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Towards a Taxonomy of Methods to Guide IT-Enabled Business Transformation Projects

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In partial fulfilment of the requirements of the degree of:
Master of Commerce (IS) by Coursework

50% Research Report

DECLARATION

I declare that this research report is my own unaided work except to the extent indicated by the acknowledgements, text and references. It is being submitted in partial fulfilment of the requirements for the degree of Master of Commerce (by coursework) in the Faculty of Commerce at the University of the Witwatersrand, Johannesburg.

This work has not been submitted for any degree or examination in any other university.

GIHunter
5 November 1998.

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ABBREVIATIONS

Abbreviation	Details
3-D	Three dimensional
ABC	Activity-Based Costing
AI	Artificial Intelligence
ANC	African National Congress
ARIS	Architecture of Integrated Information Systems
ASAP	Analytic Systems Automated Purchasing
BAD	Business Area Design
BNR	Business Network Redesign
BPR	Business Process Redesign
BSC	Balanced Score Card
BSR	Business Scope Redefinition
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CEO	Chief Executive Officer
CIO	Chief Information Officer
COO	Chief Operations Officer
CPO	Central Planning Office
CSAR	Central South African Railways
CX	Containers
DFD	Data Flow Diagrams
DVC	Desktop video conferencing
EC	Electronic Commerce
EDI	Electronic Data Interchange
EIS	Executive Information System
EMS	Electronic Meeting Systems
ERD	Entity Relationship Diagram
ETD	Education Training and Development
EW	Electronic Workplace
GLM	Global Logistics Management
GUI(s)	Graphic User Interface(s)
HR	Human Resources
HRA	Human Resources Architecture
HTML	Hypertext Mark-up Language
HTTP	Hypertext Transfer Protocol
IBM	International Business Machines
IDEF	Integrated Definition Methodology
II	Internal Integration
IP	Internet Protocol
IS	Information Systems
IT	Information Technology
ITA	Information Technology Architecture
JIT	Just in Time
JOO	Joint Operations Office

Abbreviation	Details
KBSI	Knowledge Based Systems
KPA	Key Performance Area
KPI	Key Performance Indicator
LAN	Local Area Network
LE	Local Exploitation
MA	Measurement Architecture
MAN	Metropolitan Area Network
MIT	Massachusetts Institute of Technology
MITI	(Japanese) Ministry of International Trade and Industry
MMOO	Multi-media MOO
MOO	M-U-D-Object Orientated
MUD(s)	Multi-user Domain(s)
MUI(s)	Multimedia User Interface(s)
NP	National Party
NQB	Next Quarters Business
NWB	Next Week's Business
NYB	Next Year's Business
OLAP	On-line Analytical Processing
OO	Object-orientated
PA	Process Architecture
PD	Process Development
PET	Performance Evaluation Tool
PGA	Programme Architecture
PRA	Physical Resources Architecture
R&D	Research and Development
RAD	Rapid Application Development
ROA	Return on Assets
ROAM	Return On Assets Managed
ROCE	Return On Capital Employed
ROI	Return on Investment
SA	Strategic Architecture
SAA	South African Airways
SAM	Strategic Alignment Model
SAR&H	South African Railway and Harbours
SATS	South African Transport Services
SDLC	Systems Development Life Cycle
SLA	Service Level Assessment
SMB	Spoornet Management Board
SNA	System Network Architecture
TCP	Transmission Control Protocol
TED	Total Electronic Distribution
US	United States
VRML	Virtual Reality Markup Language
VSATs	Very Small Aperture Terminals
WAN	Wide Area Network
WWW	World-Wide Web

ABSTRACT

This research report builds an IT-enabled business transformation architecture comprised of a strategic, measurement, information technology, human resource, physical resource and programme architecture. The business transformation architecture is then populated across five degrees of business transformation as defined by Venkatraman (1994:74). The population thereof demonstrates that for each degree of transformation a unique business transformation architecture exists. It is hypothesised that if all of these seven business transformation architectural dimensions are not addressed and aligned, it will cause discord and constrain the transformation of industrial age businesses to Internetworked businesses that could thrive in the age of networked intelligence (or information age). As such it represents a methodology for transformation, replete with examples, rationale, and a trajectory. As with all methodologies it is generic and it is therefore proposed that it be applied with prudence, and tailored to individual circumstances. The methodology also represents a framework for institutionalising the management of change in an organisation's structure and culture, which is an imperative for survival when the future is emergent and unpredictable. The underlying premise is that organisations, driven by information technology that is raising the minimum threshold of competition, are changing from command-and-control hierarchies of workers to empowered professionals in hyperarchies. Narrow, focused jobs are becoming boundaryless. Values and beliefs are changing from obedience and diligence to an institutionalised capacity for change. The old command-and–control computing, based on the mainframe with peripherals in a hierarchy is changing to suit the new global, molecular networked organisation. The new IT architecture is client/server, object orientated and internetworked. It is proposed that every company mentally deconstruct itself, and with cognisance of the implications shown in the taxonomy decide what degree of transformation is appropriate, and then plot a suitable transformation trajectory thereon.

Keywords

IT-enabled business transformation, business process re-design, programme of projects, degrees of transformation, business architecture alignment, transformation trajectory, deconstruction, competency creation, internetworked, virtual, information age puppeteer.

