

The project undertaken for Headquarters U.K. Land Forces (UKLF) was to carry out a high level Strategic Alignment study using the "15-Step" methodology derived from the first two studies. The project was commissioned by the Chief of Staff, UKLF, and was carried out between February and May 1994.

At the time the role of UKLF was fundamentally changing. Prior to the break up of the Warsaw Pact, the sole function of UKLF was to prepare and maintain plans to reinforce Germany in the event of heightened tension or of hostility breaking out in that Region. This role had now changed to become the planning and control centre for all operations undertaken by the Army outside the U.K.. In addition the Army was facing other pressures from the tightening of it's budgets in response to the reduced threat from the Warsaw Pact.

Consequently the project was given the following objectives:

- Define the issues facing UKLF in response to the changing external drivers.
- Define the mission critical processes that UKLF would need to enact to address these issues.
- Define how existing and new information systems could help deliver the processes.

The project was planned to be carried out by following the sequence of steps as defined in the methodology as it existed at that time. Over the first six weeks of the project twenty five people, both Army and Ministry of Defence civil servants, were interviewed. These covered all the activities of UKLF, from finance to operational deployment of Regiments. The interview results were analysed and various models were defined. These were played back to the key Army staff in a series of workshops. From the results of the workshops further analysis was carried out and a final model and report was presented to the Chief of Staff in the middle of May.

The method worked well in the initial information gathering stages, but the quantity of information gathered was so large that to analyse it within the "15-Step" methodology became too complex. This was because the steps themselves were too large. Also it was discovered early in the project that the major issues concerned the Business Strategy and Business Organisation and Process domains. Consequently a decision was made to rescope the project to focus on these two domains. The final report therefore contained an incomplete Strategic Alignment Model.

Nevertheless much valuable information concerning the process had been gained from the project. The key findings were:

- That the steps as they stood covered too many activities and needed to broken down into a larger number of discrete activities.
- That the activities themselves needed to be combined into logical groupings and a deliverable produced as the output from a completed group of activities.
- That these deliverables had to be of value in their own right.
- That the method had to be iterative and had to support a capability to rescope the project in response to unforeseen results.
- That it was not necessary to complete a full alignment to deliver a result that met the needs of the organisation and the objectives of the study.

After the report was produced the study was agreed to have been completed. Contact was maintained with UKLF over the following eighteen months to observe what they did with it. In this time two projects were carried out which implemented the recommendations in the report. These addressed the strategy and objectives of UKLF and designed and introduced the mission critical processes recommended.

1.5 ESKOM (South Africa) Project

The Electricity Supply Commission, ESKOM, is the national electricity utility of South Africa, responsible for generation and transmission of electricity throughout the whole of that country. It is also responsible for distribution of electricity to all industrial, commercial and domestic customers who are not in the 6 largest urban centres of the country. ESKOM is the 4th largest electricity utility in the world in terms of terawatt hours distributed to customers.

ESKOM Distribution was facing with far reaching change. Like the UK RECs there were issues of customer service, the application of technology and operational efficiency. There were in addition a number of other issues which revolved round workforce skills and motivation, the demand for new connections, particularly in the townships, and the potential impact of the change of government in May 1994. An initial investigation had been undertaken in November 1993 into Distribution as a whole and as a result a proposal was made to the Distribution Engineering Director that a Strategic Alignment study was carried out on his division. This was accepted and the work was carried out between June 1994 and April 1995. It resulted in a complete Strategic Alignment Model being produced and accepted. The report that contains the model is to be found in Appendix 4 of this document.

The intended approach was to use the "15-Step" Methodology, but in the light of the UKLF study a more flexible approach was adopted. This broke the project down into a number of phases, each phase comprising a set of activities and culminating in a deliverable. Four phases were used:

- Enterprise Investigation
- Architectural Modelling
- Technology Investigation
- Iteration and Analysis

Also, learning from the UKLF experience, more emphasis was placed on workshops to discuss results and issues at a much earlier stage in the project and more regularly. This approach was found to be very effective for the following reasons:

- Issues requiring attention were resolved earlier.
- It raised the commitment of the team assigned to the project.
- The level of control of activities going on in parallel was improved.
- Integration of analysis results into the whole model was simpler.
- It provided a forum to debate and resolve options.
- Communication across the whole team was improved.

These findings were incorporated into the methodology (see Section 4.6.1).

The project itself followed the process that had been derived from the first two projects (see Section 4.4.1). However the decision to break it into four steps, each containing a discrete set of activities, enabled a greater depth of study to be achieved throughout the project. After the project these were formalised into a process for a Strategic Alignment study. This is described in Section 4.6.1. In addition it was found that a number of the members working on the team had difficulty with the object types that were being used. The problem was found to be that insufficient detail was being captured and so the development of an I.S. Strategy Plan did not appear to be a logical and directly consequential step. Consequently further object types were incorporated into the model to provide the extra richness that was required. There were:

- Critical Success Factors, CSF, and Key Performance Indicators, KPI, in the business Strategy Domain to describe and quantify Objectives.
- Process Architecture in the Business Process and Organisation Domain to integrate the Value Processes
- Skill reinstalled to differentiate Capabilities that are people oriented from those that are organisationally oriented.
- Data Architecture added to the I.S. Infrastructure domain to provide more detail about the I.S. Applications, which itself was renamed as the Applications Portfolio.
- Groups renamed as I.S. Architecture to aid clarity and remove confusion concerning the differences between I.S. and I.T..
- Emergent I.T. renamed I.T. Architecture to accurate reflect its content.
- Introduction of a new object type Technology Opportunities to reflect that other technologies, not just I.T., could have an impact on the organisation.

Another important finding from the project was the importance of process. It was realised that process was the key linkage between the Business Strategy objects and the I.S. Infrastructure objects. During the early workshops the members of the team who were from the operating departments had difficulty understanding the I.S. related objects. Similarly the team members from the I.T.

department had difficulty with the business objects. Process was found to be the common ground that brought the two together (see Section 4.7.3).

The next key point to emerge was in the area of process architecture modelling. There was a parallel study, not using Strategic Alignment which was looking at the customer-related functions in Distribution. They started their project with process modelling, firstly modelling the existing processes, then using those models to derive the new process models. With Strategic Alignment the Enterprise Model is used to drive out the new processes. Comparison of the results showed that the models produced in the Strategic Alignment project were far more radical than those produced by the other project. Discussion with members of the other project produced a probable reason for this. This was that by the time the existing processes had been documented, the team was so constrained in its thought by knowledge of the existing processes that radical thought became very difficult. Although not conclusive, this is useful evidence in support of the radical rethink benefits that the top down approach used by Strategic Alignment provides. In MIT90's this was postulated in the Venkatraman 5-layer Model. [Venkatraman, 1991 and Diagram 5.5]. A further point of methodology to emerge from the study in this area was the need to think about processes beyond the organisations existing boundaries. This is the concept of process invasion [Macdonald, 1991(3)]. To enact processes which supported the Competitiveness and New Products and Alliances strategies it was necessary to define process that would operate across the organisations boundaries both upstream and downstream in the industry value chain (see Appendices 1 and 2).

This project heavily used matrix analysis to develop alignment. Although it was in fact used in the initial projects, this was the first time that that it was used as a fundamental part of the methodology. Based on the ideas of concept analysis [Ketchen and Shook, 1996] it enabled the impact of the occurrences of one object type on another to be assessed. In the project ten matrices were created and the results were fundamental in creating alignment. Although the full methodology proposes nineteen linkages (see Section 5.1.3), in this study is was possible to achieve alignment without using them all. In fact the final report (see Appendix 4) only two of the matrices were documented. This was because the Director sponsoring the project decided that the information contained in the other matrices was too sensitive to go on a wide circulation. The methodology point determined from this was that matrix analysis is a very powerful tool by which alignment can be achieved, but that it is not necessary to create all the matrices. Only those that are necessary to understand the model are required.

1.6 ESKOM Model Maintenance

1.6.1 Redeveloping the Strategic Alignment Model

After completing the model and the report it was recommended to ESKOM that a planning activity was carried out to decide how to proceed. The result was that the following activities were started:

- Process Engineering
- Data Architecture Design
- Implementation of the Quick Hits
- I.T. Architecture Design

All of the activities used the model as their start point. This provided the opportunity to review the content of the Strategic Alignment Model and its process of development because any omissions and inconsistencies would be thrown up by the development activities.

The following points emerged from this work:

- The Strategic Alignment object types were sufficient in number and no further additions or changes were found to be required.
- The lack of focus on the skills and cultural investigation turned out to be weakness as was discussed in Section 4.6.3. Whilst it had originally been proposed that this should become a 4th Steps in the process, it was found

that the information should be available earlier in the process. It was therefore moved to become the 2nd Step (See Section 5.2.1).

- The steps described in Section 4.6.1 were still insufficient in number to provide the depth of analysis needed to produce a rigorous model.

As a result of the last point the process was analysed and extended. This produced the route maps described in Section 5.2. These were employed on the Eastern Energy project to assess their completeness.

1.6.2 Implementing the Strategic Alignment Model

ESKOM moved into an I.S. Development programme shortly after completing the Strategic Alignment Model. This programme commenced the activities described in the previous paragraph. In addition there were six monthly reviews which assessed the changes that head occurred in the previous six months and updated the Model where relevant change had occurred.

The approach adopted was to identify change or any new development, define its content, evaluate its impact on the rest of the model, then update the model and the I.S. Strategy Plan. Essentially the work involved a review of the project plans and deliverables made and change discussions with the development teams and major end users. These were followed by a review of the model and presentation of the findings in a workshop to gain agreement. This activity took about 2 weeks to complete on each occasion. The applicability of the method is discussed in Section 6.2.2.

In the ESKOM study the first two reviews discovered significant changes which caused revision of the I.S. Strategy Plan. The most important are described below:

- Government pressure to increase the rate of urban electrification, an external driver increased significantly during the first year of implementation. This changed the priorities for process enactment and consequently the I.S. Application priorities. Work Management as a result became the top priority.

- The complexity of the processes had been underestimated. As a result the process architecture team were failing to meet their deadlines. After investigation of the alternatives, the model was used to scope back and redefine the process modelling sequence. This resulted in the processes that only had an impact on the later business strategies being put to one side and not being re-engineered.
- One of the quick-hits, reduction in the number of control centres enabled cost savings to be achieved earlier than planned. This allowed more money to be spent on the literacy programme. Consequently the deployment of mobile computing could begin sooner. This provided the opportunity to enact the Field Services Process to be enacted earlier.

It can be seen from the three examples that the use of Strategic Alignment to monitor the development process and exploit change opportunities is a valid and effective role for the methodology.

1.7 Eastern Energy (Australia) Project

The final piece of work was to carry out a complete Strategic Alignment Study for the whole of an Electricity Distribution Company. This work took place between April and August 1995 and put into practice all the methodology developments that had been made in the ESKOM project.

Eastern Energy were a new organisation created from the privatisation of the State Electricity Commission of Victoria, SECV. Eastern Energy were responsible for the distribution of electricity and customer service to 500,000 customers living in the eastern part of Victoria. As the organisation was newly formed, it only had systems and processes that were inherited from SECV.

These were suited for a state bureaucracy, not a medium sized public company required to be profitable. The Strategic Alignment study was therefore commissioned to address two things:

- What were the systems and processes that had to be developed?
- What were their relative priorities?

The team assigned to carry out the work consisted of four people, of whom Bob Thurlby was the lead consultant. In addition one of the other consultants had Organisational Development skills because it was decided in the project initiation that a Skills and Culture Investigation, Activity 2, was necessary. The organisation was new and staff had been assigned to it from SECV with minimal consultation. There would inevitably need to be organisation change and staff resistance was already noticeable.

The project sponsor was the Chief Executive of Eastern Energy and he assigned all of his directors and general managers to the project working party. This reflected the importance of the project to the client. that the project was successfully completed to timescale and budget was indicative of the importance of getting the most senior people possible to support this type of work.

The project followed the methods as developed during the ESKOM project and no difficulties and inconsistencies were encountered. It is reasonable to say that this project proved that the Strategic Alignment Model and Process, as described in Chapter 5, worked and was rigorous. The only divergence from full use of the method was in the use of Matrix Analysis. In this project only twelve of the recommended nineteen matrices were created (see Section 5.1.3). The reason for this was that the twelve used were found to have created alignment and to use the remaining seven would not have added anything to the richness of the model.

The project delivered an I.S. Strategy Plan to the client in August 1995. However as intermediate reports at the end of each Activity had also been delivered in line with the methodology, the organisations expectations of the models content and the resultant I.S. Strategy Plan had already been set. The organisation was therefore ready to accept the model and proposed plan and move into development immediately. It can be concluded that such acceptance is a strong indicator of the accuracy of the methodology.

1.8 Numbers Contributing to the Research

Study	Number of Staff Interviewed	Number of Staff in the Analysis Team*
NORWEB	22	8
YEG	20	12
HQ UK Land Forces	25	4
ESKOM	26	6
Eastern Energy	30	5
Average:	25	7

* excludes the Facilitator, Bob Thurlby and any other analysts from ICL who were working on the project

As can be seen the numbers of staff interviewed remained relatively consistent throughout each of the projects. There appears to be a balance between the scope of the business domain being studied and the added value obtained by interviewing more people.

The number of people involved in the matrix analysis workshops did vary significantly. The groups of 8 and 12 in the initial studies was unmanageable, contributions were missed and some attendees felt they had not had an opportunity to make a full contribution. The numbers were cut down for the later studies and this was found to work better, provided all the attendees had had access to all the outputs from the interviews. It should be noted that these figures only refer to the core team who were involved in the workshops which did the matrix analysis. There were other workshops held to analyse other results in other activities which involved most of the interviewees.

The key point from this work is that whilst it is necessary to interview about 25 people to collect the information to populate the model, it is only necessary to have a core team of up to 6 to do the matrix analysis that creates alignment.

Appendix 2: Strategic Alignment Questionnaire

The questionnaire contained in this appendix is the one used for the Eastern Energy Study. It is normal when starting a study to specify a questionnaire that is specific to the needs of the study. The start point for this activity is an existing questionnaire.

STRATEGIC ALIGNMENT QUESTIONNAIRE

1 Roles and Responsibilities

1.1 Please describe the roles and responsibilities of your department ?

1.2 How do you think that they will differ in 2 years time ?

1.3 What products and services are delivered by your department, both internal and external?

1.4 What will they be in 2 years time?

1.5 How well are your roles and responsibilities in line with the organisations strategies and objectives?

1.6 Please give examples of consistencies and inconsistencies.

1.7 How do you think that the organisations strategies and objectives will change over the next 2 years?

1.8 Why do you think this?

1.9 Please give examples of the changes.

1.10 What are the major factors will prevent or facilitate achievement of your objectives?

1.11 How will these factors change over the next 2 years?

1.12 What will cause these changes?

2 Processes

2.1 What are the major processes under your control?

2.2 Which of these add value?

2.3 Which are the most important and why are they important?

2.4 Which processes will become more important in the next 2 years?

2.5 What, if any, new processes do you think that you will be using in the next 2 years?

3 Objectives and Targets

3.1 How do you measure achievement of your objectives?

3.2 How often do you do this?

3.3 How do know that you are measuring accurately?

4 Strengths and Weaknesses

4.1 Please describe the major strengths and weaknesses of your department?

4.2 How will this position change in the next 2 years?

5 Competitors

5.1 Who are your competitors?

5.2 What is your competitive position with them?

5.3 What are you doing to improve this position?

5.4 Who will be your competitors in 2 years time and what will be your relative position?

6 Business Environment

6.1 What are the things, both internal and external, that are currently having most impact on your organisation?

6.2 What things will change in the next 2 years?

6.3 What will be impact of these changes?

7 People and Culture

7.1 How well do the staff reporting to you accept change?

7.2 What evidence have you for this?

7.3 What additional skills would help you achieve your objectives?

7.4 What problems do you have in recruiting and keeping skilled staff?

8 Doing Things Differently

8.1 Given a totally free hand what would you do differently?

9 I.S./I.T.

9.1 What do you I.S./I.T. for in your department?

9.2 What Information Systems do you use at the moment?

9.3 Do they meet your requirements?

9.4 What new information systems would you like to have or really need?

9.5 What benefits would you expect to get from them?

10 Anything Else

10.1 Is there anything else that is relevant and which we have not discussed?

Appendix 3: Results of the NORWEB and YEG Projects

This Appendix contains a copy of the paper which was published in the ICL Technical Journal in May 1993. This paper describes the initial ideas for an I.S. Strategy Planning Method, using Strategic Alignment, which were developed from the results of the NORWEB and YEG projects.

Strategic Information Systems Planning: A Process to Integrate IT and Business Strategies

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Abstract

Information Systems Planning techniques have historically been limited by their dependence on a given Business Strategy. Recent work from the Management in the Nineties Programme, described in the paper, has shown that IT is now a sufficiently powerful driver to have become interdependent with Business Strategy; consequently new IS Planning techniques have to be developed which support modelling of interdependent strategies.

This paper describes a new IS Planning methodology which enables interdependence to be analysed and dynamically modelled as a temporal process. The methodology employs the techniques of Strategic Alignment and Value Process Modelling, and these, together with their underlying theory, are described. In addition there is an examination of how analysis needs to be expanded beyond the organisation boundary using the concept of Process Invasion.

A case study is presented in the paper which describes the use of this IS Planning Methodology at Regional Electricity Companies in the UK. The case study focuses on how the methodology has been applied to develop and align Business and IS Strategies which respond to the opportunities presented by privatisation of the UK Electricity Industry.

The paper concludes by highlighting some issues raised by use of the techniques and how the issues will be addressed by research currently being undertaken by the author.

1 Introduction

The application and use of Information Technology, IT, by organisations has increased by orders of magnitude over the last 30 years. Introduced originally to automate clerically intensive activities, it has now reached a position where most organisations could not operate without it. The more progressive organisations are indeed dependant on IT for continued success in their market place.

However despite this increasingly pervasive use of IT; planning for, and investment in, IT often remains an arbitrary process, isolated from business planning and independent of the business strategy. This situation remains in spite of the evolution of techniques during the last 10 years which enable an IT Strategy to be integrated with the Business Strategy. Initially these techniques derived IT Strategies which were reactive to a given Business Strategy; but recent research shows that IT can be a driver of Business Strategy, and methodologies are now being developed which recognise this fact.

This paper examines the development of business processes for Information Systems Planning, and discusses in detail the new techniques available to enable development of a Strategic Information Systems Planning Process which regards IT as a driver of Business Strategies. To demonstrate the use of this process, a case study of the application of Strategic Information Systems Planning in Regional Electric Companies is described.

2 The Development of Information Systems Planning

2.1 Early Approaches

As use of Information Technology moved from data processing towards information systems during the 1970's, methods were developed to enable the analysis of the information need of the end-user. Early analysis techniques tended to be applied to a single application supporting a limited set of business processes. The methodology known generically as Data Analysis guides the analyst systematically through a process which seeks to identify the functions needed to be supported by the system and the data required by those functions. (Rock-Evans, 1981). Recognition that data was often common to a number of applications led to enhancements which resulted in the Strategic Data Model (Gane and Sarson, 1979). This was the first attempt to understand the structure and interrelationships of the total data requirements of an organisation.

At this time the objectives of investment in IT began to change. Managers ceased to be solely concerned with using IT to improve operational efficiency. IT could now be used to provide information which would start to increase their business effectiveness. To determine the necessary information, however, required techniques which, as well as building data and functional models, also defined what the organisation was trying to achieve and linked these definitions with the data and functional models. Business Systems Planning (IBM 1984) was a widely used technique for this type of analysis.

2.2 *Linking with Business Strategies*

Recognition and understanding of what was important for a business, if it was to achieve its objectives, had become a major issue for Information Systems designers. Without this knowledge they could not be sure that their systems were relevant to business needs.

Development of the concept of Critical Success Factors (Rockhart and Crescenzi, 1984) provided the technique by which Information Systems could be specified that gave direct support to Business Objectives, and thereby improved management effectiveness. Critical Success Factors (CSF) were those processes which had to be done absolutely correctly if an organisation's objectives were to be achieved. Furthermore each CSF could be quantified by a set of measures which determined whether it was being done correctly. Definition and analysis of the CSF measures provided the data from which the Information Systems specifications could be defined.

Together with the earlier planning and analysis techniques, an Information Systems portfolio could now be defined which was linked to the organisations business strategy. This portfolio was frequently analyzed into the standard 4 box matrix developed by the Boston Consulting Group and modified for Information System classification (McFarlan, 1984). The matrix is shown in Figure 1 below.

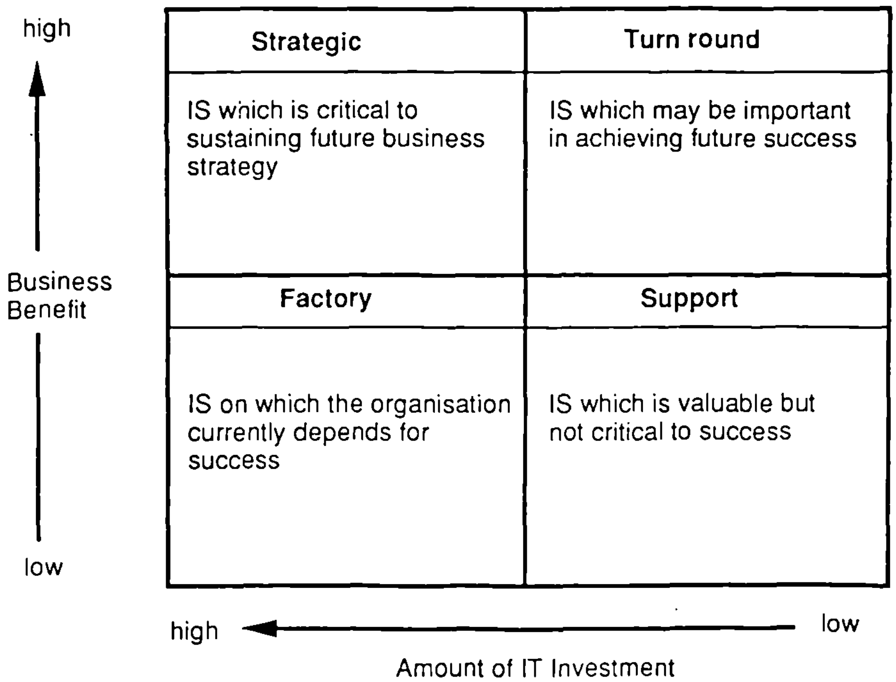

Fig. 1 Information Systems Portfolio

2.3 Information Systems and Competitive Advantage

The ability to create a link between business strategies and information systems led to another incremental step in the process of Information Systems Planning. This was to analyze where competitive advantage could be obtained from investment in IT. Although CSFs gave some information, it was not until the concept of Value Chains (Porter, 1985) started to be applied to IT investment that this step could be considered to have happened. Value Chains enabled an organisation to establish where most cost was incurred in building and delivering products and services. The high cost processes were then targeted for IT support to improve their efficiency and drive down costs.

2.4 Limitations of IS Planning

IS Planning techniques had now evolved into a sequential process, which, starting from a given set of Business Objectives, could develop an Information Systems Strategy. The process is shown in Figure 2 below.

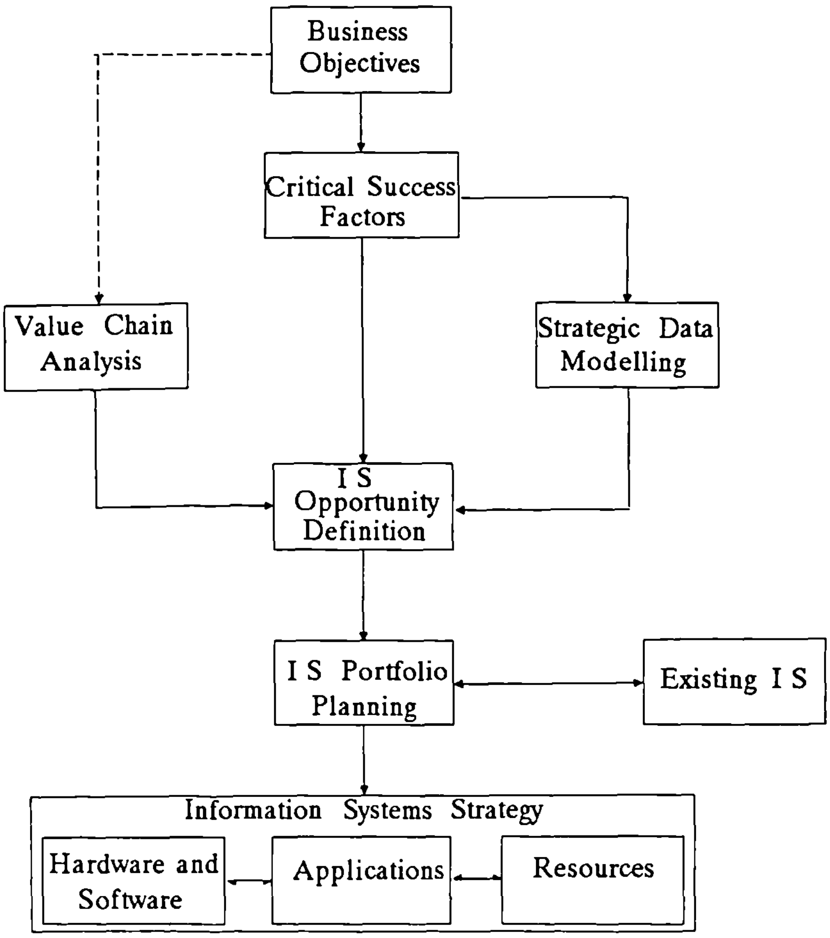

Fig. 2 IS Planning

There were 2 limitations to this approach. First, it took the set of Business Objectives as given and developed an Information Systems Strategy which was reactive to them. Second it was a once-off process and did not easily permit interaction and reiteration. Consequently many of the IS Strategies produced tended to be accurate at the time when they were done, but become increasingly inaccurate and out of step with the business as time progressed. It took the insights of the Management in the 1990s Programme (MIT90s) to address this issue.

3 Strategic Information Systems Planning

3.1 Management in the 1990's

The Management in the 1990s (MIT90s) programme was a 5 year research programme run by the Sloan School of Management at the Massachussetts Institute of Technology. It was sponsored by 12 leading companies and Government Departments, ICL and BP being the two UK sponsors. At the time of the programme's inception in 1984 there were a number of issues facing organisations. These were encapsulated into 4 major concerns.

- Would turbulence in business continue to increase?
- What caused the turbulence?
- What role could IT play to help organisations respond to turbulence?
- Was IT itself a cause of turbulence?

The programme set out to address these concerns, and rapidly came to focus on the link between Business Strategy and Information Technology. How to manage the link became a major thread of the programme, and it was soon understood that unless an organisation's processes, structures, and people skills, were clearly understood, then Business Strategy and IT could not be integrated. The programmes found that failure of a number of Information Systems Plans could be attributed to not changing an organisation's processes, or structure, to exploit the capabilities of IT, and so gain competitive advantage and achieve business objectives.

MIT90s had identified a fundamental weakness in existing Information Systems Planning methods. To address that weakness required two things. First a method to study the role IT could play in bringing benefit to an organisation. Secondly devising methods which linked organisations' processes and structure with Business Strategy and IT. In the event MIT90's produced a number of very significant findings (Scott-Morton 1990) which answered the questions posed by the programme. Of great significance were the findings which concerned the future role of IT in the organisation.

These were in summary:

1. IT does not provide sustainable competitive advantage by itself. It requires integration with the organisations processes and structure to achieve lasting advantage.
2. IT capability is now of sufficient influence to become a driver to change the organisation, its processes, products and even its market.
3. Although IT is now an agent of transformation there are still significant technical problems associated with unlocking data held in an organisations information systems, and using it to Informate (Zuboff 1988) the workforce.

The findings of MIT90s provided a paradigm shift for IS Planning. IT capability was being proposed as a driver which could change Business Strategy. Of equal importance, an organisation's processes and structure were identified as the mechanism through which Business Strategy and IS Strategy could be properly integrated. Both of these ideas needed to be incorporated into any IS Planning Process. Further consideration of the ideas then derived the additional idea that IS Planning was no longer a sequential process, but an iterative process with a number of possible start points.

Out of these findings, and the evidence from the MIT90s research which supported them, two new analysis techniques were developed. These were Strategic Alignment and Value Processes, and potentially they provided the mechanism by which IS Planning can utilise the new paradigm presented by MIT90s.

3.2 *Strategic Alignment*

3.2.1 Strategic Alignment Theory. The Strategic Alignment Model (Figure 3) can be regarded as the solution framework for MIT90s. In addition

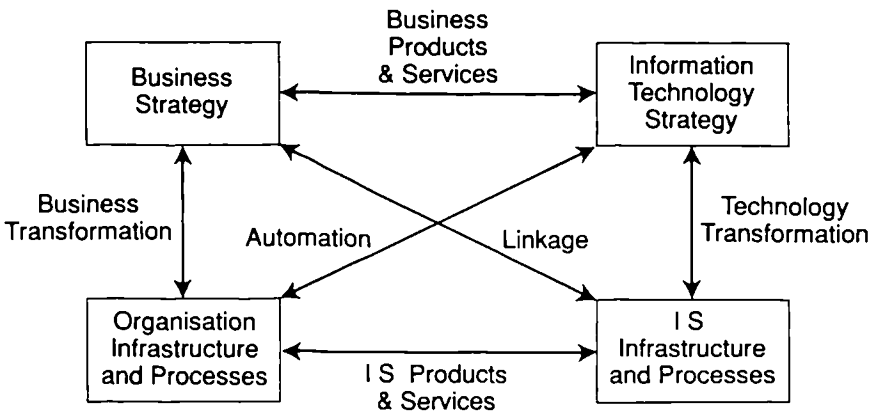

Fig. 3 Strategic Alignment Model

to its role in Strategic Information Systems Planning Strategic Alignment has a number of other purposes, for example in helping the diagnosis of organisational problems.

Using Strategic Alignment for Strategic Information Systems Planning is still a comparatively embryonic process, and has yet to be completely defined as a mechanistic technique. The case study of its application to Regional Electricity Companies (RECs) in Section 4 has elements of research as well as application. The results will not only provide a usable Strategic Information Systems Plan for RECs, but also provide research material to be used for developing the technique.

Currently Strategic Alignment is a three phase process.

Phase 1 Collect information to complete a definition of the content of the 4 elements of the model.
Phase 2 Analyze the contents of each element to ensure its consistency and compatibility with the rest of the element.
Phase 3 Analyze the content of each element to harmonise it with the content of the other 3 elements.

Phase 3 is normally tackled in 2 stages. The first stage is what is known as "a quick canter round the model" to pull out all the obvious linkages and relationships. The second stage is a detailed examination of all the linkages and relationships to create full alignment (Macdonald, 1991). Strategic Alignment is a complex process and can be very lengthy. It should not be undertaken lightly. Alignment is unlikely to be achieved after one detailed iteration. On subsequent iterations the analyst should be aware of the dangers of "paralysis-by-analysis". Nevertheless Strategic Alignment is an extremely powerful technique when used with thought and caution.

3.2.2 Strategic Alignment Practice. As stated in the previous section the initial step is to collect information which defines the contents of each element in the Strategic Alignment Model. Structured interviews and examination of published documents (eg annual reports) are a standard and effective method of proceeding. The information needed will vary from industry to industry and it is important to collect quantitative as well as qualitative data. Sets of objects relating to each element are listed in Figure 4.

In addition there are a number of objects which are common across a number of elements. These include: control mechanisms, triggers, paradigms and capabilities. It can be seen by examination of these objects that Strategic Alignment needs all the information required by earlier techniques of IS Planning. This is to be expected since the subject has not changed; it is the analysis of the subject which is fundamentally different.

Analyzing the information to produce alignment is the next step in the process. Although the detail of approaches and start points will vary, the following principles have been found to be of value:

Business Strategy	I T Strategy	Organisation Infrastructure and Process	I S Infrastructure and Processes
Objectives Competitors Markets Legislations Regulations Environmental Issues C S F s Industry Process Financial Data Competencies	Technology Technology Objectives Technology Trend Technology Competence Configuration Architecture Standards Policy	Value Process Process Element Organisation Structure Organisation Element Resources (human) Skill Role Information Need Decision	Entity (Object) Information Systems Information Process Data Model Physical Database Service Deliverable I S Skill I S Organisational Element

Fig. 4 Strategic Alignment Objects

1 The majority of drivers for change are found in the Business Strategy and IT Strategy elements so these are the logical places to start.
2 Initially it is useful to consider the strategy as a set of sequential objectives. In practice objectives tend to be pursued concurrently, but to place them in a logical sequence aids understanding and focus (Hay and Williamson 1991).
3 For an organisation to exist in a market-place, or enter that market-place, it needs to have in place a set of competencies before it can consider tackling its objectives. These need to be identified and described.
4 For that organisation to succeed in the market-place it has to achieve its objectives. To achieve each objective requires a set of capabilities to be delivered. Capabilities can be skills, value-processes and information systems.
5 Also impacting on objectives are external factors, such as market forces, competitive activity, regulation and technology. These have either a positive or negative impact on the objective, both in terms of the time needed to achieve that objective, and the benefit produced from it.

The approach described above can be described pictorially and is shown in Figure 5.

The description above gives an outline of an approach to the alignment process, the major complexities omitted being the concurrent nature of objective achievement, the second level interactions of the objects used to deliver capability, and the many-to-many relationship between objectives and capabilities.

The advantage of this method of tackling Strategic Alignment is that it provides a temporal axis which can form the basis of a dynamic simulation. Furthermore, by treating the process as sequential it can be broken down into a set of sub-alignments which makes the process manageable and understandable.

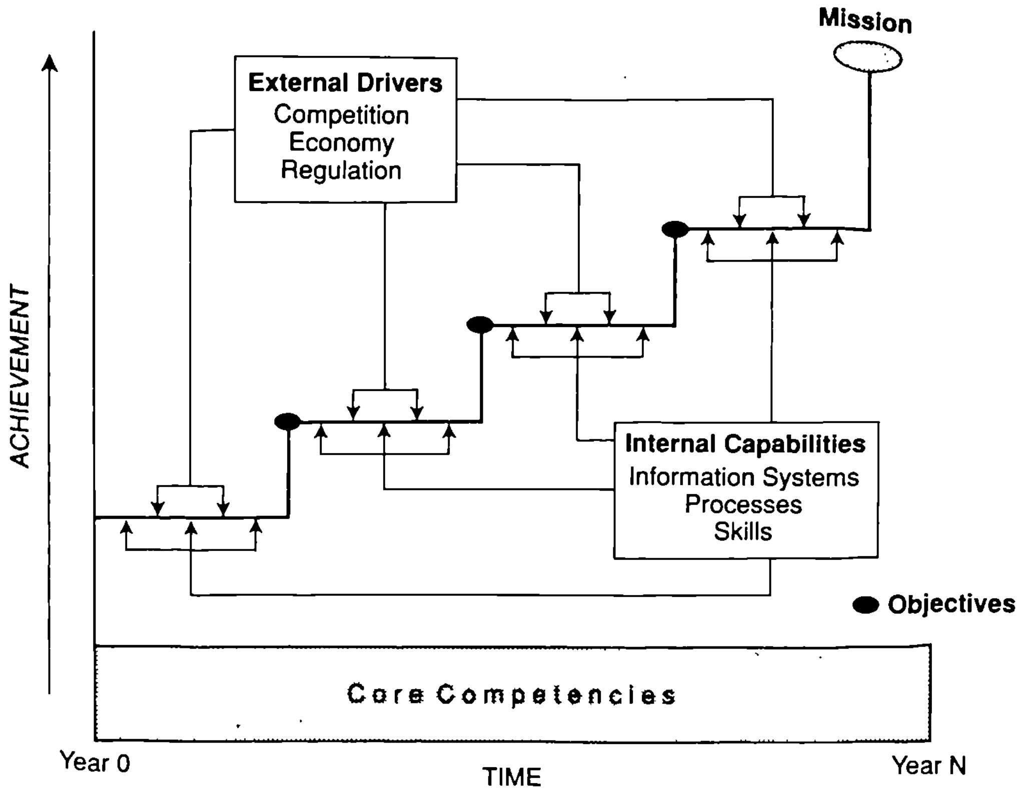

Fig. 5 Temporal Alignment

3.3 *Value Process Model*

A second technique to be developed in the MIT90s programme was that of Value Process Modelling. Although used on objects within the Organisation Infrastructure and Process element of the Strategic Alignment Model, Value Process Modelling is a technique in its own right. (Scott-Morton, 1990 {2}).

Value Process Modelling moves forward from the Value Chain concept (Porter, 1985) and changes the focus from one of cost to one of added value. Whereas Value Chains sought to identify where cost occurred and accumulate the cost into a set of discrete categories; Value Processes are concerned with logic, flow and interaction. They seek to identify the sets of processes, which when accumulated together, provide an added value to the organisation which is greater then the sum of the individual processes. An example of a Value Process is shown in Figure 9 below.

The second area where Value Process Models improves analysis capability, is that they are independent of an organisation's boundary, and permit definition of processes which integrate with the organisation's supplier and customer processes. In times where much competitive advantage is to be gained from inter-organisation collaboration, the ability to understand where other organisations' processes can be integrated with internal processes is very important. The concept, known as Process Invasion, is shown in Figure 6 below.

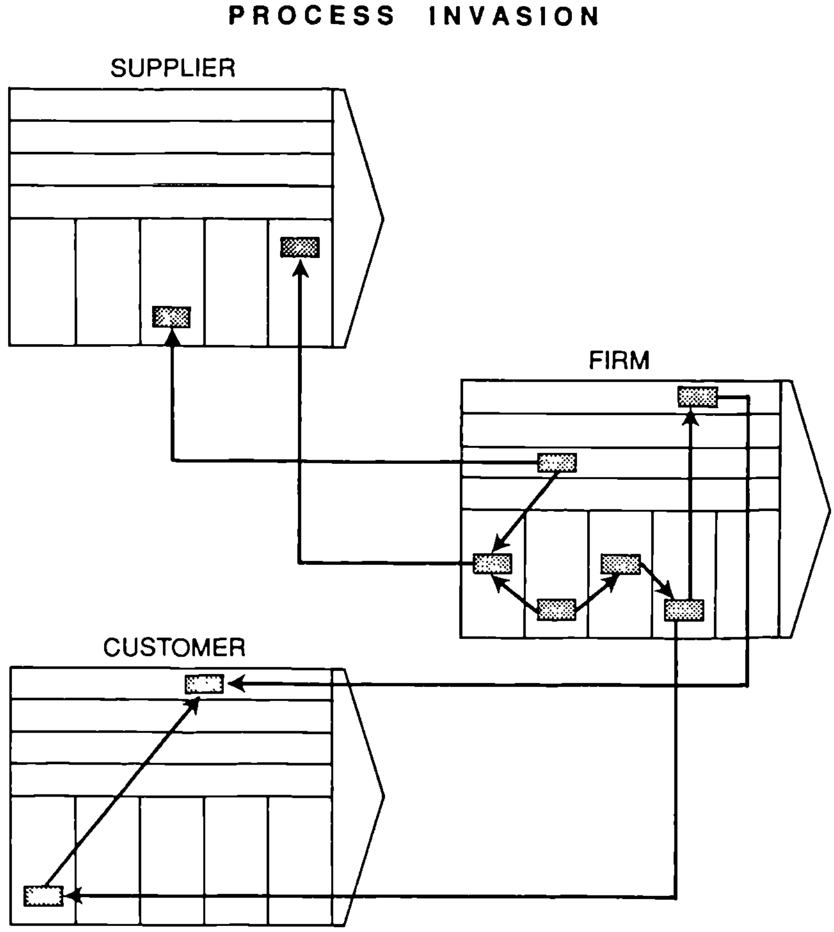

Fig. 6 Process Invasion

An interesting result to emerge from the study of Process Invasion is that the costs tend to move upstream to the supplier, and the benefits tend to move downstream. Just-in-Time inventory management is a good example of this, because the inventory costs are being unloaded on the supplier by the customer. Awareness of this has cost less thoughtful suppliers, who get into a Just-in-Time contract, a lot of money. Suppliers who think the problem through make sure that they can leverage sufficient other benefits, such as reduced production costs, through longer production runs, and larger sales volumes, through longer term contracts, to offset their increased inventory costs.

To develop a Value Process Model, use of a process identification and decomposition approach coupled with a Value Chain is appropriate. It is then subsequent analysis which develops the Value Processes. A top down approach is recommended and once the key processes have been identified, defined, and quantified, they can be examined to identify commonality linkages and sequences. In many cases a flow chart format is a good way of analysing the process; but for discussion and presentation purposes its superimposition on the Value Chain template has been found to be valuable. Commonality can be found in a number of ways:

- support of one objective
- support of the same critical success factors
- response to a driver
- use of the same data

The fourth point is both valuable and dangerous. There are some sets of processes which do integrate logically through common use of data. Focus on data without consideration of the organisational and objective impacts will potentially lead to serious distortion of the model.

The final thing to consider is what exactly is required from the model. The danger is that the Value Processes are a reflection of current practice and status quo. The question has to be asked: "is this going to improve the effectiveness of the organisation by delivering capability to achieve objectives?"

For each Value Process, and each individual process in it, it is necessary to establish its necessity, its correct position in the value process and whether alternatives exist. This analysis also requires looking outside the organisation to establish invasion opportunities.

4 Strategic Alignment in Regional Electricity Companies

4.1 Introduction

The Electricity Industry has undergone many changes because of privatisation. One result has been to cause a fundamental re-think about the use of IT. Since many of the other changes involved their organisation structures, and the related processes, it would have been unwise just to consider IT in isolation. Through contacts with ICL a number of the Regional Electricity Companies (RECs) were aware of MIT90s. The studies were undertaken with the objective of producing a Strategic Alignment Model. An important part of this objective was to use Strategic Alignment to identify and evaluate potential changes to the strategies and processes which would improve the effectiveness of the business. Finally an outline Information Systems Development Plan was to be produced which was derived from the Strategic Alignment Model. Figure 7 below shows the route map for the study.

However before the results of the study are discussed, it is necessary to give a background to the Electricity Industry and especially the impact of privatisation.