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction

Management in the 1990s Research Programme (Scott Morton 1991:17) found that all successful organisations in the 1990s will have to transform to take advantage of the unique opportunities presented by the environment and information technology (IT). There is a plethora of literature documenting case studies, approaches, risks and critical success factors of re-engineering, for example, in the Business Process Management Journal (MCB University Press 1997:1-108). Yet reengineering is in trouble with reports of up to seventy percent of projects falling disappointingly short of target (Hammer & Champy 1993:200; McFarlan & Nolan 1995:16). Because of this, Holtham (1994:61) predicted that it would fall into disrepute and disuse between 1996 and 1998. This research will explore current methodologies used, in order to discover a useful taxonomy of methodologies, which will contribute to the successful implementation of IT-enabled business transformation[1] projects.

1.2 Background

In his seminal article Drucker (1988:53) maintains:

> *"Now we are entering a third period of change: the shift from the command-and-control organisation, the organisation of departments and divisions, to the information-based organisation, the organisation of knowledge specialists".*

Drucker (1992:96) contends that if history is any guide, this transformation will not be completed until 2010 or 2020. The key issue for managing information systems/information technology (IS/IT) in the organisational context for the next decade and beyond is how to enable this information revolution (Hamel & Prahalad 1994:29). Much of what will emerge during this information revolution is unpredictable, therefore in order to survive organisations must build the management of change into its structure and culture (Drucker 1992:97; Davenport 1993:95-113; Hammer 1996:212; De Geus 1997:51-59).

Large investments in information technology have yielded disappointing results because organisations have used IT to automate or mechanise existing processes. In order to obtain advantage from information technology, processes within and between organisations should be fundamentally reshaped by exploiting the power of modern IT (Davenport and Short 1990:11; Hammer 1990:104; Davenport 1993:11; Hammer and Champy 1993:83; Gouillart & Kelly 1995:215). Short & Venkatraman (1992:7) take the concept further by encouraging organisations to consider the rôle of information, not only in their own

Notes:
1 Change of form.

organisation, but in the whole industry value chain; a holistic view. The role of IS is to identify ways in which technology may create competitive advantage or spawn new business.
Hammer (1996:xiii) opines:

> *"Everything that has been learned in the twentieth century about enterprises applies only to task-oriented organisations. For a world of process-centred organisations, everything must be rethought".*

Other researchers (Tapscott 1996:318; Benhamou 1994:191), highlight the fact that the application of IT will change the character of institutions, governance, rules, social structures and cultures. They assert that, out of self-interest businesses will have to provide leadership for all these changes, for if the information society is to work, it must enhance individuals' lives.

1.3 Conditions Necessary for Success of IT-Enabled Transformation Projects

Before starting a transformation a business must clarify its motives and scope (Coulson-Thomas 1994:5). The literature provides different approaches, but each assumes a generic approach for all degrees of IT-enabled transformation as defined by Venkatraman (1994:74-84). Successful re-engineering requires a clear methodology (Ahmed & Simintiras 1996:87). In terms of concepts and methodologies Choi & Chan (1997:42) found that the critical conditions necessary for success are to understand and clarify the concepts, select an appropriate approach, conduct change management and proper project management. Therefore, if management understands and classifies what they are trying to achieve, and then consistently applies appropriate methods, it will contribute to the success of the project. Hope & Hope (1997:216-217) describe this as follows:

> *".....managers cannot simply cherry-pick items from the third wave menu and put them into their existing second wave mixing bowl.....each cake has its own unique recipe.....tinkering around with the existing recipe will only result in a tasteless cake or one that fails to rise".*

1.4 Possible Reasons for Poor Performance of Transformation Projects

A review of case studies, such as Baxter's Analytic Systems Automated Purchasing (ASAP) (Short & Venkatraman 1992:7-19), CIGNA (Caron, Jarvenpaa & Stoddard 1994:233-249) and American Airlines SABRE Computer Reservation System (Hopper 1990:118-125), indicates that they never planned a transformational trajectory, but innovated as they learnt. Venkatraman (1994:73-86) has now furnished us with a transformation trajectory, but no comprehensive blueprint of how to implement this strategy exists. The reasons revealed in the literature (Hammer & Champy 1993:200-213; Pellegrinelli & Bowman 1994:126; Peppard & Rowland 1995:235-245) that IT-enabled business transformation projects are falling short of their target can be summarised as follows:

1. Whilst thinking they are doing radical transformation, management are in fact only implementing incremental improvement.
2. Strategic radical transformation slips back to incremental improvement during implementation.
3. Top management is failing to give the transformation project the necessary priority.
4. The maze of diverse, piecemeal literature, and lack of comprehensive and simple guidelines for implementation, leave project managers to innovate the methodology. This results in a lack of congruency between strategy, programme, measurement, process, technology, and human and physical resources.

1.5 Aim of the Research

An in-depth review of current and relevant literature will be made. The information attained will be synthesised and from this and my own insights gleaned in Spoornet, a concise taxonomy will be developed which will serve to:

1. Assist management in clarifying "what" degree of IT-enabled business transformation, as defined by Venkatraman (1994:73-86), they are trying to perform.
2. Assist management in plotting a trajectory to achieve this business transformation.
3. Provide management with a road map for the implementation of the transformation - the "how", which maintains congruency between strategy, programme, measurement, process, technology, human and physical resources.
4. Identify under-developed areas (where pitfalls are) in IT-enabled business transformation for future research.