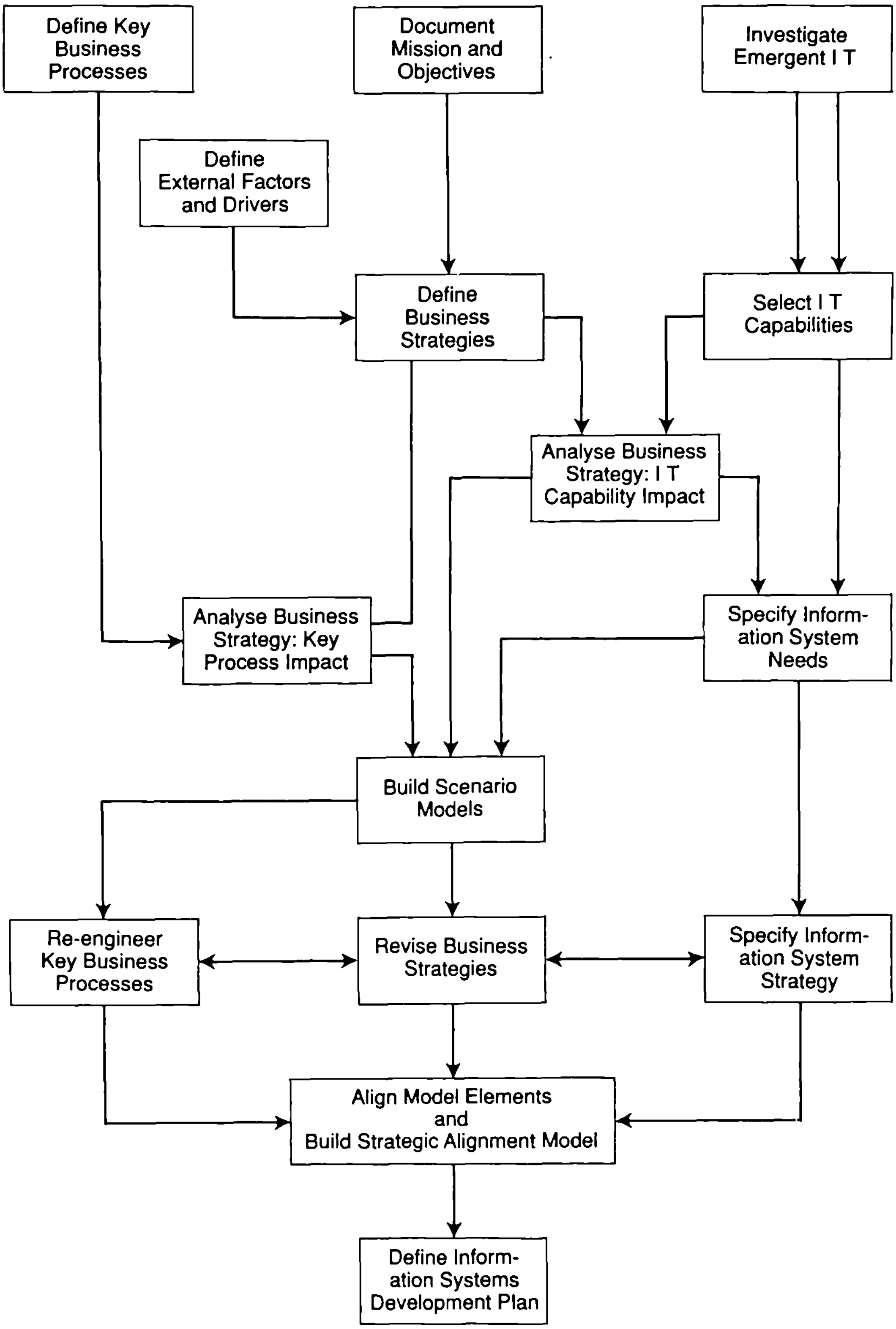

Fig. 7 Strategic Alignment Route Map

4.2 *The Impact of Privatisation*

The privatisation of the Electricity Supply Industry in the UK caused fundamental changes to the way organisations in the industry carried out their business operations. Whilst pre-privatisation Area Electricity Boards, responsible for distribution of electricity from the transmission network to the customer continued to have this responsibility, when they became Regional Electricity Companies (RECs). there were a number of fundamental changes underneath the veneer of a public monopoly becoming a private monopoly. The principal change on the Supply Side was the introduction of real competition to generate electricity. For RECs the result was that they now had to negotiate their own contracts with Generation Companies and also were able to generate their own electricity. A further requirement was that in a REC the Supply Business (buying and selling electricity) had to be kept financially separate from the Distribution Business, (managing the network).

Distribution was also subjected to change, primarily through being regulated on price and service, but also by having competition introduced to its non-regulated operations, which was work to maintain, refurbish and reinforce the network, including building extensions to the network which provided supplies to new customers. The Distribution Businesses have the bulk of RECs employees within their activities and were faced with threats on three sides. Their revenue was regulated through the RPI-X formula and Use of System Charges. They had to operate within defined standards of service, and the non-regulated areas of their business, where they had freedom, were being opened to competition.

4.3 *Regulation*

Regulation, as can be seen from the previous section, emerged as a major driver of the business strategy of RECs. It is therefore worth looking at the exact nature of this driver.

In recognising that RECs were natural monopolies, competition had to be introduced through generation and supply. However to prevent RECs from exploiting their position, the Distribution Business had to be regulated, which was one of the roles of the Office of Electricity Regulation (OFFER). OFFER introduced the RPI$-$X formula to regulate the amount by which RECs could increase their tariffs. RPI is the inflation rate, and X is a REC specific value, negotiated with the Regulator, based, among other things, on the cost of running the network and maintaining it. Since this cost falls within the orbit of Distribution activity companies are concerned to negotiate a realistic X-factor.

The second regulation area is standards of service. These are measures of how a customer is treated by its REC. It includes such measures as the number of minutes off-supply per customer each year, keeping scheduled appointments, and the time taken to restore customers after a fault, plus technical measures about, for example, preventing voltage fluctuation outside pre-defined limits. Again many of these measures fall directly within the responsibility of the Distribution activities.

Finally there is the use-of-system charge. An electricity bill consists of two elements, a charge for the energy, and a charge for using the distribution network. This is a sum added to each unit of electricity sold and its value is controlled by the Regulator. Use-of-System is of prime importance since it is from this that 90% of their revenue accrues. To reflect further the importance of use-of-system, the RECs make very little profit from the buying and selling of electricity. Most of their profits come from use-of-system. Therefore to maximise profit means driving down the cost of operating the network. This impacts the Distribution Business directly.

4.4 Results of the Study

4.4.1 Introduction. The results produced by the Strategic Alignment Studies are described in the following sections. They cover the following areas:

- objectives of the Distribution Business.
- drivers impacting achievement of the objectives.
- competencies and capabilities needed to respond to the drivers
- information Technology and Information Systems needed
- value processes
- alignment

The volume of information collected in the studies is such that a complete description of all the results is precluded. Consequently a subset of the results is presented, but in such a way which demonstrates their interrelationships and how they align.

4.4.2 Pre-Privatisation Objectives. Prior to being privatised the objectives of the Engineering Department (the precursor of the Distribution Business) were as listed below.

- to operate the network in the most safe and secure way possible
- to maintain a continuous supply to all consumers
- to achieve the two previous objectives within an agreed budget.

The objectives were always quantified by a number of measures, which usually demanded incremental improvements on previous years' performance.

4.4.3 Post-Privatisation Objectives. There has been a fundamental shift in the objectives since privatisation. Although the objectives concerning safety and continuous supply remain (this is to be expected because they cover areas which are subject to regulated standards) new, and fundamentally different ones, have been identified by the study:

- to improve overall levels of customer satisfaction and service at a rate better than set by the Regulator.
- to reduce the costs of the Distribution Business in real terms year on year.
- to maximise use-of-system charge revenues in order to assist the group in achieving its profit targets.
- to seek and create incremental revenue streams by fully exploiting skills and capabilities.
- to seek to influence the Regulator to ensure that any changes in regulation are favourable.

As can be seen the shift has caused a refocus away from engineering and cost management to customer service and profit.

4.4.4 Drivers. The research concentrated part of the information collection on what the senior managers saw as the major drivers that affected day-to-day and long term activities. There was a high degree of commonality in the results which are listed below:

- the need to respond to competition which is eroding their market.
- the need to drive down costs
- responding to, and managing, the Regulator's requirements.
- the need to change the culture from an engineering driven culture to a customer and profit culture.
- the need to exploit IT as an agent of change.

Each of the drivers was then further analyzed to pull out the detailed issues. These produce a set of competencies and capabilities as discussed in section 3.3.2. The competencies and capabilities associated with the driver "Need to Drive Down Costs" were found to be:

- improve productivity of industrial staff.
- deskill procedures and practices.
- multiskill industrial staff.
- pay staff at the market rate for the job.
- reduce system losses by improved network planning and control.
- develop new maintenance regimes based on usage rather than time.
- develop distant and remote control processes.
- plan work to eliminate peaks and troughs of activity
- introduce on-line network analysis capabilities to enable more accurate reinforcement and replacement planning.
- develop analysis capability to run the network to minimise ageing.
- investment risk appraisal capability.

The competencies and capabilities listed can be classified into a number of groups

Efficiency Improvers.
Process Re-engineering.
Organisational and Cultural.
IT Capability Dependant.
Information Availability Dependant.

Driver: Need to Drive Down Costs Classifications / Competencies and Capabilities	Efficiency	Process Re-engineering	Organisational & Cultural	IT Capability Dependent	Information Dependent
Improve Staff Productivity	X		X		
De-skill Procedures and Practices	X		X		
Multi-skill staff	X		X		
Competitive Pay Rates			X		
Reduce System Losses	X	X		X	X
New Maintenance Regime		X			X
Distant/Remote Control		X		X	
Work Planning/Scheduling		X		X	X
Reinforcement Planning/Scheduling		X			X
Network Ageing Minimisation				X	X
Investment Risk Appraisal		X			X

Fig. 8 Driver Analysis Matrix

The analysis is shown in Figure 8.

Having identified the competences and capabilities required and classified them, analysis of their IT implications was the next step. These defined both the technology capabilities and information systems that would be required.

4.4.5 Information Technology. To develop each competence where it does not already exist, and more importantly, develop the capabilities implies an IT and Information dependence. Some are heavily dependent on IT and information, as can be seen from Figure 8 but others have less dependence.

Analysis of each associated competence and capability will determine the following;

- functional and process requirements.
- organisational impact and requirements.
- data needed to support the capability.
- specific IT required to deliver the capability.
- interrelationships with other capabilities and competences.

It was now possible to draw out the IT capabilities required and also build up the Information System's needs.

This activity was recursive in as much as the potential impact of emerging IT capability has to be considered, as well as exploitation of existing IT capability. In this study the IT capabilities needed to support the driver: "The need to drive down costs," were identified as being:

- expert system scheduling software, for work planning and network switching programmes.
- screen technology, capable of being run without mains power so Engineers could control parts of the network from vehicles at remote sites.
- wide band telecommunications, to support system control and management.
- intelligent meters and remote terminal units.
- Object Oriented data bases, to enable the dynamic nature of the network to be modelled so the topology and load data could be kept consistent.
- on-line network analysis software.
- demand forecasting software, based on neural network techniques.

Examination of the above list of capabilities shows a mixture of existing and emerging IT capabilities. It is also clear that the capabilities will have to be delivered as information systems if they are to have a positive impact on the objectives. For example use of neural network techniques in demand forecasting software should produce more accurate results than use of conventional algorithms. However, unless the database of network load histories is not available then the software cannot be used to support the processes.

4.4.6 Value Processes. From analysis of the capabilities and competences, and the information needed to support them, a number of value processes were identified. These were sets of individual processes which when integrated were found to improve effectiveness of the organisation. The research identified five value processes. Each improved effectiveness by increasing the level of control that the organisation could exert on its assets or costs. They were also identified by common use of a dataset by each process.

The five identified were:

Control of Energy.
Control of Resources.
Control of Money.
Control of Assets.
Control of Customers.

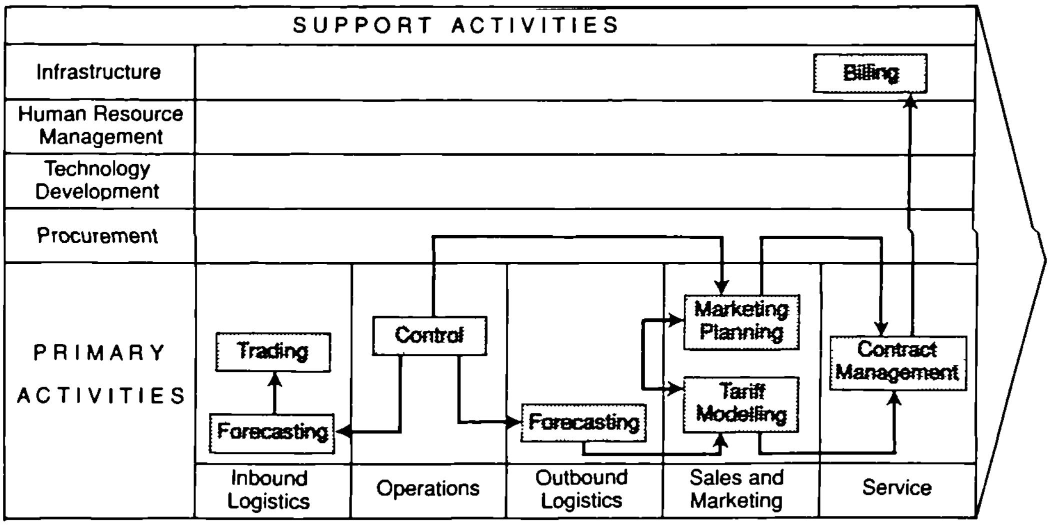

Fig. 9 Energy Control Value Process

Figure 9 shows the value process for Control of Energy as an example.

Each individual process uses data which defines the loads and flows of electricity in the network. They integrate to create the mechanism which controls electricity in a Distribution Business. Re-engineering these processes so they are co-operative and aligned, and provision of a common database with supporting information processing, will deliver capability which enables achievement of the objectives of the business (see Section 4.4.3). Further analysis revealed how the Control of Energy Process could possibly be extended into the value chains of a RECs suppliers and customers. This invasion is shown in Figure 10.

IT capability to implement control systems both upstream and downstream would provide significant benefit to a REC, through creation of an external energy management capability. The IT and communications technology exists to develop such a facility, but implementation, and resultant accrual of competitive advantage is dependant on negotiation of contracts which provide tangible benefits to all the players.

4.4.7 Completing Alignment. The Strategic Alignment process has now reached the point where objects in the 4 elements of the Strategic Alignment have been identified. By use of the concepts of competences and capabilities an initial degree of alignment has been achieved.

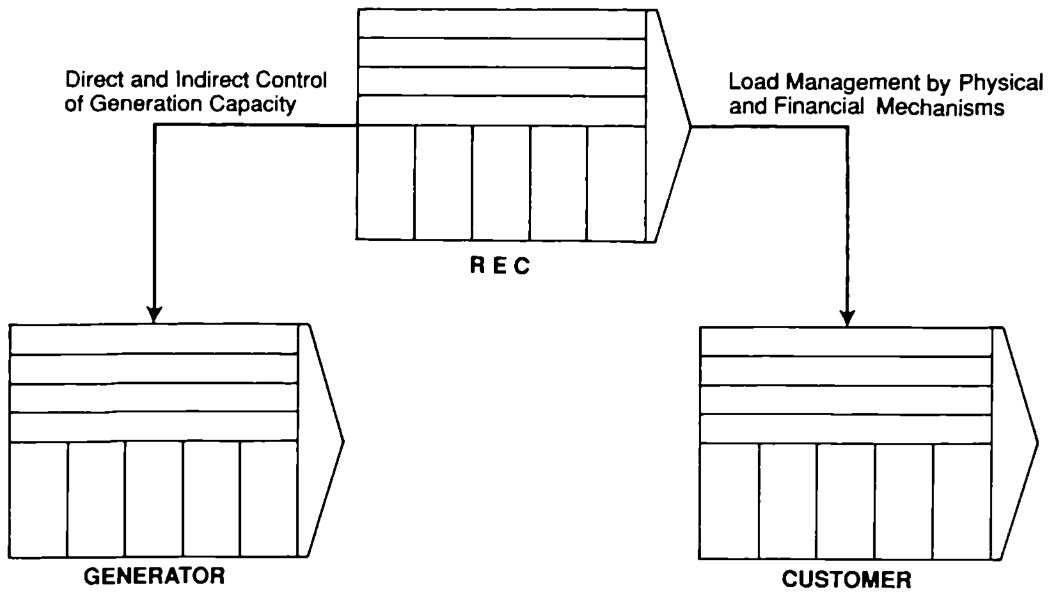

Fig. 10 Energy Process Invasion

The relationship between capabilities and IT and Information Systems has been defined, and the value processes identified. These objects were now mapped back to, and aligned with, the business objectives listed in Section 4.4.3. The purpose was two-fold. First to prioritise the objectives, and second to establish the impact of IT and value processes on these objectives. Of the five objectives, two emerged as the most important in terms of responding to the drivers. These were:

- to reduce the cost of the Distribution Business in real terms, and
- to improve overall levels of customer satisfaction and service.

For the first it was found that all five value processes identified had a major impact on the achievement of the objective whereas for the second only Control of Resources, Control of Energy, and Control of Customer had significant impact.

Moving round the model to look at the Information Systems, the need to have a set of systems relating to each value process was identified. These were then aligned back to the objectives to check applicability. From the Control of Energy process, the applications which impacted the objective to reduce costs of the Distribution Business in real terms were all concerned with effective distribution of electricity. The five most important applications were:

- load analysis (loading of feeders).
- switching schedule control.
- load forecasting.
- loss minimisation.
- fault and incident management.

As was suggested by the Value Process Analysis, data is an integrating element and data modelling of the five applications showed that they had a common data requirement. The common data was a record of the load of measurements at each node in the network. So to develop the above five applications requires a supporting database of load data to be developed. Relational Database technology would satisfy this need. But to provide the applications would benefit from emergent IT and three areas were identified:

- neutral networks, for load analysis and load forecasting.
- expert systems, for switching schedule control.
- low energy graphics screens, for fault and incident management.

This last technology would enable control of the network to be passed to remote sites during the restoration process.

So having identified the IT needed, the penultimate step was to relate it back to the Objectives to establish what its impact would be. In this example IT impacted the Objective in two ways. First its availability would reduce the time taken to achieve the Objective and second, analysis showed it could improve the level of achievement of the objective. That is, the benefits would be greater. A final alignment step reconsidered the Value Process and three further implications were discovered.

- skills in the control room staff would change in order to exploit the applications.
  - deskilling as regards Switching Schedule Control, due to automation.
  - reskilling as regards Load Analysis and Load Forecasting in order to improve effectiveness of decision making.
- control-room working procedures would require re-engineering to enable control to be passed to field-based staff.
- industrial relations issues would need to be resolved concerning the empowerment of field-based staff.

Thus the alignment process identified the process re-engineering and skills issues which would need to be addressed if full benefit is to be gained from implementation of the Information Systems. Use of the Strategic IS Planning Methodology in general and Strategic Alignment in particular, cannot be considered complete unless this work is done.

5 Conclusion

The research project completed an alignment process for each of the Objectives and then attempted to integrate the results. This was a complex process, not least due to the overlap and commonality of instances of the Objectives being analysed. The case study demonstrated clearly the wealth of results and richness of the Strategic Alignment Model through the examples discussed. Strategic Alignment is emerging as a powerful but complex technique which, as can be seen from the case study, requires persistence and thoroughness on the part of the Strategic IS Planner.

One obvious problem is that it is not easy to check the validity of the results because they will not be known until the plan is implemented. By then of course the drivers may have changed.

To address this issue is the next stage of research. The case study has shown a Strategic Alignment Process will produce a valid model. This model needs to be automated by use of process simulation software, which will simulate the model and assess the result. A further benefit of such an approach is that an object instance, or metric, can be changed and the model re-run. This capability would then enable IS Planning to move from being a static process to a dynamic process. As was identified by MIT90's, business turbulence will continue to increase, therefore Strategic IS Planning must evolve into a dynamic process for it to be a valuable analysis toolset.

Acknowledgements

The author would like to thank Professor G Musgrave of Brunel University, and K Hugh Macdonald of ICL, for their support and guidance during his secondment and in the preparation of this paper.

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Biography

Bob Thurlby graduated in Chemistry from Durham University and worked in the management services departments of a number of companies before joining ICL's

Product Support organisation in 1976. In this role he was responsible for providing technical advice and guidance to ICL's early customers of IDMS and DDS.

In the early 1980's his work concentrated on the use and application of data analysis and database design methodologies and he used his experience to contribute to the development of ICL's Fourth Generation System Building software.

Since 1986 he has been a Principal Consultant working with ICL customers in the Electricity Supply Industry. In this role he has led a number of major development projects for applications to support the engineering, commercial and generation functions of the Electricity Industry.

In recent years he has specialised in the development and application of Information System Planning methodologies and is currently on a secondment to Brunel University as a Visiting Fellow, where he is undertaking research into this subject.

Appendix 4: ESKOM Strategic Alignment Model

This Appendix contains a copy of the report presented to the Director of ESKOM Distribution Operations. It contains the Strategic Alignment Model produced for ESKOM. This report was accepted by ESKOM and used to plan the next steps in a programme to build a set of new Information systems for the Distribution Engineering Division.