1.6 Importance of the Research

In a survey conducted in 1992 (Galliers, Merali & Spearing 1994:50), in which respondents were asked to rank IS issues as they expected them to be in 1997, Business Process Redesign (BPR) (a degree of organisational transformation) was ranked fifth in terms of importance, and second in terms of problematic. In a survey conducted in South Africa in 1997 on key IT issues by the University of The Witwatersrand, Johannesburg, Master of Commerce (IS), 1997 class, Facilitating and Managing Organisational Transformation was ranked seventh (1997:1). The advent of the information age has made organisational transformation inevitable. The better this transformation can be managed, the less traumatic the impact on society will be. This taxonomy will assist organisations in classifying and applying an appropriate approach to transformations. As a simple communication mechanism it will also assist change agents in aligning all parties.

1.7 Plan and Organisation of the Research

The research is organised as follows:

- **Chapter one**
  Presents the case that the transformation of businesses to benefit from information technology is imperative for their survival. It highlights the problem that, notwithstanding a plethora of literature on the subject, the success rate of business transformation is dreadfully poor. It motivates that a simple taxonomy of methods will contribute to the successful implementation of IT-enabled business transformation projects.

- **Chapter two**
  Reviews the literature. The argument in this chapter unfolds in three steps. The first step develops a model that identifies and classifies the architectural components of IT-enabled business transformation. The second step introduces Venkatraman's (1994:74) five degrees of IT-enabled business transformation model. The third step populates the seven architectural components of the IT-enabled business transformation model, synthesised from current literature, across each of the five degrees of IT-enabled business transformation. This forms the taxonomy. Finally the seven taxonomies are synthesised into one principle taxonomy.

- **Chapter three**
  Presents the research methodology that includes the research unit of analysis, the samples, the data collection and data analysis methods and discusses triangulation.

- **Chapter four**
  Presents and analyses the results of the data collection.

- **Chapter five**
  Interprets the converged results of the data analysis.

- **Chapter six**
  Contains the findings of the research, describes the limitations and details recommendations for future research. It discusses whether the ultimate goal of this research, to provide guidelines for management and academia that will contribute to the successful implementation of IT-enabled business transformation projects, has been met.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Chapter one discussed why there is a need for this type of research. It also highlighted the plethora of literature addressing this issue. This chapter aims to discuss the literature in a critical light. As such the chapter is divided in to ten sections, each examining a different element of the literature, i.e. it is organised as follows:

Section 2.2. Defines transformation.
Section 2.3. Introduces the frameworks used for the taxonomy of IT-enabled business transformation.
Section 2.4. Identifies the issues to be addressed in the business strategic architecture[2] and describes their characteristics across the five degrees[3] of IT-enabled transformation.
Section 2.5. Identifies the issues to be addressed in the business programme architecture and describes their characteristics across the five degrees of IT-enabled transformation.
Section 2.6. Identifies the issues to be addressed in the business measurement architecture and describes their characteristics across the five degrees of IT-enabled transformation.
Section 2.7. Identifies the issues to be addressed in the business process architecture and describes their characteristics across the five degrees of IT-enabled business transformation.
Section 2.8. Identifies the issues to be addressed in the IT architecture and describes their characteristics across the five degrees of IT-enabled business transformation.
Section 2.9. Identifies the issues to be addressed in the HR architecture and describes their characteristics across the five degrees of IT-enabled business transformation.
Section 2.10. Identifies the issues to be addressed in the physical resources architecture and describes their characteristics the five degrees of IT-enabled business transformation.
Section 2.11. Discusses the complete IT-enabled business transformation architecture and synthesises the individual taxonomies in to one congruent principal taxonomy.

2.2 Definition of Transformation

Organisations appear to go through three stages as they attempt to respond to their changing environments; automate, informate, and transformation (Scott Morton 1991:16). The advent of computers placed the focus of IT on automating for efficiency (Hammer 1990:104; Remenyi *et al* 1995:2).

Notes:
2 Art or science of building.
3 Level in ascending process.

From 1970 to 1980 the focus changed to effectiveness by informating through the research of Zuboff (1988:391). Since the late 1970s the focus changed to transformating the function of the actual business. Gouillart & Kelly (1995:7), who believe business transformation is now the primary management challenge, define business transformation as:

> *"The orchestrated redesign of the genetic architecture of the corporation, achieved by working simultaneously - although at different speeds - along the four dimensions of Reframing, Restructuring, Revitalisation and Renewal".*

Reframing refers to a shift of the business's conception of what it is. **Restructuring** considers the organisational structure in support of new processes. **Revitalisation** means new growth, and renewal deals with regenerating the spirit of the business. The fundamental difference between the re-engineering and transformation approaches, is the transformation emphasis on growth. For the purposes of this research, transformation is defined as:

> *"The alignment of measurement, process, IT, human and physical resource architectures, in various degrees, to changes in strategy by means of a programme of projects".*

2.3 Introduction to the Frameworks used for the Taxonomy

2.3.1 Introduction to Existing Frameworks and Methodologies

Tapscott (1996:28) asserts:

> *"The starting point for transformation should not be the business process, but the business model – the high-level abstraction of how the business can respond to and create markets, of what the business is and could be. The new economy demands that companies change their business model, and the new technology enables it".*

A number of business frameworks have already been proposed (see appendix A). The MIT90's Strategic Alignment Model (SAM) (Venkatraman 1991:155) addresses business strategy, organisational infrastructure and process, information technology strategy, and information systems' infrastructure and process. Cash *et al* (1994:455) propose a model addressing organisation, control and culture, with people, information, and technology in the centre. Gouillart & Kelly (1995:6) propose a four-part framework consisting of reframing the company's conception of what it is, restructuring the corporate body, revitalising the company's relationship to the competitive environment and renewing the spirit of the individuals. Bainbridge (1996:43) provides a model that resembles the architecture proposed in this dissertation, but without the measurement module or any of the detailed sub-headings. Scheer (1994:13) proposes the Architecture of Integrated Information Systems (ARIS) model with four views, organisation, data, function and control. This is a comprehensive methodology, but is focused on the functional areas of an industrial firm (Scheer 1994:IX). The literature discussing

these frameworks does not provide any guidelines as to how the methods will change across the five degrees of IT-enabled business transformation as defined by Venkatraman (1994:73-86). This research will clarify the difference in methods that needs to be applied depending on the degree of IT-enabled business transformation desired, by deriving a framework that cross-relates the five degrees of IT-enabled transformation with the architectural components.

As a basis for building onto and integrating world best practice the steps of fourteen representative IT-enabled transformation/re-engineering methodologies are depicted in appendix II. Manganelli & Klein (1994:265–281) furnish the most detailed methodology replete with templates. Gouillart & Kelly's (1995:6–14) approach with its reframing, restructuring, revitalisation and renewal components is, however, the most comprehensive. Davenport's (1993:25) methodology lacks a section on creating the environment or awakening, which is covered best by Tichy & Sherman (1995:331–374) in their interpretation of the successful transformation at General Electric under the leadership of Jack Welch. Peppard & Rowland (1995:211–226) have synthesised all available concepts into a concise methodology and have a most comprehensive section on how physical resource architectures should be addressed. It, however, lacks some of the insights of Gouillart & Kelly's (1995:6–14) approach and omits some ideas, such as creating new businesses. Cash *et al* (1994:414) are the only ones to encourage incremental continuous innovations (using American Hospital Supplies, now Baxter's, legendary ASAP System as an example) and advance four key processes to create such a climate. The rest are fundamentally lesser versions of the aforementioned methodologies. Still more methodologies, such as those suggested by Choi & Chan (1997:54) and Zairi (1997:71), do exist, but they do not represent a significant departure from those shown above.

2.3.2 The IT-Enabled Business Transformation Architecture

The first framework to be used for the taxonomy addresses all the architectural components of an IT-enabled business transformation. Five of the architectural components of the framework are based on the Purdue Enterprise Reference Architecture (Williams 1994:143). The term "architecture" is used because in the words of Hamel and Prahalad (1994:117):

> *"An architect must be capable of dreaming of things not yet created.....but an architect must also be capable of producing a blueprint for how to turn the dream into reality".*

The Purdue Enterprise Reference Architecture does not have a process architecture, but a definition layer with a functional view. The Integrated Definition Methodology (IDEF) principles are, therefore, supplanted into the definition layer of the Purdue Enterprise Reference Architecture to enforce the process view and re-engineering approach. The IDEF methodology defines controls that govern processes utilising mechanisms (Miers 1994:147). The controls (or measures, which is a more acceptable term to empowered workers) are determined by the

strategic architecture. Since the selection and implementation of appropriate measures is critical to the successful implementation of strategy, they are separated into a "measurement architecture" to elevate their importance and attain the necessary focus. As stated by Kaplan & Norton (1992:71):

"What you measure is what you get".

Kaplan & Norton (1993:134) advance the "balanced score card" as a comprehensive framework that translates a company's strategic objectives into a coherent set of performance measures. They assert that it can motivate breakthrough improvements in product, process, customer, and market development. The "measurement architecture" governs the business processes that, in turn, prescribes how work is done utilising information, human and physical resources.

The "programme architecture", which is a critical element to achieve success (Pellegrinelli & Bowman 1994:129), is included in the framework. Cash *et al* (1994:409) advise that the stimulus for, and scope of change are important determinants of who will participate at what levels and phases. This comprises the "programme architecture". The model is depicted in figure 1.