ESKOM

DISTRIBUTION ENGINEERING

STRATEGIC ALIGNMENT MODEL

R. Thurlby

Managing Consultant
ICL
UK

April 1995

CONTENTS

1. INTRODUCTION

This document contains the completed Strategic Alignment model for ESKOM's Distribution Engineering organisation. The model defined in this report focusses on the Process and Information System Architectures. These have been aligned with each other and the Process Architecture aligned with the Business Strategy objects. Through this alignment process it has been possible to propose an I.S. and technology development plan which will enable ESKOM to implement the Strategic Alignment Model and thereby achieve its Business strategies. The development plan is highly focused, concentrating on the implementation of applications and supporting technologies which will deliver maximum benefit to ESKOM in the shortest possible time. The rationalisation for this approach and how the Strategic Alignment Model should be used to manage it, is also discussed in the document. Since the business strategy objects of the model have been presented and agreed in earlier reports, they are descibed in a summary in an appendix of this document.

2. PRINCIPLES OF STRATEGIC ALIGNMENT

The purpose of Strategic Alignment is to ensure that all an organisation's efforts and investments are aligned to be supportive of its business strategy. This has two dimensions. The first is that of the interactions and interdependencies between the alignment objects. The second is time. Together these dimensions create the underlying principle that there is a logical sequence of transformation, defined by the interactions and interdependencies and constrained by the rate at which an organisation can implement transformation.

The conceptualisation of Strategy Alignment principles is encapsulated as follows:

1. Given that the business paradigm in which the organisation operates has these characteristics.........

2. Then to be successful the organisation has to have a mission which is..........

3. Therefore to achieve the mission we need to adopt the following business strategies...........

4. The success of which will be measured by the following factors or key performance indicators...........

5. However, to implement the business strategies, we will need to develop and enact mission critical processes which are ....

6. And each of these processes will require the following skills..............

7. Furthermore to enact the processes so they achieve maximum effectiveness will require the following Information Systems..............

8. These Information Systems will, in turn, require investment in the following technologies...............

. **BASELINE**

There are three baselines of input for this document.

The first is the decomposition of the three Distribution Engineering Value Processes developed by the CMP teams. These are:

Process C; Provide a Capable Delivery Network
Process D; Trade and Deliver Electricity
Process E; Field Services

The decomposition of the three value processes is summarised in Appendix 1 of this document.

The second is the list of I.S. Opportunities identified at the Strategic Alignment Workshop held at the Karos Indaba Hotel on 21-25 June 1995. This list is to be found in Appendix 2 of this document.

The third is the Strategic Alignment Report produced by R Thurlby in December 1994 which defined the Objects of the Strategic Alignment Model focussing primarily on the definition and alignment of the business strategy objects. A summary of the findings contained in the report is to be found in Appendix 3 of this document.

From these baselines the alignment of the Processes and the Information Systems are derived.

These in turn lead to definition of the development plan for process design and Information System development.

STRATEGIC STAIRCASES

To achieve the Mission of Distribution Engineering, a sequence of four Strategies was proposed. This was developed from the strategies which were derived for each of the three Value Processes. The four strategies are summarised as:

1. Improve Efficiency

2. Develop Effectiveness

3. Create Competitiveness

4. Develop New Alliances

Each strategy has associated with it a set of critical activities which will have to be successfully carried through if the strategy is to be achieved. The activities have been derived from three objects in the Strategic Alignment Model. These are:

1. Business Drivers

2. Critical Success Factors

3. Value Processes

The overall Strategy Staircase, together with their critical activities, is shown in diagram 1.

The creation of an integrated staircase from the three value processes specific staircases was straightforward. All three value processes had in common the first two steps; Improve Efficiency and Develop Effectiveness. Value Processes C and E then had one further step which was concerned with new products and services. Process D, however, had two further steps; the first was responding to competition and the second was exploiting opportunities to grow the business by expansion of the value chain.

Detailed examination of the content and meaning of the third strategy for Value Process C and E revealed that this strategy was concerned about positioning the organisation to be successful in a competitive environment. It therefore had much in common with the third and fourth strategies of value Process D. It was logical, therefore, to adopt the four Strategies of Process D as the general model with adoption in the critical activities to reflect the needs of Processes C and E. Adoption of the four strategy staircase had the added benefit of enabling the model to recognise the temporary loss of business effectiveness caused by competition.

The activity focus of each strategy gives a description of its purpose and thrust. However, a brief statement to encapsulate the strategy is proposed below to further reinforce its purpose:

1. Improve Efficiency:
   To do things right in the organisation by making them cheaper and quicker.

2. Develop Effectiveness:
   To do the right things by being different and better.

3. Create Competitiveness:
   To recognise that the business environment will change with increased demands and that the organisation has to respond to change to survive.

4. Develop New Alliances:
   To exploit the organisation's strengths and position to reinforce and expand the business both within its existing and into new markets.

. ACTIVITY EXPANSION AND MEASUREMENT

Diagram 1 shows the focus of activities required to make the strategy they support successful. To judge the success requires that the activities are measurable. The list below proposes a set of measures for each strategy step. The measures are further broken down by the Process to which they relate. The target for each measure have yet to be agreed and metricated and will require input from the Process Managers.

DISTRIBUTION ENGINEERING STRATEGY STAIRCASE

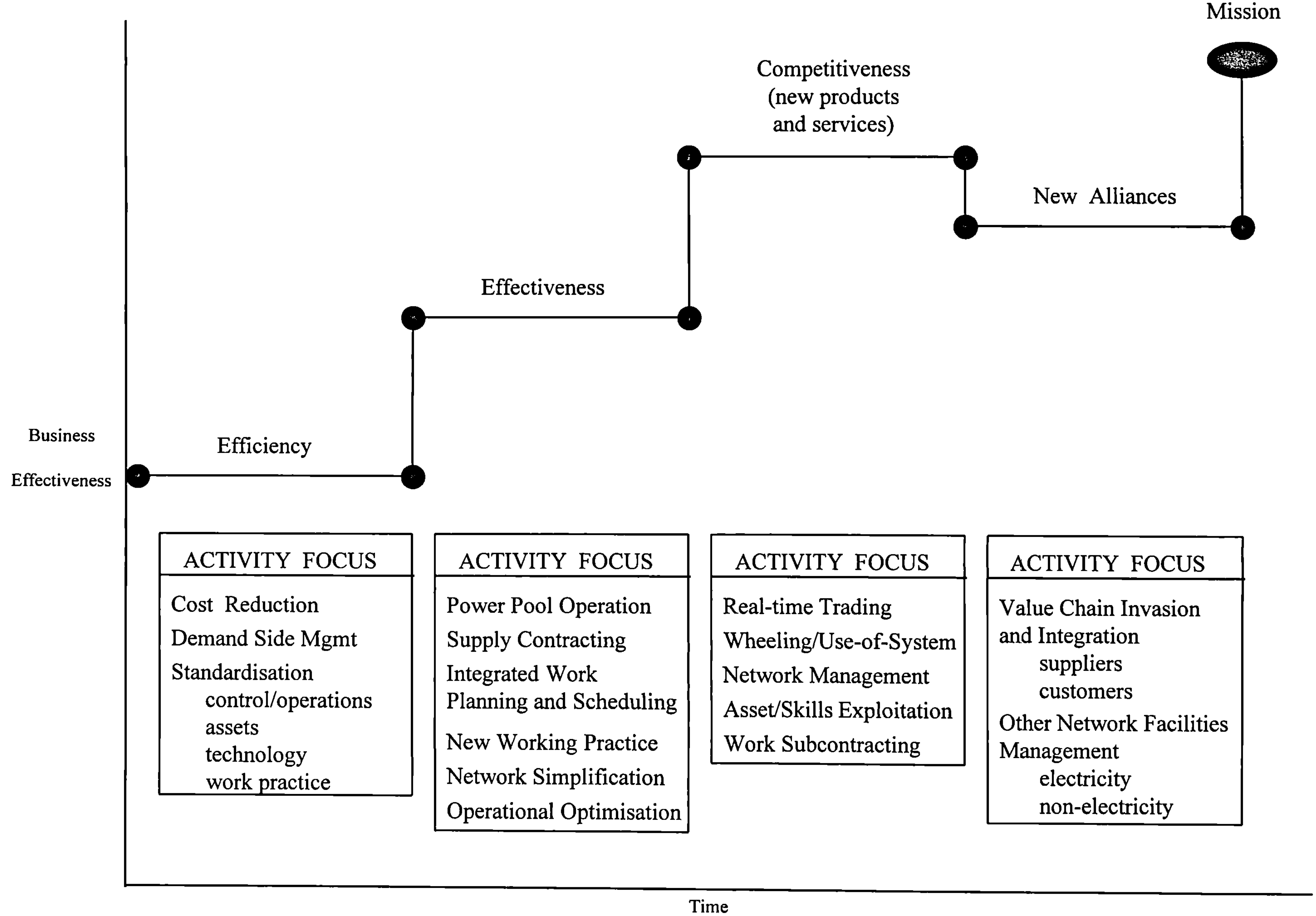


Diagram1

ESKSS010-BT-95

1. Improve Efficiency

   1-1 Process C
      1-1-1 Network planning integration and rationalisation
      1-1-2 Standardisation of technology and procedures
      1-1-3 Asset optimisation within current usage
      1-1-4 Skills specification

   1-2 Process D
      1-2-1 Control Room practice
      1-2-2 Operations practice and efficiency
      1-2-3 D.S.M. initiatives

   1-3 Process E
      1-3-1 Standardised work practice
      1-3-2 Staff skills and training
      1-3-3 Staff productivity
      1-3-4 Inventory control (consumables, tools, and equipment)

2. Develop Effectiveness

   2-1 Process C
      2-1-1 Resource optimisation
      2-1-2 Network simplification and rationalisation
      2-1-3 Introduction of new practice
      2-1-4 Internal contracting

   2-2 Process D
      2-2-1 Network operational optimisation
      2-2-2 Supply contract development
      2-2-3 Integration of DSM with supply contract

   2-3 Process E
      2-3-1 Work scheduling
      2-3-2 Work forecasting and planning
      2-3-3 Internal contracting
      2-3-4 Third party management

3. Create Competitiveness

   3-1 Process C
      3-1-1 New use of network assets
      3-1-2 Additional use of skills and resources

   3-2 Process D
      3-2-1 Real time energy trading
      3-2-2 Wheeling and Use-of-System costing
      3-2-3 Contingency planning
      3-2-4 New tariffs for supply
      3-2-5 Supply related services

3-3 Process E
- 3-3-1 Outsourcing work
- 3-3-2 Project and programme management services
- 3-3-3 Contract management
- 3-3-4 Non-ESKOM work
- 3-3-5 Work design and planning services

4. Develop New Alliances

4-1 Process C
- 4-4-1 Supplier integration and collaboration
- 4-4-1 Customer integration and collaboration

4-2 Process D
- 4-2-1 Facilities management services
- 4-2-2 Supply chain integration
- 4-2-3 Energy contract management and broking

4-3 Process E
- 4-3-1 Facilities Management services
- 4-3-2 Work "other side of the meter"
- 4-3-3 "Non-electricity" work

ı. VALUE PROCESS ALIGNMENT WITH STRATEGIES

Diagrams 2, 3 and 4 align the Value Processes to the four Strategies. This alignment has been done at the Level 2 breakdown of the Value Processes. It was necessary to do it at this level to achieve alignment consistency.

Examination of the alignment reveals the following points:

1. The majority of the processes are focused on the first two steps of the strategy. Whilst it may be unreasonable to expect a lot of detail pertaining to strategies three and four at this time, nevertheless it will have to be addressed within the next year.

2. Processes C and E tend to match with the strategies at the first level of breakdown. This reflects a good alignment and degree of cohesion.

3. Process D only achieves a match with the strategies at the second level of breakdown in many cases. This is indicative of the size and complexity of Process D and in that aspect is not a significant problem. However, it may indicate that the integration of the second level processes may be incorrect and will benefit from further examination.

Note:
The value process decompositions and are shown in diagrams 7, 8 and 9 at the back of this document in Appendix 1.

STRATEGY STAIRCASE
Process C Support of Strategies

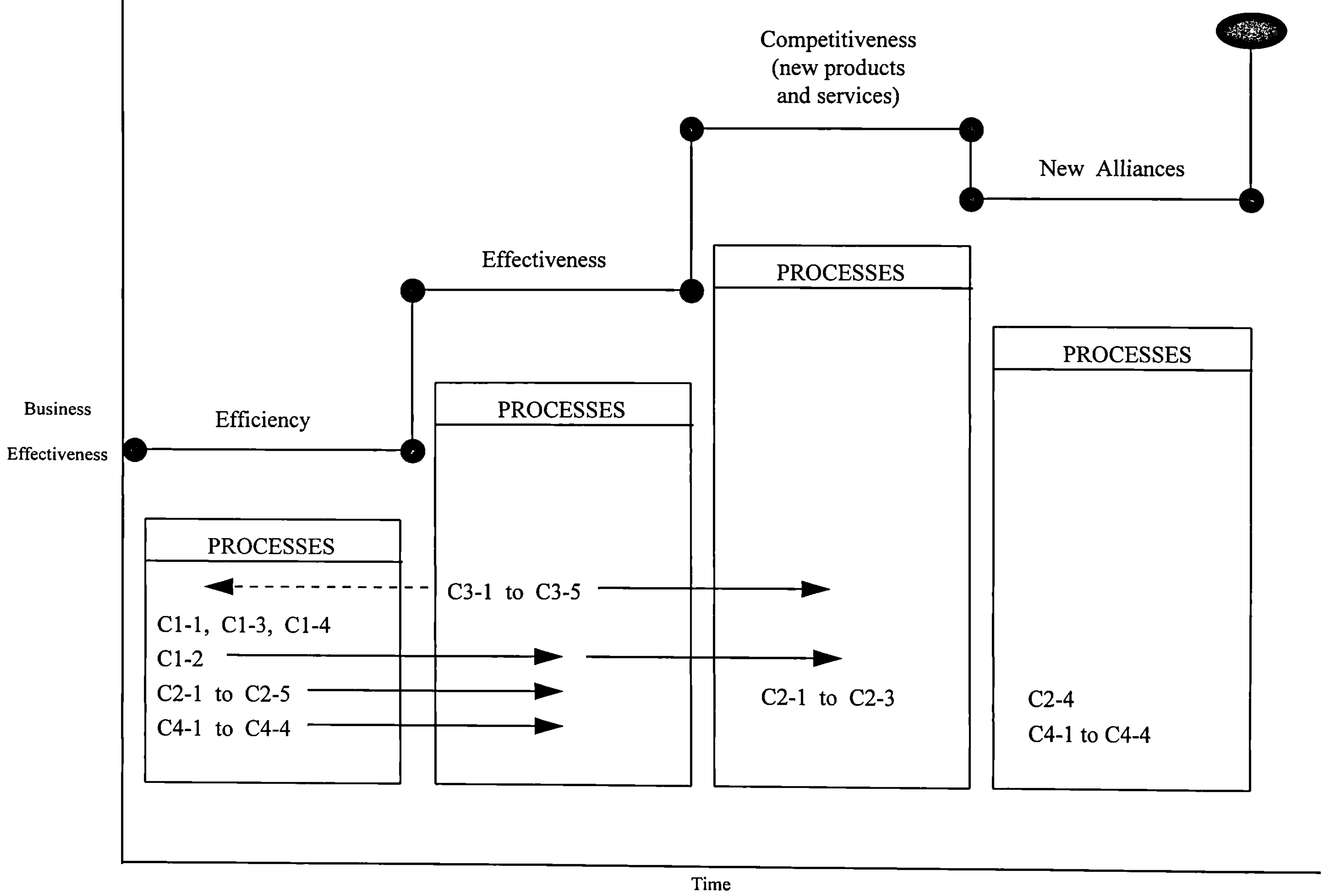


Diagram 2

STRATEGY STAIRCASE
Process D Support of Strategies

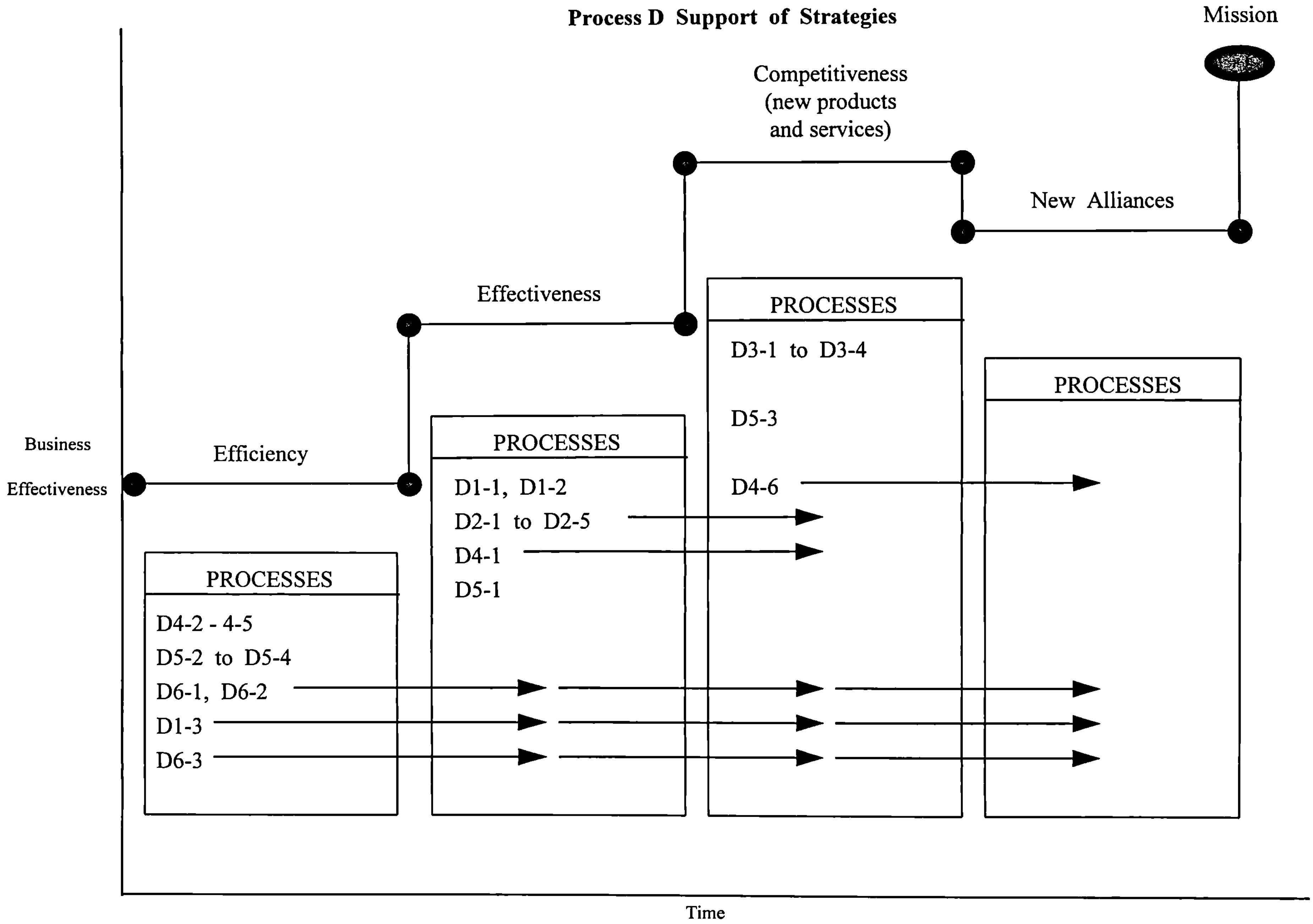
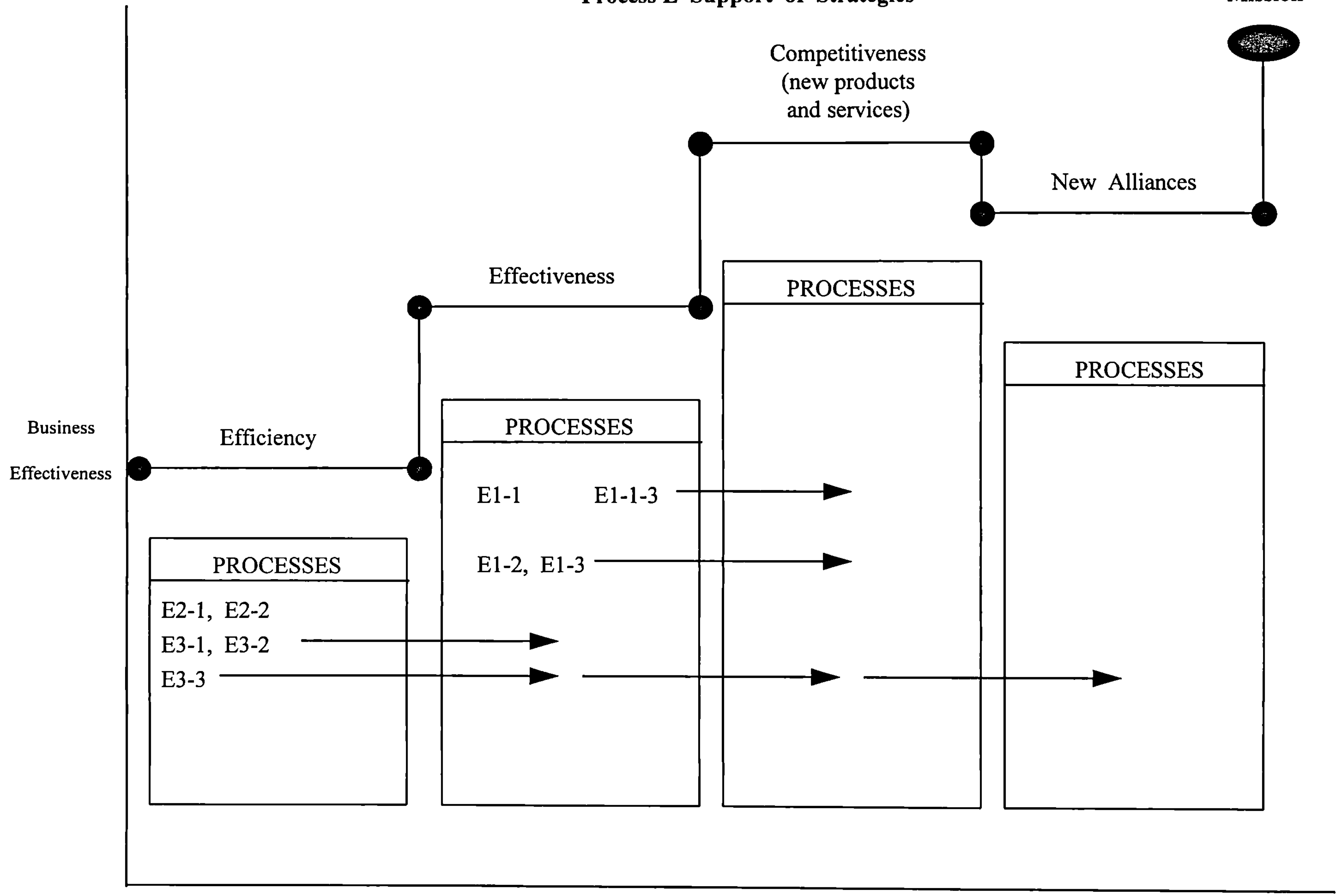


Diagram 3

STRATEGY STAIRCASE
Process E Support of Strategies



VALUE PROCESS INTEGRATION

Diagrams 5 and 6 show the way the Value Processes integrate. Diagram 5 describes the integration needed to support the Improve Efficiency Strategy whilst Diagram 6 is for the Improve Effectiveness Strategy. Diagrams for the two remaining Strategies have not been produced because of the small number of processes identified which support these Strategies. This is not to say that such an exercise will not be necessary in the future.

The diagrams show the interworking between the sub-value processes at the second level of decomposition. Interworking is defined as the need by one sub-process for information created or modified by another. The arrows showing information flow are labelled with the specific second level processes which provide the information.

The following conclusions can be drawn from this analysis which will help determine the process design sequence:

1. Value Process E is significantly dependent on Value Processes C2 and C3.

2. The primary interworking between Value Processes E and D occurs through Value Processes C2 and C3. There is also limited direct interworking between D4 and E2.

3. Value Process C is highly dependent on Value Processes D4 and D5, but Value Process D has less dependence on Value Process C.

4. Within Value Processes C and D there is major interworking.

5. A sequential development approach for the 3 processes cannot be considered due to the high degree of interdependence and interworking.

6. A parallel process design should therefore be undertaken and the programme should commence with Value Processes C1, C2, C3, D4, D5 and E2.

7. The next group to be developed should be C4, E1 and E3.

8. The final process to be developed should be D3.

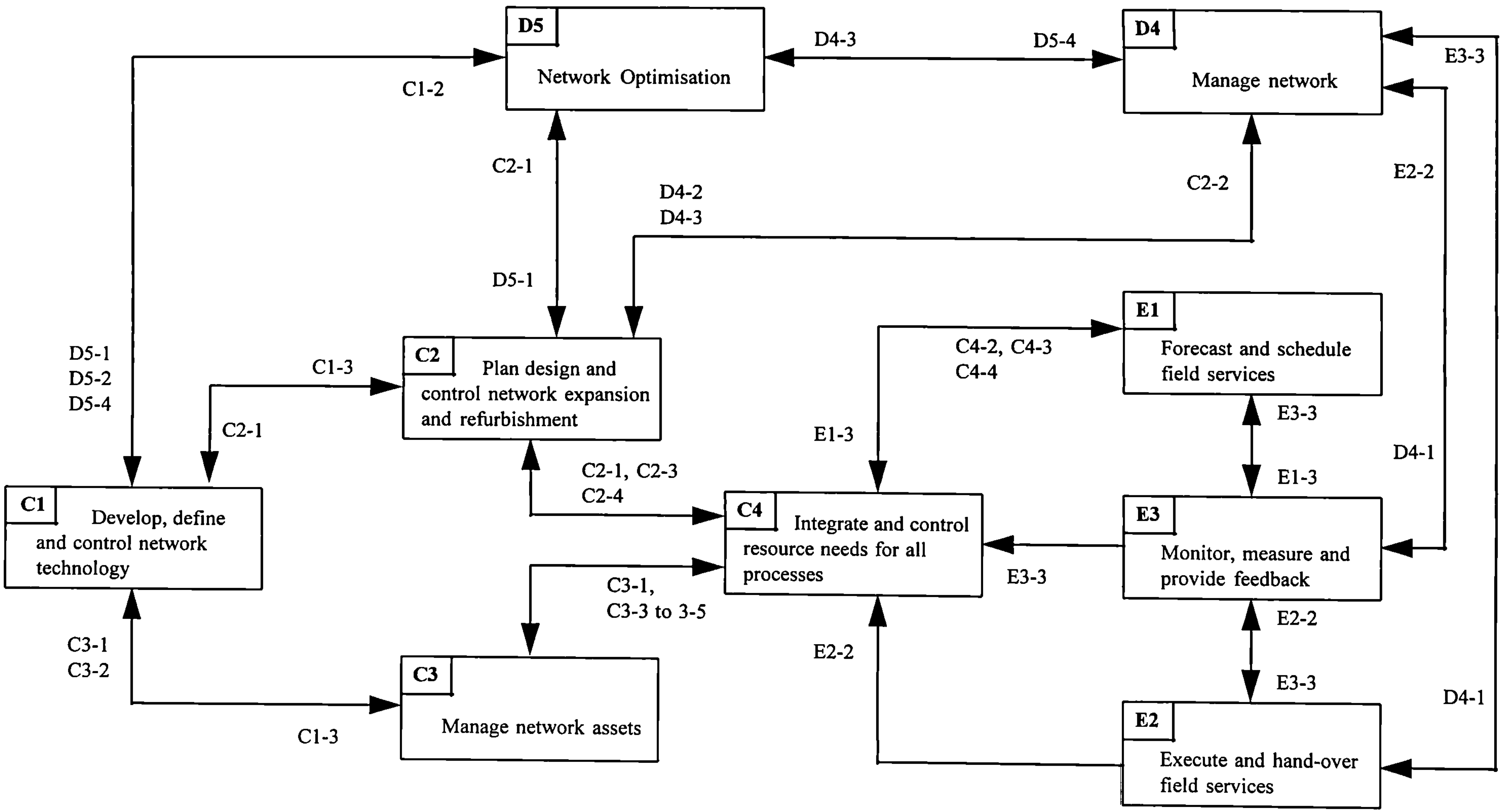
9. Value Processes D1, D2 and D6 have been excluded from the Diagrams because their interworking is only with Value Processes within the same Group. These 3 Value Processes fit into the proposed development sequence as follows:-

    - D1 and D2 should be developed in the same time frame as D3.

    - D6 should be developed in the same time frame as D4 and D5.

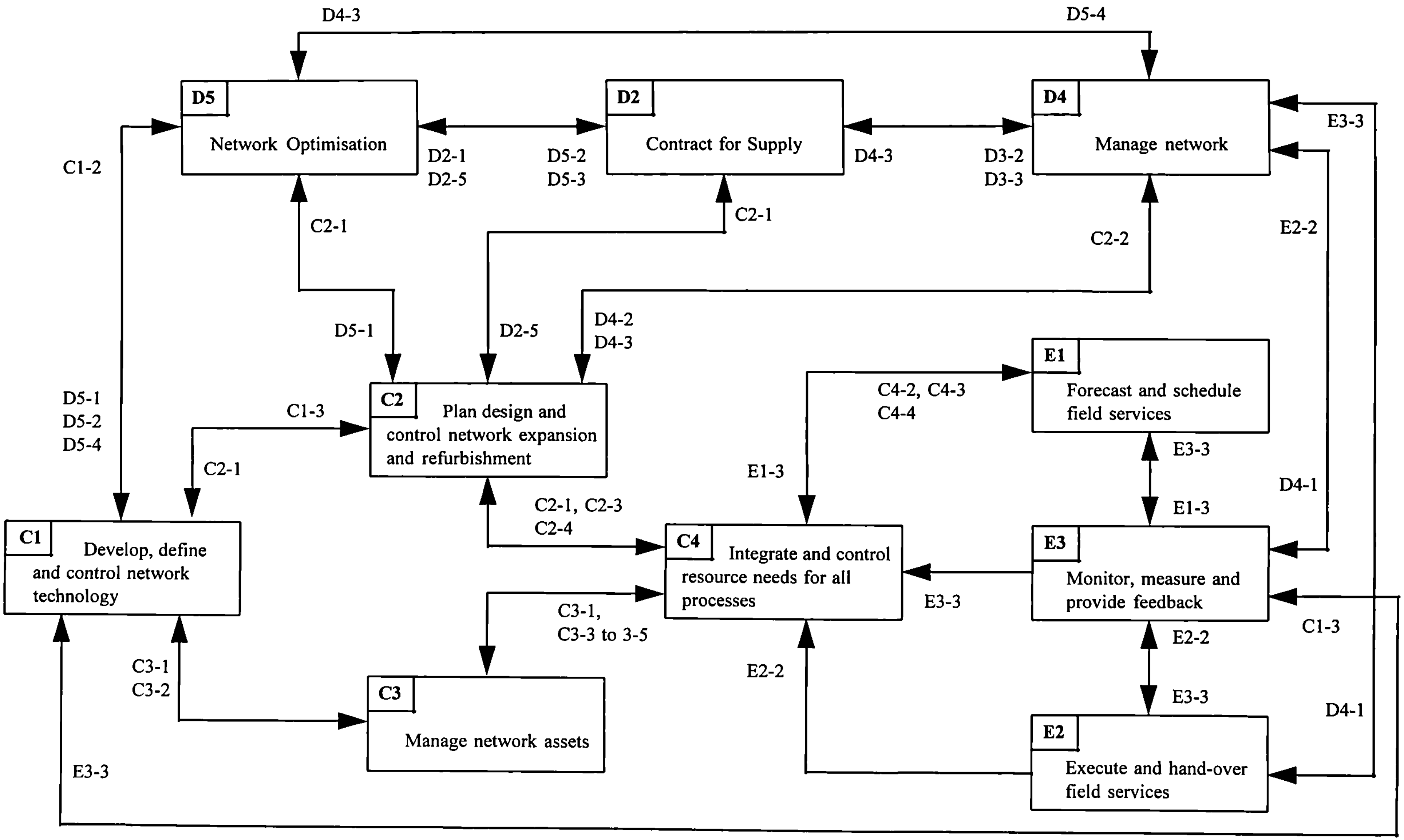
IMPROVE EFFICIENCY

Value Process Interworking



IMPROVE EFFECTIVENESS

Value Process Interworking



8. VALUE PROCESS ALIGNMENT WITH I.S. OPPORTUNITIES

41 I.S. Opportunities were identified at the Karos Indaba Workshop in June 1994. These were each assigned to one of five groupings which are:

Infrastructure Systems
: I.S. applications which have limited functionality, but are essential to support other I.S. applications. They primarily are the data warehouses.

Work Systems
: I.S. Applications which support processes which perform work on the Distribution Network in its broadest sense.

Engineering Systems
: Those systems which support the control operation and analysis of the network.

Trading Systems
: Those systems which support the purchase and sale of energy and the optimisation of these processes. They include D.S.M., but exclude the technical analysis systems which are used to model the impact of trading on the network, because these systems have been assigned to the previous group.

Management Systems
: Those systems which support short and long term control, planning and management of the Distribution Engineering; including financial systems.

Appendix 2 contains a set of tables which analyse and determine the alignment of the I.S. Opportunities with the Value Processes. Tables 1 to 5 are the lowest level analysis where each I.S. Opportunity is mapped to each second level value process.

Table 6 aggregates the scores from Tables 1 to 5 and Table 7 ranks the I.S. Opportunities.

Tables 8 to 13 then repeat the aggregation and ranking but at the strategy level. That is only the processes which support the specific strategy are included. Note, Strategy 4, New Alliances, has not been scored due to the limited number of processes which support it.

The scoring was done on the following basis:

> 9 was scored if the Value Process created or modified data in the I.S. Opportunity.
>
> 3 was scored if the Value Process could not be executed without access to data in the I.S. Opportunity.

1 was scored if the Value Process had a non-critical use for the data in the I.S. Opportunity.

0 (left as a blank in the table) was scored if there was no relationship.

Inspection of the ranking tables (numbers 7, 9, 11 and 13) shows the changing emphasis in the way I.S. will be required to support the strategies. The proposed priority list for development is contained in the next section of this report. The general conclusion, however, is that there are no significant surprises in the results and there is good consistency with other Electricity Distribution Companies who have undertaken similar studies.

PRIORITISATION OF I.S. OPPORTUNITIES

As with the Value Processes a sequential development plan cannot be postulated; I.S. applications will have to be developed in parallel. In developing the priorities the heaviest weighting will be placed on those I.S. Opportunities which provide support to the Value Processes which are most critical to support achievement of the Strategies.

From analysis of the Tables in Appendix 2 and placing a heavier weight on the I.S. Opportunities support of Value Processes required by the Efficiency and Effectiveness Strategies, the priority list is derived as:

1. Executive Information
2. Plant and Circuit
3. Decision Support
4. Contact Management
5. Work Planing (5 year)
6. Work Scheduling
7. Project Management
8. Network Optimisation
9. Maintenance Planning
10. Work Control
11. Load Management (D.S.M.)
12. Network Security
13. Fault Management
14. Materials Procurement
15. Load Flow Analysis
16. Budgeting
17. G.I.S. (AM/FM)
18. Materials Management
19. Job Costing
20. Network Stability
21. SCADA
22. Switching Instruction
23. Energy Supply Costing
24. Energy Purchasing
25. Load Forecasting
26. Alarm and Event Management

The list, however, is not a practical sequence because it ignores the dependencies of the I.S. Opportunities. These are discussed in the next section.

I.S. OPPORTUNITY INTEGRATION

A number of high scoring I.S. Opportunities have a technical dependency on lower scoring I.S. Opportunities. This clearly has to adjust the development sequence. For example, the Engineering Systems are dependent on the low scoring SCADA I.S. Opportunity. To incorporate these dependencies a new sequence has been derived which is shown in diagram 10. This shows the integration of the I.S. Opportunities and as a result their proposed development sequence.

A further anomaly and inconsistency to emerge from the scoring and analysis is in the area of Demand and Load Forecasting. These are performing the same function, but from different viewpoints. The former is from the Customer side and the latter is from the Network side. Each will use the same software programs. Furthermore each provides a major input into other applications. Consequently a combined I.S. Opportunity, labelled Load Forecasting has been included in the model.

Even within this sequence there is flexibility which may only be resolved when application packages are evaluated with regard to their scope and functionality.

PROPOSED DEVELOPMENT PLANS

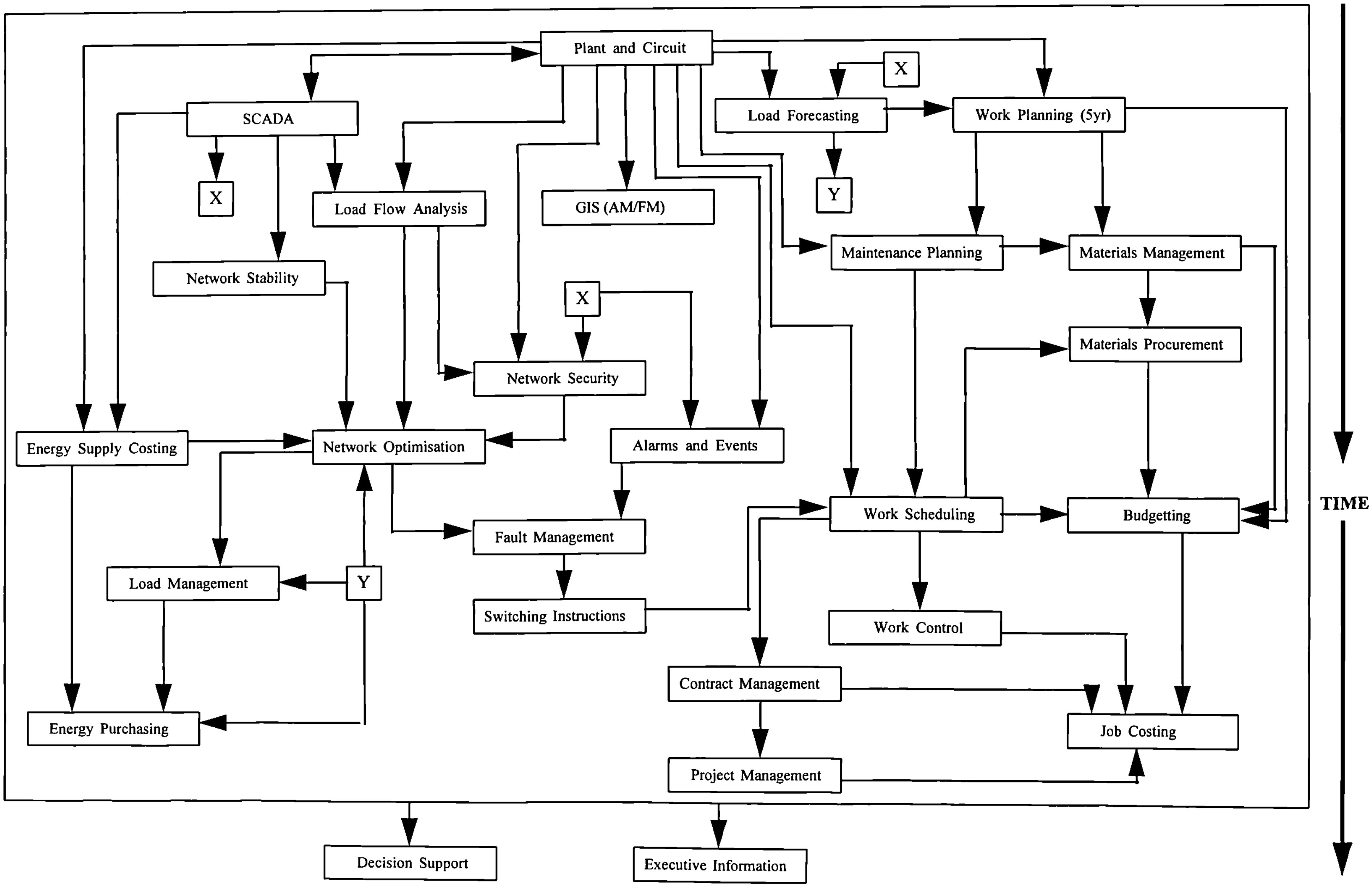
The Strategic Alignment Model contained in this report describes the process design sequence in Section 7 and the I.S. development sequence Section 10, diagram 10. The I.S. development sequence selected the I.S. Opportunities which provided most support for the processes and worked out their technical dependencies to define the order in which they should be developed. The processes were prioritised by their support of the four business strategies which comprise the Strategic Staircase (diagram 1). Whilst these are therefore conformant with the principles of Strategic Alignment and as such must be recorded for future reference and use of the Strategic Alignment Model, they do not represent a practical way forward for ESKOM.

As has already been discussed in Sections 7, 8 and 9, there is a high degree of interworking and interdependency in the model. This therefore precludes a linear approach to the design of the processes and development of the I.S. applications which will enable their enactment. However to try to do too many design and development projects in parallel will present serious management and budgetry issues. Furthermore the technical dependencies ot the I.S. applications cannot be ignored totally.

A second factor to be considered is that of time. Any I.S. development programme nowadays is expected to produce deliverables in months not years. Also the deliverables have to produce quantifiable benefits within similar timeframes. This management requirement has been made achievable by the availability of a new generation of Application Packages. These not only have a high degree of conformance to the organisations systems requirements, but also can be tailored easily to meet requirements not supported in the basic software of the package. In the last five years there has been a major shift of Utilities throughout the world, from in-

I.S. OPPORTUNITIES

INTERDEPENDENCIES and DEVELOPMENT SEQUENCE



house developments, to the purchase of application packages to meet their I.S. needs. This trend has been led by Utilities who have been privatised and are now under regulatory and competitive pressure to cut costs and become more effective. These are exactly the same business drivers being faced by ESKOM.

The third factor requiring consideration is that of process design and enactment. Specifically how to do it. Whilst the process decomposition teams have produced high quality models, they have reached a point where analysis must stop and design and implementation commence. There are two, not necessarily exclusive, approaches to this. The first, purist, approach is to embark on a phase of design and modelling to produce optimal models which can be enacted in a further phase by use of process generation, workflow and application software development tools. The second, pragmatic, approach is to implement application packages which support the key processes. In summary the advantage of the first approach is rigour and completeness, whereas for the second approach it is time and business focus. Although the second approach runs the risk of missing areas of business and not delivering the perfect solution; experience has shown that a properly selected package will contain facilities to optimise it to produce an acceptable solution. Also by having a referential model, such as the Stratregic Alignment Model, to work with the risks of missing process areas is minimised.