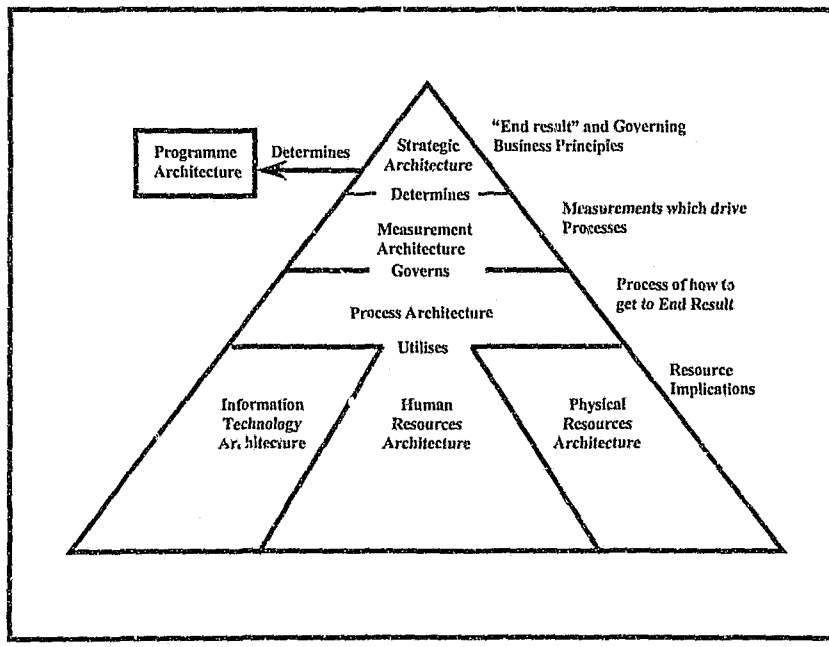


Figure 1: IT-Enabled Business Transformation Architecture
Derived from: The Purdue Enterprise Reference Architecture (Williams 1994:143), the Balanced Score Card (Kaplan and Norton 1993:134), IDEF (Miers 1994:147) and Implementing Strategy through Projects (Pellegrinelli & Bowman 1994:129)

2.3.3 *Five Degrees of IT-Enabled Business Transformation*

The second framework to be used for the taxonomy is Venkatraman's (1994:74) five degrees of IT-enabled business transformation. Venkatraman (1994:73) introduces the view that IT has become a fundamental enabler and presents us with a transformational trajectory consisting of five degrees of IT-enabled business transformation based on two dimensions; the range of IT's potential benefits and the degree of organisational transformation. Figure 2 illustrates this concept.

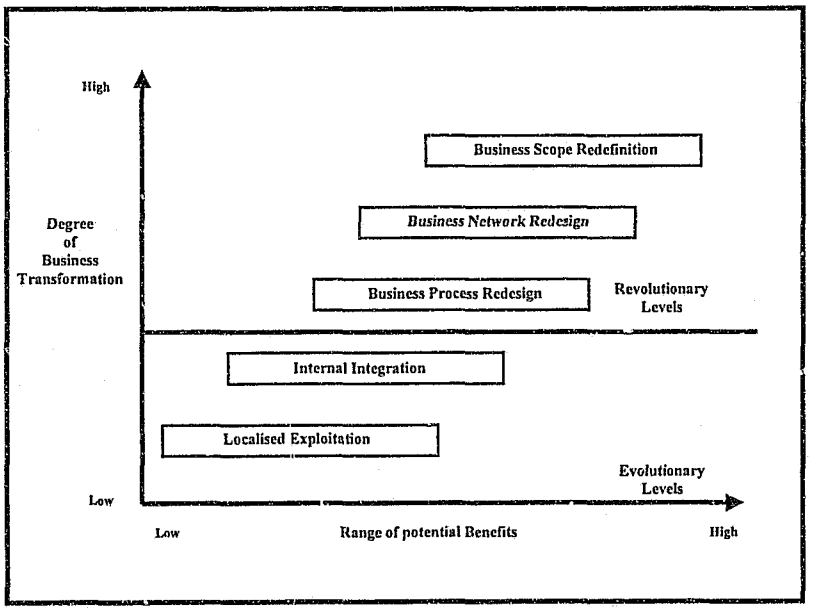


Figure 2: Five Degrees of IT-Enabled Business Transformation
Source: Venkatraman (1994:74).

The first level is localised exploitation by decentralised, functional, operational managers. The second level involves two types of integration, technical interconnectivity and business process independence. The third level is the fundamental redesign of business processes to exploit IT. The fourth level is the redesign of the nature of exchange among multiple business partners through IT. The fifth level is the IT-enabled redefinition of business scope. The first two levels are considered "evolutionary" and the last three "revolutionary". The "evolutionary" levels require relatively incremental changes in the business processes to exploit IT capabilities, while the three "revolutionary" levels require radical changes in business practices. The framework is based on the premise that IT's potential benefits are directly related to the degree of change in organisational routines (strategies, structure, processes, and skills) (Venkatraman 1994:84).

2.3.4 *Taxonomy of Architectures Across five Degrees of IT-Enabled Business Transformation*

Developing a comprehensive methodology within each architecture, and showing how the methods vary across the five degrees of the IT-enabled business transformation spectrum, will yield a comprehensive classification of current literature, and also show where there are gaps. The framework for the taxonomy is shown in figure 3.