Given the importance to ESKOM of producing deliverables, which bring quantifiable benefit in the short term, then the use of application packages to enact the key processes is the logical way to proceed. The rest of this section describes the plan to deliver application packages and related capability which will enact the key processes of the Value Processes C, D and E. This plan descibes implementation of the Strategic Alignment Model in a practical way. It was developed through a series of workshop sessions attended by the CMP teams and consequently has their full support as the most effective way forward.

Given that an application package based approach is to be adopted, it was necessary to integrate the 26 I.S. opportunities into groups which mapped to known application packages. This had the effect of reducing the I.S. opporunity list from 26 to 16. The results of this work are shown in diagram 11. There were 6 primary areas of integration:-

Integrated Work Management:

This brings together all the information systems concerned with the design, planning, scheduling, monitoring, progressing and costing of all work. Ideally it would also support project and contract management activities, but it was recognised that this may not be achievable with a single package.

Network Analysis:

This integrates all those systems which mathematically analyse the state of the network in both real-time and off-line mode.

Materials Management and Procurement:

All modern materials management packages support all the activities relating to the procurement, stock control, forecasting and accounting of inventories.

I.S. OPPORTUNITIES

INTERDEPENDENCIES and DEVELOPMENT SEQUENCE

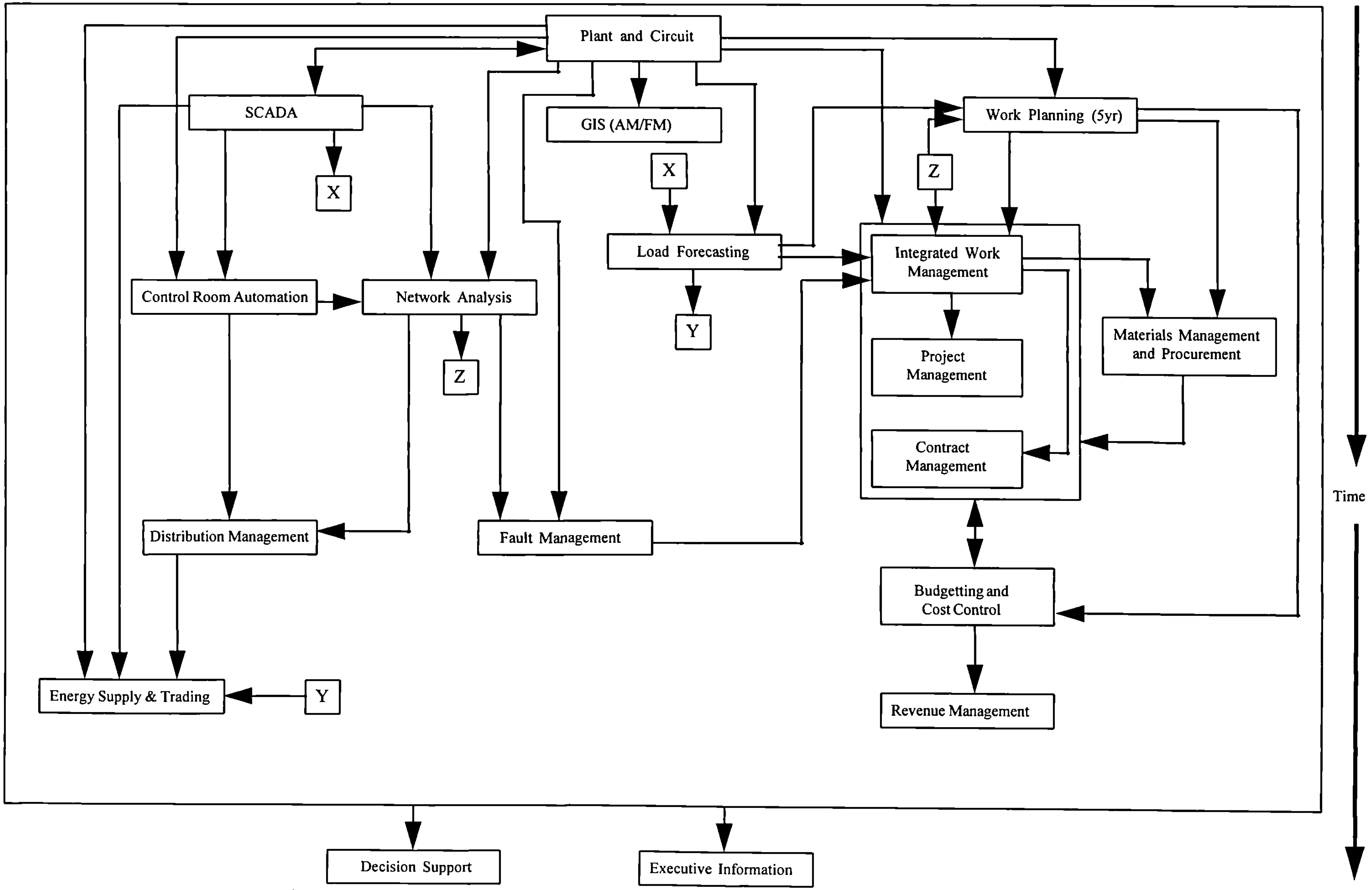


Diagram 11

Control Room Automation:

This combines the systems which link with the SCADA to operate the network. Traditionally these have been integrated with the SCADA computer, however the emergence of Open Systems and integrated Plant and Circuits application packages has enabled these systems to be decoupled from the SCADA and developed seperately.

Distribution Management:

These packages provide functionality which enables control room and operations staff to optimise the network and how it is run. Demand side manaagement is included in the functionality.

Energy Supply and Trading:

This package will support all the functions required to plan, negotiate, manage and reconile energy purchase and sales contracts

At present single packages which support all the requirements of Distribution Management and Energy Supply and Trading are unlikely to be found due to the comparative newness of the business function. To implement systems is therefore likely to require a higher degree of in-house development and integration of a number of packages than will be required for any of the other 14 applications areas.

Examination of the 16 application package areas shown in diagram 11 identified 7 which would provide most support for the process development sequence proposed in section 7 of this document. These applications, togrther with their interdependencies, are shown in diagram 12. Of the 7, there are current initiatives in 4. These are:

SCADA:

New configurations have been ordered and implementation is planned.

Integrated Work Management:

A package is being trialled in 1 Distribution Area currently. If this is suitable then full roll-out can be planned.

Plant and Circuit:

A project has defined the entity model(logical data model) for this application and a package search along with a "way-ahead" debate is the current activity.

Network Analysis:

A number of network analysis software tools are in use across ESKOM, work has commenced to identify and evaluate the long term relevance of these.

Development of the above 4 applications should therefore exploit the existing work, with the objective of building on it wherever practical. However to ensure rigour and minimise risk of producing applications which do not support the processes correctly; the first task in the development programme must be to audit the existing work for conformance with the value process architectures and the rest of the Strategic Alignment Model.

I.S. OPPORTUNITIES

INTERDEPENDENCIES and DEVELOPMENT SEQUENCE

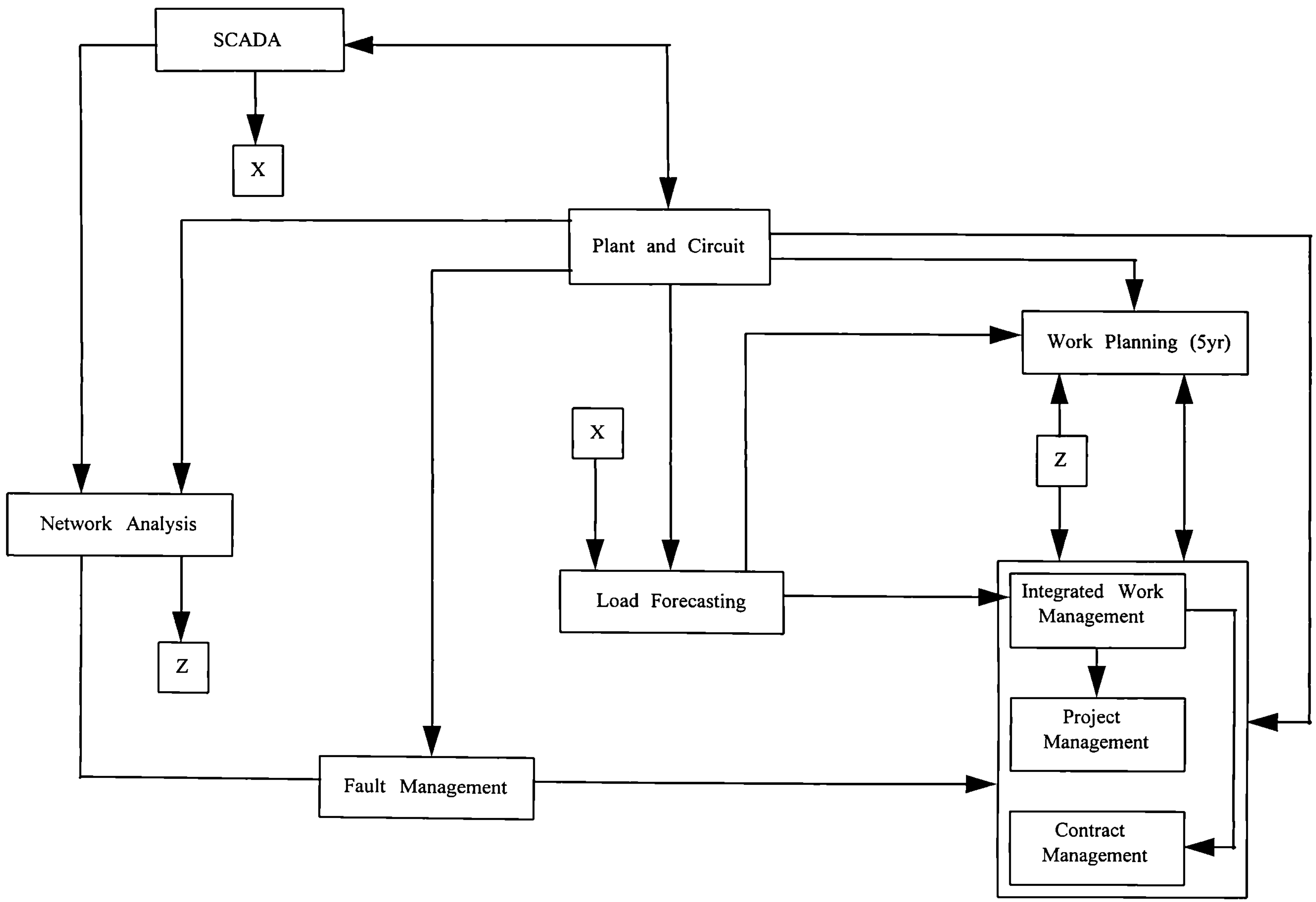


Diagram 12

For the remaining 3 application package areas; 5-Year Work Planning, Load Forecasting and Fault Management; new development programmes will have to be started. These programmes should even so start with an activity to seek to identify any relevant software already in use in other parts of ESKOM. This is especially relevant for Load Forecasting.

For completeness overview definitions of the functionality each application package will need to support are described in Appendix 4 of this document.

12. TECHNOLOGY INITIATIVES

In addition to the development of the 7 application packages described above, there are a further 5 technology initiatives which have to be included in the Strategic Alignment Model. These were all identified at the Karos Indaba Workshop, held in June 1994, as technology based "Quick-Hits". Each of them provides direct support to the enactment of those processes which are concerned with achievement of the first strategy; "Improve Efficiency". The 5 initiatives are listed and summarised below:

Work Practices:

Definition of standard methods of doing all aspects of work from planning , through execution, to accounting and evaluation; which will be implemented uniformly across ESKOM Distribution.

Control Centre Rationalisation:

Introduction of the new SCADAs provides the opportunity to reduce the numbers of control centres and also to implement common operational practices in all the centres.

Plant and Design Standards:

This initiative is essentially the same in concept as Work Practices above, only that it is applied to the plant and equipment in the network and the standards used for designing extensions to, and refurbishments of, the network.

Energy Accounting:

This is an initiative which calculates the costs of operating the network and then seeks to identify how these costs can be reduced by minimising losses and "wear and tear".

Metering Co-ordination:

This initiative will introduce common metering standards as well as increasing the amount and accuracy of metering.

The impact of these initiatives, together with the impact of the I.S. initiatives, is shown in diagram 13. This diagram includes only those processes which have been identified as enactors of the first 2 strategies; Improve Efficiency and Improve Effectiveness.

PROCESS DEVELOPMENT INTERWORKING

TECHNOLOGY DEVELOPMENT INITIATIVE	PROCESS D					PROCESS C				PROCESS E		
	D1	D2	D4	D5	D6	C1	C2	C3	C4	E1	E2	E4
PLANT AND CIRCUITS	M	M	H	H	M	H	H	H		M	M	M
WORK PLANNING				H		M	H	H	M	H		M
INTEGRATED WORK MANAGEMENT						M	M	M	H	H	H	M
NETWORK ANALYSIS	M	M	H	H	H		H	H				
LOAD FORECASTING	H	M	M	H	M		M	M				
FAULT MANAGEMENT			M	M						H	H	M
SCADA			H	H								
WORK PRACTICES						M	M		M	H	H	H
CONTROL CENTRE RATIONALISATION			H	H								
PLANT AND DESIGN STANDARDS				M		H	H	H	M	M	M	M
ENERGY ACCOUNTING	H	H		M	H							
METERING CO-ORDINATION	M	M	M	M	M							

Diagram 13

13. NEXT STEPS

The Strategic Alignment Model as contained in this document is now sufficiently complete to allow the work to move into an implementation phase. The specific development activities to be done are as follows:

1. Implement the processes which directly support the first two business strategies; Improve Efficiency and Improve Effectiveness. These processes are identified in Section 7.

2. This should be achieved by developing and implementing the Applications Packages identified in Section 11. The packages should be developed as a set of parallel activities which will require a certain amount of phasing to allow for the technical dependencies between the packages.

3. The Technology Initiatives already underway should continue but will require co-ordination with the development of the Application Packages.

It can be seen that a development approach based on selection and implementation of Application Packages is proposed. In order to derisk this approach a number of other activities will have to done as well. These are:

1. Definition of I.T. architecture guidelines to ensure that there is conformance across all selected packages and other software so it can be integrated.

2. Agreement on which will be the definitive data architecture model. This model is required to evaluate potential application packges.

3. Completion of an integration and technical phasing study on the 7 application package areas selected for devlopment. This is needed for detailed planning of the development programmes.

4. Construction of a detailed development plan for each of the 7 application package areas which will start to deliver systems and tangible business benefit before the end of 1995.

5. A cost benefit analysis for each application package area. This analysis will not just include package costs but also the costs of dependency on other packages and, conversely, the pull-through benefits a package may achieve by supporting another.

6. Selection and assignment of the staff who will form the development and implementation teams.

It is vital to remember that all of the above 6 activities exist to support implementation of the application packages and enactment of the processes. They therefore must not be allowed to become independant activities in their own right, nor hold up development progress. Each therefore must have produced its own project plan and schedule for

There are 2 additional activities which need to be undertaken to help ensure success of the programmes. These are:

1. A technology search to identify best practice and new developments in the areas of I.S. applications, I.T. and other technologies which could bring additional benefits and shorter development timescales to the programme.

2. Continued use of the Strategic Alignment Model to do the following things:

   - ensure that all I.S. and other developments remain consistent with business strategies.

   - ensure that all developments remain conformant with process, data and I.T. architectures.

   - identify and record any divergencies from requirments caused by lack of functionality in the application package and then determine corrective action

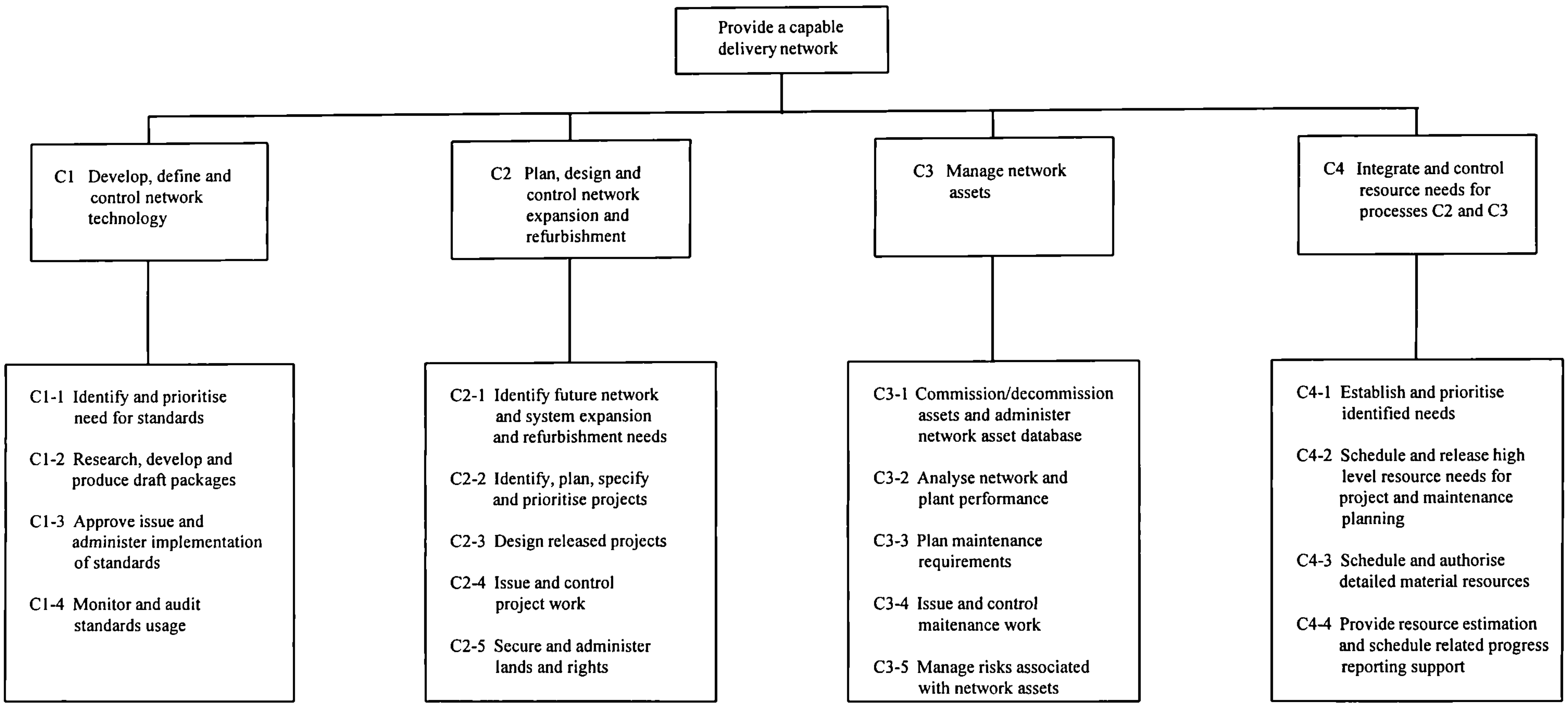
   - identify and define opportunities for strategy change and/or enhancement made possible by introdution of new technology and/or revision of the development plans.

   - definition and assessment of the opportunities presented by changes in the business paradigm and its drivers.

Appendix 1 VALUE PROCESS DECOMPOSITION

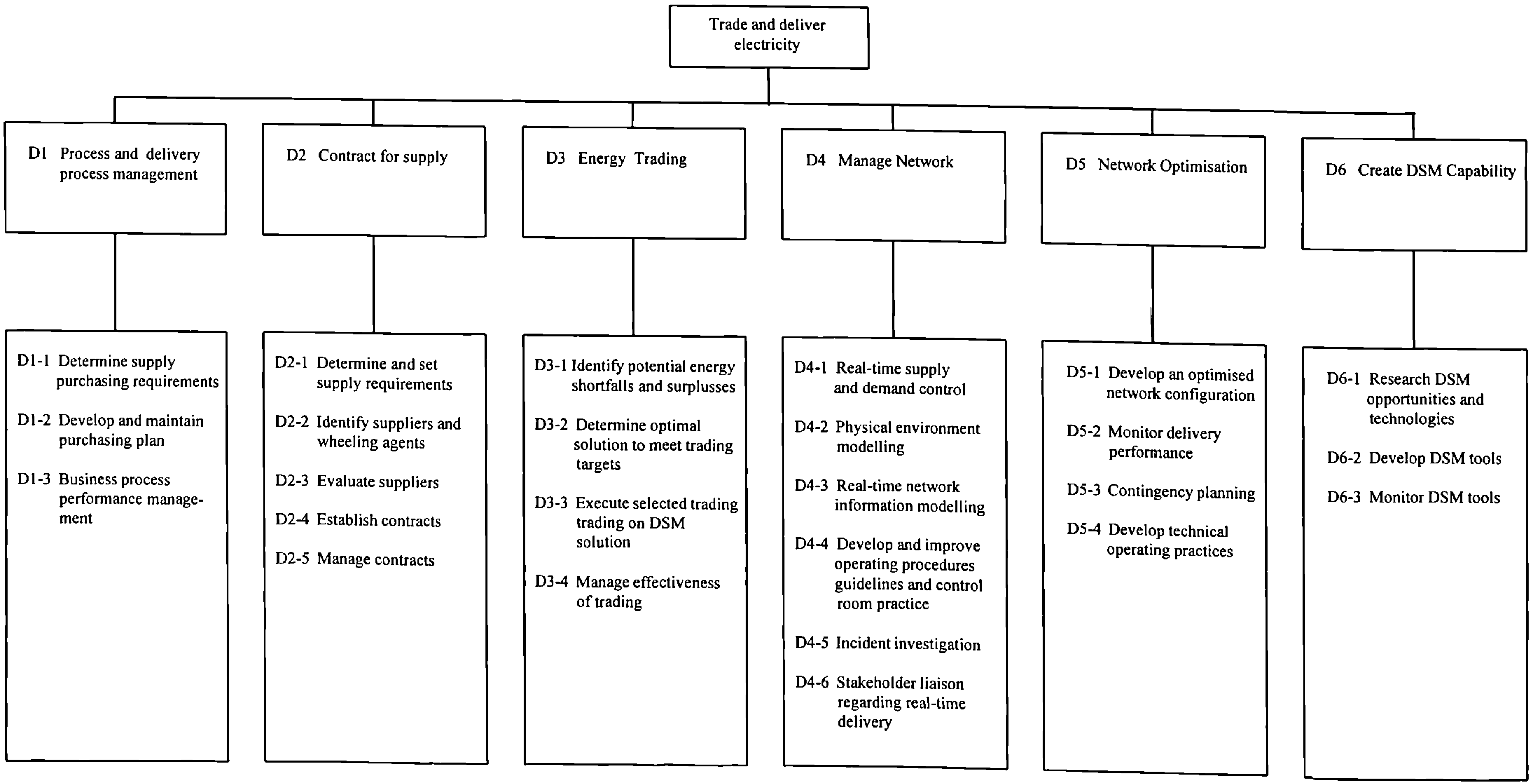
PROCESS DECOMPOSITION

Process C



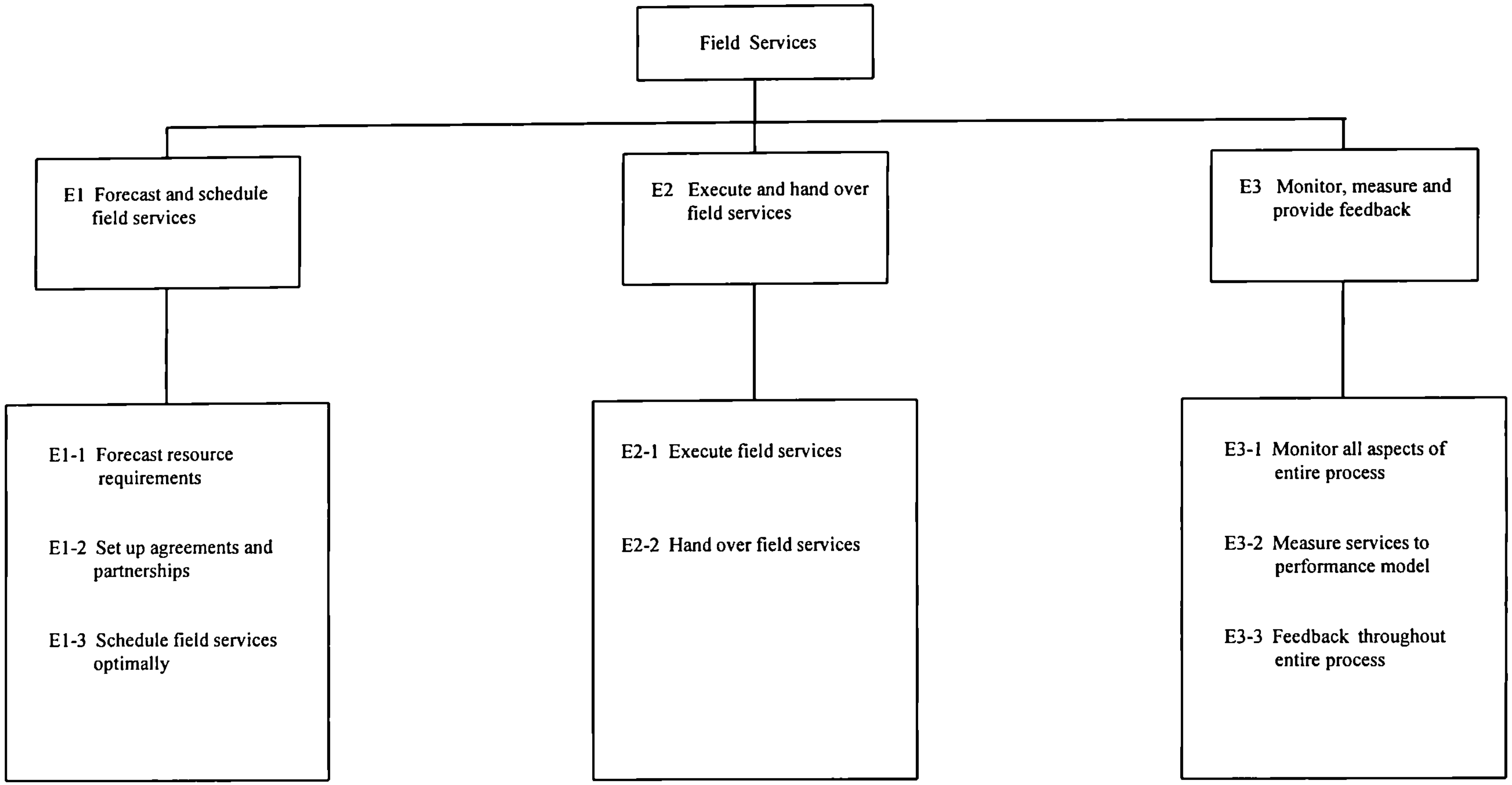
PROCESS DECOMPOSITION

Process D



PROCESS DECOMPOSITION

Process E



Appendix 2 I.S. OPPORTUNITY LIST and PRIORITISATION ANALYSIS

				SUB-VALUE PROCESSES								TOTAL
IS OPPORTUNITIES	C1-1	C1-2	C1-3	C1-4	C2-1	C2-2	C2-3	C2-4	C2-5			
Infrastructure Systems												
Plant & Circuits	9	9	9	3	9	3	3		9			54
Customer X-reference					3	3			9			15
GIS (AM/FM)	3	3	9	1	3	3	3		9			34
New Customer Mgmt					9	3	9					21
CAD	1	3		1			3					8
Document Mgmt		9	3	1								13
Customer Information					9	3	3		3			18
Work Systems												
Work Control	3	3	9	1				9				25
Job Costing								9				9
Work Scheduling						3		9				12
Human Resources Mgmt	1	1	1	1		3		9				16
Project Mgmt						9		9				18
Materials Procurement	3	3	9			3	9					27
Materials Mgmt			1	3			3					7
LV Design	3	1	9	1			9					23
Network Design	3	1	9	1			9					23
Permit to Work	1	1	3	1								6
Maintenance Planning	3	1	9	1			9					24
Contract Management	3	3	3	3		3	3	9				27
Engineering Systems												
Fault Mgmt					3	3	3					9
Load Flow Analysis					9	3	3					15
Loss Minimisation					9	3	3					15
Stability					9	3	3					15
Network Security Modelling					9	3	3					15
Outage Planning	1		1	1	3	3	3					12
Switching Instructions	1	1	1	1			3	9				16
Load Forecasting					9	3						12
Alarm & Event Mgmt	3	3	3	1								10
SCADA												
Network Optimisation(load)					9	3	1					13
Trading Systems												
Load Mgmt (DSM)					3							3
Demand Forecasting					9							9
Energy Purchasing												
Energy Trading												
Energy Supply Costing					9							9
Energy Sales Contract Mgmt												
Management Systems												
Work Planning (5 year)		3	9	1	9	9	1		1			33
Budgetting					9	9	1	3	1			23
Revenue Mgmt								3	1			4
Decision Support	3	3	3	1	3	1			1			15
Executive Information	3	3	3	3	3	1			1			17

Table 1

IS OPPORTUNITIES	SUB-VALUE PROCESSES											TOTAL
	C3-1	C3-2	C3-3	C3-4	C3-5	C4-1	C4-2	C4-3	C4-4			
Infrastructure Systems												
Plant & Circuits	9	9	3		3							24
Customer X-reference			1		3							4
GIS (AM/FM)	9		3									12
New Customer Mgmt												
CAD	1											1
Document Mgmt	1			3								4
Customer Information			3		3							6
Work Systems												
Work Control				9			9		3			21
Job Costing					3	9	3		3			18
Work Scheduling	3			9	3	9	9		9			42
Human Resources Mgmt			3	9	3	3	9		3			30
Project Mgmt				9		3	9	3	9			31
Materials Procurement			3	9	1	3		9				25
Materials Mgmt			3	9	1	3		9				25
LV Design	1					1						2
Network Design	1					1						2
Permit to Work				9		1						10
Maintenance Planning			9	9	3	9	3	3	3			39
Contract Management				9			9	3				21
Engineering Systems												
Fault Mgmt		9	9		1	3						22
Load Flow Analysis		9			3	1						13
Loss Minimisation					3	1						4
Stability		9	3		1	1						14
Network Security Modelling		9	3		9	1						22
Outage Planning		1	9			1						11
Switching Instructions	3	1		9		1						14
Load Forecasting		1			3	1						5
Alarm & Event Mgmt		9	1			1						11
SCADA												
Network Optimisation(load)		9			9							18
Trading Systems												
Load Mgmt (DSM)												
Demand Forecasting												
Energy Purchasing												
Energy Trading												
Energy Supply Costing												
Energy Sales Contract Mgmt												
Management Systems												
Work Planning (5 year)			9	9		3	9	1	3			34
Budgetting				9	3	9	3	3	3			30
Revenue Mgmt					9		3	1	1			14
Decision Support	9	9	3	1	1	1						24
Executive Information	9	9	3	1	1	1			3			27

Table 2

	SUB-VALUE PROCESSES												TOTAL
IS OPPORTUNITIES	D1-1	D1-2	D1-3	D2-1	D2-2	D2-3	D2-4	D2-5	D3-1	D3-2	D3-3	D3-4	
Infrastructure Systems													
Plant & Circuits													
Customer X-reference													
GIS (AM/FM)													
New Customer Mgmt													
CAD													
Document Mgmt													
Customer Information													
Work Systems													
Work Control													
Job Costing													
Work Scheduling													
Human Resources Mgmt													
Project Mgmt													
Materials Procurement													
Materials Mgmt													
LV Design													
Network Design													
Permit to Work													
Maintenance Planning													
Contract Management													
Engineering Systems													
Fault Mgmt									1				1
Load Flow Analysis	3	3	3				3	3	3	3		3	24
Loss Minimisation	3	3					3	3	1				13
Stability	3	3	3				3	3	1				16
Network Security Modelling	3	3	3				3	3	3				18
Outage Planning	3	3	3						3				12
Switching Instructions													
Load Forecasting									9				9
Alarm & Event Mgmt									1				1
SCADA													
Network Optimisation(load)	3	3	3				3	9	3	3		3	30
Trading Systems													
Load Mgmt (DSM)	9	9	9	3			3	3	1	3		3	43
Demand Forecasting	9	9	9				1	1	9	3			41
Energy Purchasing	9	9		9	9	9	9	9		3			66
Energy Trading	3	3								9	9	9	33
Energy Supply Costing	3	3	9		9			9		9	3	3	48
Energy Sales Contract Mgmt	3	3							3	3		3	15
Management Systems													
Work Planning (5 year)													
Budgetting													
Revenue Mgmt					1			3				3	7
Decision Support			9		9			3					21
Executive Information			9		9			3					21

Table3

	SUB-VALUE PROCESSES													TOTAL
IS OPPORTUNITIES	D4-1	D4-2	D4-3	D4-4	D4-5	D4-6	D5-1	D5-2	D5-3	D5-4	D6-1	D6-2	D6-3	
Infrastructure Systems														
Plant & Circuits	9	9	9	3	9	3	9	9	3	3				66
Customer X-reference						3	3	3	3					12
GIS (AM/FM)						3	3	1	3	1				11
New Customer Mgmt						3								3
CAD														
Document Mgmt														
Customer Information							9	3	3					15
Work Systems														
Work Control														
Job Costing														
Work Scheduling														
Human Resources Mgmt														
Project Mgmt														
Materials Procurement														
Materials Mgmt														
LV Design														
Network Design														
Permit to Work														
Maintenance Planning														
Contract Management														
Engineering Systems														
Fault Mgmt	3			3	9			9		1				25
Load Flow Analysis		9		3		3	9	3	3		9		3	42
Loss Minimisation		9		3		3	9	3	3		9			39
Stability	3	9		3		3	9	3	3					33
Network Security Modelling	3	9		9	3	9	9	3	9	3			3	60
Outage Planning		3		9		3	1	1	9	3	3			32
Switching Instructions					3		1	1		3				8
Load Forecasting		3				9	9	1	9					31
Alarm & Event Mgmt	9			9		9	3	9	1	9	9			58
SCADA	9	3	9	9	9	9	9	9	1	9			3	79
Network Optimisation(load)	3	9		9		3	9	3	9	3	9		3	60
Trading Systems														
Load Mgmt (DSM)				9			3	3	9	3	9	9	9	54
Demand Forecasting											9		3	12
Energy Purchasing														
Energy Trading											3			3
Energy Supply Costing											9		3	12
Energy Sales Contract Mgmt											9		9	18
Management Systems														
Work Planning (5 year)							3	3	9					15
Budgetting														
Revenue Mgmt														
Decision Support				3	9	3	3	1	1		3	3	3	29
Executive Information					9	3	3	1	1		3	3	3	26

Table 4

				SUB-VALUE PROCESSES								**TOTAL**
IS OPPORTUNITIES	E1-1	E1-2	E1-3	E2-1	E2-2	E3-1	E3-2	E3-3				
Infrastructure Systems												
Plant & Circuits	3			3	3	3		1				13
Customer X-reference	1			3	3	3		1				11
GIS (AM/FM)				3	9	3		1				16
New Customer Mgmt	1			3	1			1				6
CAD				3		1		1				5
Document Mgmt					3	1		3				7
Customer Information	3	3		3	1	1		1				12
Work Systems												
Work Control	3		3	9	3	9		1				28
Job Costing				9		9		1				19
Work Scheduling		3	9	9		9		1				31
Human Resources Mgmt	9	3	3			3		1				19
Project Mgmt	9		3	9	3	9		1				34
Materials Procurement	9	9				3		1				22
Materials Mgmt			9	9		9		1				28
LV Design	9			1		3		1				14
Network Design	9			1		3		1				14
Permit to Work			9	1		3		1				14
Maintenance Planning	9			1		3		1				14
Contract Management		9	3	9	9	9		1				40
Engineering Systems												
Fault Mgmt	9		9		3	3		3				27
Load Flow Analysis												
Loss Minimisation												
Stability												
Network Security Modelling												
Outage Planning	3		3		3			1				10
Switching Instructions				9	9	3		1				22
Load Forecasting												
Alarm & Event Mgmt												
SCADA												
Network Optimisation(load)												
Trading Systems												
Load Mgmt (DSM)												
Demand Forecasting												
Energy Purchasing												
Energy Trading												
Energy Supply Costing												
Energy Sales Contract Mgmt	1							1				2
Management Systems												
Work Planning (5 year)	9		9	1		3		3				25
Budgetting	3	1	3			1		1				9
Revenue Mgmt		3	3		9	1		1				17
Decision Support		9	9	3	9	3						33
Executive Information	3	9	3	3	9	9	3	3				42

Table 5

VALUE PROCESS ; IS OPPORTUNITY MATRIX ANALYSIS
TOTAL PROCESS SCORES

IS OPPORTUNITIES	E	C1 & C2	C3 &C4	D1,D2,D3	D4,D5,D6		TOTAL
			SUB-PROCESS SCORES				
Infrastructure Systems							
Plant & Circuits	13	54	24		66		157
Customer X-reference	11	15	4		12		42
GIS (AM/FM)	16	34	12		11		73
New Customer Mgmt	6	21			3		30
CAD	5	8	1				14
Document Mgmt	7	13	4				24
Customer Information	12	18	6		15		51
Work Systems							
Work Control	28	25	21				74
Job Costing	19	9	18				46
Work Scheduling	31	12	42				85
Human Resources Mgmt	19	16	30				65
Project Mgmt	34	18	31				83
Materials Procurement	22	27	25				74
Materials Mgmt	28	7	25				60
LV Design	14	23	2				39
Network Design	14	23	2				39
Permit to Work	14	6	10				30
Maintenance Planning	14	24	39				77
Contract Management	40	27	21				88
Engineering Systems							
Fault Mgmt	27	9	22	1	25		84
Load Flow Analysis		15	13	24	42		94
Loss Minimisation		15	4	13	39		71
Stability		15	14	16	33		78
Network Security Modelling		15	22	18	60		115
Outage Planning	10	12	11	12	32		77
Switching Instructions	22	16	14		8		60
Load Forecasting		12	5	9	31		57
Alarm & Event Mgmt		10	11	1	58		80
SCADA					79		79
Network Optimisation(load)		13	18	30	60		121
Trading Systems							
Load Mgmt (DSM)		3		43	54		100
Demand Forecasting		9		41	12		62
Energy Purchasing				66			66
Energy Trading				33	3		36
Energy Supply Costing		9		48	12		69
Energy Sales Contract Mgmt	2			15	18		35
Management Systems							
Work Planning (5 year)	25	33	34		15		107
Budgetting	9	23	30				62
Revenue Mgmt	17	4	14	7			42
Decision Support	33	15	24	21	29		122
Executive Information	42	17	27	21	26		133

Table 6

VALUE PROCESS : IS OPPORTUNITY MATRIX ANALYSIS
RANKED IS OPPORTUNITIES

IS OPPORTUNITIES	SUB-PROCESS SCORES						TOTAL
	E	C1 & C2	C3 &C4	D1,D2,D3	D4,D5,D6		
Plant & Circuits	13	54	24		66		157
Executive Information	42	17	27	21	26		133
Decision Support	33	15	24	21	29		122
Network Optimisation(load)		13	18	30	60		121
Network Security Modelling		15	22	18	60		115
Work Planning (5 year)	25	33	34		15		107
Load Mgmt (DSM)		3		43	54		100
Load Flow Analysis		15	13	24	42		94
Contract Management	40	27	21				88
Work Scheduling	31	12	42				85
Fault Mgmt	27	9	22	1	25		84
Project Mgmt	34	18	31				83
Alarm & Event Mgmt		10	11	1	58		80
SCADA					79		79
Stability		15	14	16	33		78
Maintenance Planning	14	24	39				77
Outage Planning	10	12	11	12	32		77
Materials Procurement	22	27	25				74
Work Control	28	25	21				74
GIS (AM/FM)	16	34	12		11		73
Loss Minimisation		15	4	13	39		71
Energy Supply Costing		9		48	12		69
Energy Purchasing				66			66
Human Resources Mgmt	19	16	30				65
Budgetting	9	23	30				62
Demand Forecasting		9		41	12		62
Materials Mgmt	28	7	25				60
Switching Instructions	22	16	14		8		60
Load Forecasting		12	5	9	31		57
Customer Information	12	18	6		15		51
Job Costing	19	9	18				46
Customer X-reference	11	15	4		12		42
Revenue Mgmt	17	4	14	7			42
LV Design	14	23	2				39
Network Design	14	23	2				39
Energy Trading				33	3		36
Energy Sales Contract Mgmt	2			15	18		35
New Customer Mgmt	6	21			3		30
Permit to Work	14	6	10				30
Document Mgmt	7	13	4				24
CAD	5	8	1				14

Table 7

			PROCESSES SUPPORTING EFFICIENCY											TOTAL
IS OPPORTUNITIES	C1	C2	C4	D1-3	D4-2	D4-3	D4-4	D4-5	D5-2	D5-4	D6	E2	E3	
Infrastructure Systems														
Plant & Circuits	30	24			9	9	3	9	9	3		6	4	106
Customer X-reference		15							3			6	4	28
GIS (AM/FM)	16	18							1	1		12	4	52
New Customer Mgmt		21										4	1	26
CAD	5	3										3	2	13
Document Mgmt	13											3	4	20
Customer Information		18							3			4	2	27
Work Systems														
Work Control	16	9	12									12	10	59
Job Costing		9	15									9	10	43
Work Scheduling		12	27									9	10	58
Human Resources Mgmt	4	12	15										4	35
Project Mgmt		18	24									12	10	64
Materials Procurement	15	12	12										4	43
Materials Mgmt	4	3	12									9	10	38
LV Design	14	9	1									1	4	29
Network Design	14	9	1									1	4	29
Permit to Work	6		1									1	4	12
Maintenance Planning	14	9	18									1	4	46
Contract Management	12	15	12									18	10	67
Engineering Systems														
Fault Mgmt		9	3				3	9	9	1		3	6	43
Load Flow Analysis		15	1	3	9		3		3		12			46
Loss Minimisation		15	1		9		3		3		9			40
Stability		15	1	3	9		3		3					34
Network Security Modelling		15	1	3	9		9	3	3	3	3			49
Outage Planning	3	9	1	3	3		9		1	3	3	3	1	39
Switching Instructions	4	12	1					3	1	3		18	4	46
Load Forecasting		12	1		3				1					17
Alarm & Event Mgmt	10		1				9		9	9	9			47
SCADA					3	9	9	9	9	9	3			51
Network Optimisation(load)		13		3	9		9		3	3	12			52
Trading Systems														
Load Mgmt (DSM)				9			9		3	3	27			51
Demand Forecasting				9							12			21
Energy Purchasing														
Energy Trading											3			3
Energy Supply Costing				9							12			21
Energy Sales Contract Mgmt											18		1	19
Management Systems														
Work Planning (5 year)	13	20	16						3			1	6	59
Budgetting		23	18										2	43
Revenue Mgmt		4	5									9	2	20
Decision Support	10	5	1	9			3	9	1		9	12	3	62
Executive Information	12	5	4	9				9	1		9	12	15	76