Architecture	Degree of IT-Enabled Business Transformation				
	Evolutionary Degrees		Revolutionary Degrees		
	Local Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
Strategic Architecture					
Programme Architecture					
Measurement Architecture					
Process Architecture					
IT Architecture					
HR Architecture					
Physical Resource Architecture					

Figure 3: Framework for Taxonomy of Architectures through Five Degrees of IT-Enabled Business Transformation

2.3.5 *IT-Enabled Business Transformation Methodology*

Venkatraman (1994:74) underscores that the levels are not conceptualised as stages of evolution because effective strategies do not follow any one prescribed model of evolutionary stages. He advises that each organisation should first identify the transformational level where the benefits are in line with the potential costs of the needed organisational changes. If a business intends re-engineering its processes exploiting IT for quantum gains then it should not waste time and money embedding existing industrial age processes (Venkatraman 1991:138; Duimering, Safayeni & Purdy 1993:47-56) in silicone, only to re-do all systems later to support a new process. Furthermore, a business should not embark on business process re-engineering without first contemplating its future information age business vision, and how it will need to re-engineer its business network and targeted industry and then ensure the current processes are re-engineered to support the future vision. If this is not done, each degree of transformation may require a complete re-engineering of existing processes, and the IT, HR and

physical architectures it supports. The transformation trajectory is from left to right, horizontally, across the taxonomy. The methodology per transformation degree, is vertical as depicted in figure 4.

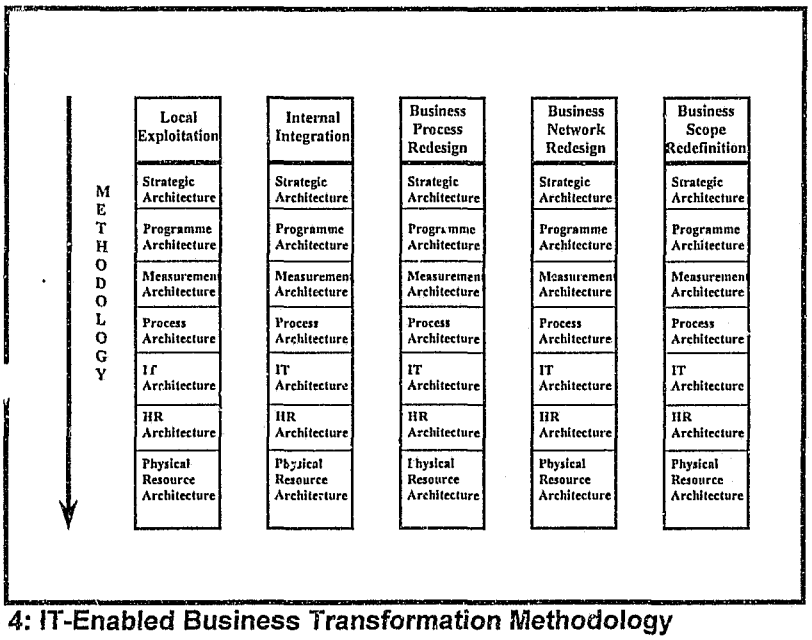


Figure 4: IT-Enabled Business Transformation Methodology

Should a business not align the seven vertical architectures, it runs the risk of creating a mal-aligned company, where each architecture directly opposes or negates what the other is striving to achieve. In this manner a company could defeat itself, without any help from competitors. Essentially this is what happened to Wespac, its architectures went out of synchronisation. As Pine II *et al* (1993:114) assert:

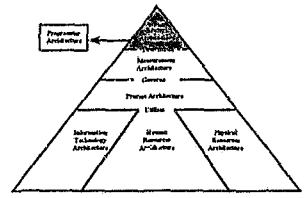
> *"The challenges of automating inflexible processes, building on ossified products, and trying to create a fluid network within a hierarchical organisation, particularly at a time when the company was in poor financial condition due to intensifying competition in depressed markets, proved too difficult".*

2.3.6 Summary

Six architectures that cumulatively comprise one business architecture have been identified. The business architecture plus the programme architecture comprises an IT-enabled business transformation architecture. The IT-enabled business transformation architecture projected across the "transformation trajectory" will now be populated to derive thirty-five distinct architectures, each of which can be identified as falling into one of the five transformation trajectory degrees. Should all the architectures not fall into the same transformation trajectory degree, then

this may serve to identify mal-alignment. If a vision stretching through all five degrees of transformation has not been articulated, and a course plotted to arrive there, then companies should question if they can remain as they are and survive in the information or age of networked intelligence as defined by Tapscott (1996:26). The following sections will examine the elements of the strategic, programme, measurement, process, IT, HR and physical resource architectures.

2.4 Strategic Architecture



2.4.1 Introduction

Re-engineering efforts undertaken without reference to strategic goals and objectives have no direction, exist for their own sake, and much effort is expended with very few results (Peppard & Rowland 1995:243). The strategic architecture determines the measurement architecture that governs the process that in turn utilises IT, HR and physical resources. This section discusses the elements of the strategic architecture across the transformation trajectory.

2.4.2 Mobilisation

Several authors advance creating the need to change as the first step in the strategic architecture (Tichy & Sherman 1995:331; Gouillart & Kelly 1995:9; Hammer & Champy 1993:149). In order to awaken the need to change, to break the inertia or natural resistance to change, management may have to create a burning platform, or feeling of urgency. In the words of Tichy & Sherman (1995:331):

> *"The protagonists have to shake up the status quo enough to release the emotional energy for the revolution".*

They state there are three types of resistance:

- technical resistance; all the rational reasons for resisting change,
- political resistance; the response to the disruption of the existing power structures, and
- cultural resistance; the mindsets, blinders and anchors that keep people in the past.

In order to break the resistance and obtain "buy-in" management will have to articulate and communicate the rationale for the degree of transformation they wish to undertake. The focus of the rationale across the transformation trajectory is as follows (Venkatraman 1991:128–150):

1. Local Exploitation (LE).	Define rationale for firm specific areas for exploitation.
2. Internal Integration (II).	Articulate the logic for technological and organisational integration.

3. Business Process Redesign (BPR).	Define rationale for strategy and IT alignment.
4. Business Network Redesign (BNR).	Articulate the logic of network redesign for the focal firm.
5. Business Scope Redefinition (BSR).	Identification of new scope of business.

2.4.3 Vision

Once mobilisation has been achieved the next step is to create a vision for the business that matches the degree of transformation sought. The ability to create a shared picture of the future one seeks to create, building a shared vision, is the one step on which most researchers concur (Senge 1990:9; Keen 1991a:26; Hammer & Champy 1993:149; Davenport 1993:117; Tichy & Sherman 1995:339; Champy 1995:113; Gouillart & Kelly 1995:10). Only Hamel & Prahalad (1994:83) prefer the word "foresight" to emphasise that it should not be fantastical, but an amalgam of many individual perspectives. Tichy & Sherman (1995:341) warn that envisioning must include an assessment of current reality. Visions are company specific, but a correlation exists between the competencies required for the degree of transformation sought. The following five competencies could assist management in forging an appropriate vision for the degree of transformation sought:

- **Operational Excellence, Product Leadership and Customer Intimacy**
  There are fundamentally three paths to market leadership. A business should attain world class best practice standards at these which are: operational excellence; product leadership and customer intimacy; and then strive to be the best at one (Treacy & Wiersma 1993:84-93). These three paths approximate Venkatraman's (1991:127-139) transformation trajectory objectives of efficiency, efficiency and effectiveness and differentiation (or cut out intermediaries). Using the three pathways as a transformation trajectory is not to say businesses must excel at these, but at least attain a minimum threshold.

- **Mass Customisation**
  Customer intimacy strategies continually tailor and shape products and services to fit an increasingly fine definition of the customer to build customer loyalty for the future focusing on lifetime value (CSC Foundation 1994:2-3). This competitive dictum still subscribes to the either/or dichotomy of providing large volumes of standardised goods or services at a low cost, or to make customised products in smaller quantities at a high cost.

  Many firms such as Motorola, Bell Atlantic, United Services Automobile Association, TWA Getaway Vacations, and Hallmark have taken this a step further by achieving low costs, high quality, highly varied, often individually customised products. This is the mass customisation model. IT has enabled this by facilitating a linkage system that can bring together whatever modules are necessary; instantly, costlessly, seamlessly, and frictionlessly (Pine II *et al* 1993:111; Parker 1996:92-111). Tapscott (1996:85) calls this the "virtual

corporation". He argues that instead of staffing up, companies blend their competencies with a series of ever-changing alliances to achieve competitive success. Under these conditions, he asserts, the traditional value chain becomes a value network and value added becomes value-generative. Since mass customisation is the operational opposite of mass production, it would be more appropriate to call this mass customer intimacy. For understanding it may be advantageous to retain already accepted terminology.

- **Internetworked Brand**
  In the aforementioned loose network organisation, necessary to make mass-customisation work, Evans & Wurster (1997:80-82) predict that customers' switching costs will drop, and companies will have to develop new ways of generating customer loyalty. They also predict that new branding opportunities will emerge for third parties that neither produce a product nor deliver a primary service. Peters (1997:18) states that this is the great age of "the brand" using Nike, Microsoft and Intel amongst others as examples. As Hamel & Prahalad (1994:231) explain, Nike does not make the shoes that bear its famous name. The manufacturing is outsourced to China, Singapore and the Philipines: Nike are now redefining the scope of their business using that famous brand name to sell apparel and sponsor events from soccer to golf tournaments (Hamel 1997:24). Dell Computers (Magretta 1998:74-82) is another virtually integrated company whose brand represents the most efficient and effective way for customers to buy Intel or Microsoft technologies. They are also redefining the scope of their business using their brand to evolve into a technology selector, or navigator. Tapscott (1996:55) calls this the "internetworked enterprise" and states it will be a far-reaching extension of the virtual corporation because it will have access to external business partners, constantly reconfigure external relationships, and dramatically increase outsourcing. Hope & Hope (1997:100) call this a constellation of independent suppliers. Tapscott (1996:54) asserts:

    > *"The new economy is a networked economy, integrating molecules into clusters that network with others for the creation of wealth".*

  In order to encapsulate the two concepts of internetworking and branding this will be referred to as the "internetworked brand". The rationale for highlighting "brand" is that in a global networked economy, without a brand a business will often be reduced to one of many global internetworked commodity suppliers, competing on price. These predictions seem to be substantiating Davis & Davidson's (1991:128) premise that businesses must redefine themselves once they have reached a design limit, if they want to grow.

The focus of the vision across the transformation trajectory is therefore as follows:

1. LE. Operational excellence (mass production).
2. II. Product leadership.
3. BPR. Customer intimacy.
4. BNR. Mass customisation (mass customer intimacy).
5. BSR. Internetworked brand.