Table 8

VALUE PROCESS : IS OPPORTUNITY MATRIX ANALYSIS
RANKED IS OPPORTUNITIES

IS OPPORTUNITIES	C1	C2	C4	D1-3	D4-2	D4-3	D4-4	D4-5	D5-2	D5-4	D6	E2	E3	TOTAL
			PROCESSES SUPPORTING EFFICIENCY											
Plant & Circuits	30	24			9	9	3	9	9	3		6	4	106
Executive Information	12	5	4	9				9	1		9	12	15	76
Contract Management	12	15	12									18	10	67
Project Mgmt		18	24									12	10	64
Decision Support	10	5	1	9			3	9	1		9	12	3	62
Work Control	16	9	12									12	10	59
Work Planning (5 year)	13	20	16						3			1	6	59
Work Scheduling		12	27									9	10	58
GIS (AM/FM)	16	18							1	1		12	4	52
Network Optimisation(load)		13		3	9		9		3	3	12			52
Load Mgmt (DSM)				9			9		3	3	27			51
SCADA					3	9	9	9	9	9	3			51
Network Security Modelling		15	1	3	9		9	3	3	3	3			49
Alarm & Event Mgmt	10		1				9		9	9	9			47
Load Flow Analysis		15	1	3	9		3		3		12			46
Maintenance Planning	14	9	18									1	4	46
Switching Instructions	4	12	1					3	1	3		18	4	46
Budgetting		23	18										2	43
Fault Mgmt		9	3				3	9	9	1		3	6	43
Job Costing		9	15									9	10	43
Materials Procurement	15	12	12										4	43
Loss Minimisation		15	1		9		3		3		9			40
Outage Planning	3	9	1	3	3		9		1	3	3	3	1	39
Materials Mgmt	4	3	12									9	10	38
Human Resources Mgmt	4	12	15										4	35
Stability		15	1	3	9		3		3					34
LV Design	14	9	1									1	4	29
Network Design	14	9	1									1	4	29
Customer X-reference		15							3			6	4	28
Customer Information		18							3			4	2	27
New Customer Mgmt		21										4	1	26
Demand Forecasting				9							12			21
Energy Supply Costing				9							12			21
Document Mgmt	13											3	4	20
Revenue Mgmt		4	5									9	2	20
Energy Sales Contract Mgmt											18		1	19
Load Forecasting		12	1		3				1					17
CAD	5	3										3	2	13
Permit to Work	6		1									1	4	12
Energy Trading											3			3
Energy Purchasing														0

Table 9

	PROCESSES SUPPORTING EFFECTIVENESS												TOTAL
IS OPPORTUNITIES	C1-2	C3	C4	D1	D2	D4-1	D5-1	D6-2	E1	E3			
Infrastructure Systems													
Plant & Circuits	9	24				9	9		3	4			58
Customer X-reference		4					3		1	4			12
GIS (AM/FM)	3	12					3			4			22
New Customer Mgmt									1	1			2
CAD	3	1								2			6
Document Mgmt	9	4								4			17
Customer Information		6					9		6	2			23
Work Systems													
Work Control	3	9	12						6	10			40
Job Costing		3	15							10			28
Work Scheduling		15	27						12	10			64
Human Resources Mgmt	1	15	15						15	4			50
Project Mgmt		9	24						12	10			55
Materials Procurement	3	13	12						18	4			50
Materials Mgmt		13	12						9	10			44
LV Design	1	1	1						9	4			16
Network Design	1	1	1						9	4			16
Permit to Work	1	9	1						9	4			24
Maintenance Planning	1	23	18						9	4			55
Contract Management	3	9	12						12	10			46
Engineering Systems													
Fault Mgmt		19	3			3			18	6			49
Load Flow Analysis		12	1	6	6		9						34
Loss Minimisation		3	1	9	6		9						28
Stability		13	1	9	6	3	9						41
Network Security Modelling		21	1	9	6	3	9						49
Outage Planning		10	1	9			1		6	1			28
Switching Instructions	1	13	1				1			4			20
Load Forecasting		4	1				9						14
Alarm & Event Mgmt	3	10	1			9	3						26
SCADA						9	9						18
Network Optimisation(load)		18		9	12	3	9						51
Trading Systems													
Load Mgmt (DSM)				27	9		3	9					48
Demand Forecasting				27	2								29
Energy Purchasing				18	45								63
Energy Trading				6									6
Energy Supply Costing				15	18								33
Energy Sales Contract Mgmt				6					1	1			8
Management Systems													
Work Planning (5 year)	3	18	16				3		18	6			64
Budgetting		12	18						7	2			39
Revenue Mgmt		9	5		4				6	2			26
Decision Support	3	23	1	9	12		3	3	18	3			75
Executive Information	3	22	4	9	12		3	3	18	15			89

Table 10

VALUE PROCESS : IS OPPORTUNITY MATRIX ANALYSIS
RANKED IS OPPORTUNITIES

IS OPPORTUNITIES	C1-2	C3	C4	D1	D2	D4-1	D5-1	D6-2	E1	E3			TOTAL
		PROCESSES SUPPORTING EFFECTIVENESS											
Executive Information	3	22	4	9	12		3	3	18	15			89
Decision Support	3	23	1	9	12		3	3	18	3			75
Work Planning (5 year)	3	18	16				3		18	6			64
Work Scheduling		15	27						12	10			64
Energy Purchasing				18	45								63
Plant & Circuits	9	24				9	9		3	4			58
Maintenance Planning	1	23	18						9	4			55
Project Mgmt		9	24						12	10			55
Network Optimisation(load)		18		9	12	3	9						51
Human Resources Mgmt	1	15	15						15	4			50
Materials Procurement	3	13	12						18	4			50
Fault Mgmt		19	3			3			18	6			49
Network Security Modelling		21	1	9	6	3	9						49
Load Mgmt (DSM)				27	9		3	9					48
Contract Management	3	9	12						12	10			46
Materials Mgmt		13	12						9	10			44
Stability		13	1	9	6	3	9						41
Work Control	3	9	12						6	10			40
Budgetting		12	18						7	2			39
Load Flow Analysis		12	1	6	6		9						34
Energy Supply Costing				15	18								33
Demand Forecasting				27	2								29
Job Costing		3	15							10			28
Loss Minimisation		3	1	9	6		9						28
Outage Planning		10	1	9			1		6	1			28
Alarm & Event Mgmt	3	10	1			9	3						26
Revenue Mgmt		9	5		4				6	2			26
Permit to Work	1	9	1						9	4			24
Customer Information		6					9		6	2			23
GIS (AM/FM)	3	12					3			4			22
Switching Instructions	1	13	1				1			4			20
SCADA						9	9						18
Document Mgmt	9	4								4			17
LV Design	1	1	1						9	4			16
Network Design	1	1	1						9	4			16
Load Forecasting		4	1				9						14
Customer X-reference		4					3		1	4			12
Energy Sales Contract Mgmt				6					1	1			8
CAD	3	1								2			6
Energy Trading				6									6
New Customer Mgmt									1	1			2

Table 11

	PROCESSES SUPPORTING COMPETITIVENESS									TOTAL
IS OPPORTUNITIES	D1-3	D3	D4-6	D5-3	D6-2	E1-1	E1-2	E3-1	E3-2	
Infrastructure Systems										
Plant & Circuits			3	3		3		3		12
Customer X-reference			3	3		1		3		10
GIS (AM/FM)			3	3				3		9
New Customer Mgmt			3			1				4
CAD								1		1
Document Mgmt								1		1
Customer Information				3		3	3	1		10
Work Systems										
Work Control						3		9		12
Job Costing								9		9
Work Scheduling							3	9		12
Human Resources Mgmt						9	3	3		15
Project Mgmt						9		9		18
Materials Procurement						9	9	3		21
Materials Mgmt								9		9
LV Design						9		3		12
Network Design						9		3		12
Permit to Work								3		3
Maintenance Planning						9		3		12
Contract Management							9	9		18
Engineering Systems										
Fault Mgmt		1				9		3		13
Load Flow Analysis	3	9	3	3						18
Loss Minimisation		1	3	3						7
Stability	3	1	3	3						10
Network Security Modelling	3	3	9	9						24
Outage Planning	3	3	3	9		3				21
Switching Instructions								3		3
Load Forecasting		9	9	9						27
Alarm & Event Mgmt		1	9	1						11
SCADA			9	1						10
Network Optimisation(load)	3	9	3	9						24
Trading Systems										
Load Mgmt (DSM)	9	8		9	9					35
Demand Forecasting	9	12								21
Energy Purchasing		3								3
Energy Trading		27								27
Energy Supply Costing	9	15								24
Energy Sales Contract Mgmt		9				1				10
Management Systems										
Work Planning (5 year)				9		9		3		21
Budgetting						3	1	1		5
Revenue Mgmt		3					3	1		7
Decision Support	9		3	1	3		9	3		28
Executive Information	9		3	1	3	3	9	9	3	40

Table 12

VALUE PROCESS : IS OPPORTUNITY MATRIX ANALYSIS
RANKED IS OPPORTUNITIES

IS OPPORTUNITIES	PROCESSES SUPPORTING COMPETITIVENESS									TOTAL
	D1-3	D3	D4-6	D5-3	D6-2	E1-1	E1-2	E3-1	E3-2	
Executive Information	9		3	1	3	3	9	9	3	40
Load Mgmt (DSM)	9	8		9	9					35
Decision Support	9		3	1	3		9	3		28
Energy Trading		27								27
Load Forecasting		9	9	9						27
Energy Supply Costing	9	15								24
Network Optimisation(load)	3	9	3	9						24
Network Security Modelling	3	3	9	9						24
Demand Forecasting	9	12								21
Materials Procurement						9	9	3		21
Outage Planning	3	3	3	9		3				21
Work Planning (5 year)				9		9		3		21
Contract Management							9	9		18
Load Flow Analysis	3	9	3	3						18
Project Mgmt						9		9		18
Human Resources Mgmt						9	3	3		15
Fault Mgmt		1				9		3		13
LV Design						9		3		12
Maintenance Planning						9		3		12
Network Design						9		3		12
Plant & Circuits			3	3		3		3		12
Work Control						3		9		12
Work Scheduling							3	9		12
Alarm & Event Mgmt		1	9	1						11
Customer Information				3		3	3	1		10
Customer X-reference			3	3		1		3		10
Energy Sales Contract Mgmt		9				1				10
SCADA			9	1						10
Stability	3	1	3	3						10
GIS (AM/FM)			3	3				3		9
Job Costing								9		9
Materials Mgmt								9		9
Loss Minimisation		1	3	3						7
Revenue Mgmt		3					3	1		7
Budgetting						3	1	1		5
New Customer Mgmt			3			1				4
Energy Purchasing		3								3
Permit to Work								3		3
Switching Instructions								3		3
CAD								1		1
Document Mgmt								1		1

Table 13

Appendix 3 STRATEGIC ALIGNMENT OBJECTS

DISTRIBUTION ENGINEERING STRATEGIC ALIGNMENT OBJECTS

Using the theoretical structure of Strategic Alignment, the objects for Distribution Engineering's business strategy quadrant were identified as follows:-

1. Business Paradigm Characteristics

- External Regulations
- Devolution of ESKOM into a set of profit centred operations.
- Transmission is accepted as a natural monopoly.
- Independent Competitive Generation.
- Trading of Electricity in a Power Pool
- Creation of internal and multi-national Power Pools
- Extension of operations of municipalities such that they have responsibility for distribution to most end-users.
- Large end-users (municipalities and major industrial users) given access to the Power Pools
- Energy brokers emerge to act for small end-users in the Power Pool

2. Mission of Distribution Engineering

- To survive by focusing on becoming a bottom line driven "Wires Business" and integrating its operations with Transmission wherever it is appropriate in order to provide value added services to customers.

3. Business Strategies for Distribution Engineering

- Maximise efficiency of existing processes in the key business areas of network maintenance, network development and network control by cost reduction.
- Make the key business areas effective by adopting new processes.
- Develop and offer new products and services.
- From new alliances with other players in the electricity supply chain.

These four strategies have a dependency which requires that they are addressed and developed in the sequence listed above.

The descriptions in the following sections define the specific activities of each strategy element.

4. Critical Success Factors

The factors listed below relate specifically to each of the four strategy elements.

- 1. Efficiency Maximisation.

    - Productive hours of the labour force
    - Reduction in plant types on the network
    - Inventory cost
    - Work standardisation
    - Life cycle cost of the network
    - Organisation delayering
    - Reduction in the number of control rooms
    - Minutes lost per consumer
    - Network Losses
    - Telecontrol extensions
    - Voltage quality

    Note: The first six items relate to the network maintenance, the last six relate to network control.

- 2. Effectiveness.

    - Introduction of integrated work planning
    - Introduction of dynamic work scheduling
    - "Plan to Implementation" cycle time
    - Subcontracting capability
    - Network structure simplification
    - Introduction of condition-based maintenance
    - Introduction of devolution of control to the field.
    - Introduction of pro-active and pre-emptive network management
    - Introduction of Demand Side Management techniques

Note: The first six items relat to network maintenance and the last five relate to network control.

3. New Products and Services.

- Subcontracting work on the distribution network

- Introduction of trading and realtime pricing capabilities

- Use of demand side management techniques

- Winning of contracts to do work for customers

- 4. New Alliances

  - Capability to act as an energy trader on behalf of end-users.
  - Management of networks external to the organisation as a third party contractor.

    Note: This will be for both control and maintenance/construction

  - Integration with Transmission

  - Demand side management capability

Appendix 4 APPLICATION PACKAGE FUNCTIONALITY

APPLICATION PACKAGE FUNCTIONALITY

The six applications, which were identified as being of highest priority, were recommended for development by procurement of application packages. To enable evaluation and procurement of the right packages, including investigation of existing ESKOM IT capability, will require definition of the functionality which the packages must provide. This will require production of a Systems Requirement Specification document. This appendix contains a high level overview of this functionality in order to give guidance to the production of the requirements documents.

1. Plant and Circuits

There is little doubt that the Plant and Circuits application forms the heart of all Engineering computing in the Electricity Supply Industry. Historically each function had its own plant and circuits system, built specifically to support its own needs. These systems each containing a limited subset of the data pertinent to plant and circuits. Often there was overlap in these data subsets which led to serious inconsistencies and inaccuracies in the systems. Initial attempts to develop integrated Plant and Circuits Databases were hampered by the complexity of the data models and limitations of the database management software. Furthermore, as the plant and circuits database was primarily a data warehouse with little functionality of its own, they were difficult to cost justify, unless a total view across the whole of the Engineering function was taken.

Recent developments in IT, specifically object oriented analysis and design and applications networking, have removed the technology inhibitors and Plant and Circuits application packages have begun to emerge; from which a choice can be made. The areas of functionality which are essential are itemised below.

- asset data, including plant maintenance and modification history
- connectivity including a history of changes caused by switching
- network data including both geographic and schematic co-ordinates to enable interworking with GIS, AM/FM and control room display systems.
- plant and circuit typing data, including alternates
- performance data
- measurement data (from SCADA and other metering systems)
- other networks, not just load carrying (e.g. communications)

It is essential that the application can interwork with the real time control systems as well as the off-line network analysis and work management systems. Further considerations are that the volumes of data are large particularly when measurement data is being stored and that the usage profiles are disparate. Consequently one approach which should be considered is that Plant and Circuits is developed as a single virtual database which is implemented as a number of interworked physical systems. This would then require a layer of middleware which gave the user a homogenous view of the system, without needing to know where the physical data was stored.

2. Work Planning

The purpose of this application is to enable all work and investment to be planned and prioritised relative to itself. It has to be able to produce and maintain the master plan for all work and projects for up to 5 years into the future.

The plan is a list of work projects and programmes, described at a high level, which will be done on the network. It will have to cover all capital and revenue (operational) work, including maintenance, and should also have the capability to include non network investment such as vehicles, IT and equipment. The level of detail in the plan will increase as the time frame for doing the work becomes closer. For example, maintenance 5 years ahead will probably be no more than a budget sum, but 6 months ahead will have individual tasks identified. Similarly, for capital projects 5 years ahead will only identify the project and allocate a target expenditure, whereas a re-inforcement project planned to be done in the next 6 months will have been designed and costed.

The application will support the following functions:-

- long term network planning and development
- budget planning and preparation
- project prioritisation
- resource planning
- budget management prioritisation and re-allocation
- network usage optimisation

It is primarily a management and decision making tool which will enable the levels of control degrees of flexibility and effectiveness of planning to be significantly improved.

3. Integrated Work Management

The objective is to avoid the use of many different packages to carry out the functions of work management. However, that is not to suggest that a single work management package cannot be implemented many times, each implementation supporting a specific geographic area. This approach has significant control and scalability benefits, so scalability has to be a capability of any package considered.

Work Management packages tend to have their antecedants in either the construction of large infrastructures, such as oil rigs or power stations, or the maintenance of plant in a factory. Neither of these is particularly useful or relevant to the management of work carried out in small and large packets by a geographically dispersed organisation. Selection therefore must include an examination of the package's origins because a number of organisations who have purchased packages originally built to support factory plant maintenance or large constructions have subsequently encountered performance and tailoring problems.

The packages under consideration should have the following capabilities:

- support of all work types (maintenance, construction, inspection etc)
- support of capital and operation work
- a central database of work definitions and breakdowns (work library)
- the capability to handle outage and emergency work as well as planned work
- the capability to use and interwork with an external plant and circuit system
- the capability to support:-
    - work definition and construction
    - work monitoring and control (progressing)
    - work costing
    - resource management
    - skills allocation
    - work breakdown analysis
- the capability to interwork with human resources and payments systems.

The final essential capability is work scheduling. Work Scheduling is the capability to assign people, materials and equipment to tasks to ensure their optimum use and that the work is completed in the minimum time. Traditionally work scheduling has been a manual task where experience is the key skill. Whilst schedulers nomally produced a schedule of work which was near optimal it took time and couldn't be easily changed. New computer based schedulers enable schedules to be changed in a matter of seconds. Consequently, when a problem occurs the work affected can be re-scheduled to minimise delay and lost time. Modern scheduling software is based on expert system technology and so is frequently stand alone from the work management application. This means that it can be selected separately but this requires that it can be interworked with the work management package.

Further requirements of the work management package include:-

- integration with hand-held terminals and other data collection devices.

- integration with mapping systems and the ability to pass map based data to remote and mobile locations (for example lap top computers in vehicles).

- a capability to perform project and contract management tasks.

Finally, whilst today most maintenance is planned and scheduled on a time parameter this is likely to change. In the future maintenance will be subjected to a varity of policies. These include:

- usage based maintenance

- condition based maintenance

- fix on fail

- fix just before fail

All of these approaches have one thing in common. This is that the maintenance decision will require much more information concerning the network. In turn, this will require higher degrees of interworking with the SCADA and increased storage capability. Any package under consideration should have at least the capability to be extended to include support of these requirements.

4. Network Analysis

Network analysis is no longer just doing off-line load flow calculations. It is a whole set of calculations which investigate the network state including such things as stability, harmonics, protection co-ordination, voltage fluctuation and load growth as well as load analysis. Not only does it have to do these tasks but it has to do them to support a wider range of functions to cover control operations, planning and design. Therefore, it has to work in semi-real-time to off-line mode.

Coupled with this is the need to store results and input data which requires as a result integration with both plant and circuit and SCADA systems.

The basic algorithms which perform the calculations are well established and not likely to be significantly improved. Expert systems show some promise but have yet to emerge from the laboratory and show no signs of doing so in the near future. Consequently, packages need to be evaluated on other parameters. These include:

- interworking capability (primarily with SCADA and plant and circuits)

- shared data capability and shared usage (i.e. are they stand alone or multiple concurrent user?)

- degree of sophistication and capability of back end databases
- front end (GUI) format and overall usability
- integration with over functions such as network design
- capability of being used in both a control room and design office environment.
- ability to translate loads into cost and economic values.

5. Load Forecasting

Most packages sold as load forecasting software tend to be standard forecasting packages based on an ARIMA (auto regressive integrated moving average) algorithm, where the user is left to do all the tailoring to make them electricity specific.

It is unlikely, therefore, that a suitable off-the-shelf package will be found and ESKOM must be prepared to consider doing it themselves or teaming with a software house or academic institution who have the necessary skills.

In specifying a Load Forecasting application, the key areas are range, flexibility and usability.

Range is the ability to forecast for the whole network down to an individual feeder and from 30 minutes to many years ahead in time. The implication of this is the need for highly granular loads database held in the plant and circuit system.

Flexibility is the ability to cut and paste standard load curves into the input data stream, to adjust input data to iron out anomalies and to change weightings in the algorithms.

Usability is the ability to drive everything from a screen and work both on and off line. Additionally, it is the ability for the users to set up their own local databases in which they can store the input and output data of their own studies.

6. Fault Management

As with Load Forecasting, it is unlikely that a single package will be found. This is becuase fault management is the integration of a number of other applications linked through middleware and a common interface. The system requires to support the following capabilities:

- Customer Management - telephoning, call logging and progress monitoring.
- Alarm and Event handling
- Fault tracking

- Network analysis

- Fault resolution including escalation support:

    - switching programme definition

    - work scheduling and control

- Post Fault analysis

It can be seen from the above list that the required capabilities all exist in other applications. The system requires that they be interworked to provide the fault management capability.