2.4.4 *Objectives and Scenarios*

In order to build an imagined sequence of future events scenarios need to be used to create new mental models, a mindshift (Senge 1990:8-13). The following are examples of appropriate illustrative cases of how other companies achieved the objectives sought for each degree of transformation:

- **Efficiency**
  Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) are illustrative cases for achieving efficiency benefits (Venkatraman 1991:128).

- **Efficiency and Effectiveness**
  The digitised receipt of tax return data by the Internal Revenue Service in the United States of America (US) and concomitant value-added services (Venkatraman & Kambil 1991:33–43; Venkatraman 1991:134) is an illustrative case in achieving efficiency and effectiveness.

- **Cut Intermediaries Out**
  Batterymarch Financial Management Corporation, with its totally redesigned processes exploiting IT and a seventy-seven percent lower staff than industry average, is an illustrative case of market differentiation (Venkatraman 1991:138).

  The development of the Boeing 777, the first aircraft to be designed without physical models and blueprints, by customers and suppliers on a workgroup design system, is another illustrative case for this level of transformation (Tapscott 1996:81). Besides providing opportunities for differentiation, business process redesign, when extended beyond the company borders, also begins to cut out intermediaries such as brokers as agents.

- **Hook Customers in to Value-added Services**
  Baxter's ASAP (Short & Venkatraman 1992:7–19; Venkatraman 1991:142-152) which supplies seventy percent of hospital supplies to more than 5000 hospitals nation-wide in the United States of America (US) through proprietary linkage is an illustrative case of hooking customers into value added services.

  CIGNA's Total Electronic Distribution (TED) system (Venkatraman 1991:142; Caron, Jarvenpaa and Stoddard 1994:233-249) which integrates with agents to respond on policy quotes is another illustrative case of hooking customers into value-added services

  Wal-Mart and Target Stores (US) are examples of companies extending their network to their suppliers to achieve just-in-time delivery (Tapscott 1996:85).

- **Redefine Raison d'être**
  The legendary American Airlines SABRE System (Hopper 1990:118-125), who accepted several cohosts and OTISLINE who extended their service to non OTIS elevators (Venkatraman 1991:148) are illustrative examples of identification of new scope of business.

McKesson Economost System (Clemons & Row 1988; Venkatraman 1991:148, Hardaker, 1995: 197) who added third party claims and credit card facilities to their order processsing system is another example.

More recent examples are GE's "Direct Connect" system offering finance and next day delivery, and Levi's Personal Pair Jeans. A woman can now go into a store, be measured by a clerk who feeds the information into a touch screen. The data is transferred via the Internet, using Lotus Notes, to various other companies who do the cutting, stitching and washing and the jeans are delivered within three weeks by Federal Express to the customer. The infostructure that supports this was created by, and belongs to, Custom Clothing Technology. Soon this service will be available on Levi's Home Page (Tapscott: 1996:92).

Amazon Bookstore was a corner bookstore before it created http://www.Amazon.com on the Internet. Now it offers 2.5 million books, ten times more than that of the largest chain store. It carries very little inventory and orders primarily from two industry wholesalers in response to customers' requests. Books are delivered anywhere in the world in between four and ten days by Federal Express, UPS or DHL. It has superior information and lower physical costs than the traditional store (Evans & Wurster 1997:80-81).

Encyclopaedia Britannica published the best-selling encyclopaedias in the world for more than 200 years before being nearly bankrupted by Microsoft Encarta and Grolier who published encyclopaedias on CD-ROM. Britannica responded by creating Britannica On-Line, putting its encyclopaedia on the Internet with hotlinks to related sites effectively becoming a directory to all human knowledge electronic stored anywhere in the world (Tapscott 1996:77–78).

The objectives followed by their supporting scenarios across the transformation trajectory are therefore as follows:

1.	LE.	Efficiency:	CAD and CAM.
2.	II.	Efficiency and effectiveness:	Digitised receipt of tax returns.
3.	BPR.	Cut intermediaries out:	Batterymarch financial management corporation and Boeing.
4.	BNR.	Hook customers in to value-added services:	Baxter ASAP system, CIGNA TED system, Wal-mart and Target Stores.
5.	BSR.	Redefine raison d'être:	American Airlines SABRE system, Mckesson's Economost system, Otis Elevator OTISLINE system, GE's

Direct Connect system, Levi Strauss Personal Pair, Amazon.com, Brittanica On-Line, Dell Technology Navigator and Nike.

2.4.5 Scope and Benchmarking

It is important to determine the scope of the change effort so that management knows what they are letting themselves in for (Benjamin & Levinson 1993:29). The scope is also important to determine the programme architecture and can be used to determine the scope of benchmarking. Enterprises undertaking process development should seek out best practices and benchmark with other comparable enterprises to break a business' inwardly focused mindset and help formulate objectives (Davenport 1993:125; Magee *et al* 1997:1). Hammer (1996:199) emphasises the importance of benchmarking by asserting that a business must be number one or two, world class in its processes, or they are candidates for out-sourcing.

The scope across the Transformation Trajectory, as estimated by Talwar (1997:7) is as follows:

1. LE. Tasks in a process.
2. II. End to end process.
3. BPR. All processes.
4. BNR. Entire organisation.
5. BSR. Entire organisation.

2.4.6 Strategies

A strategy or tactic is a procedure calculated to gain some end. Having achieved mobilisation; consensus on a vision; agreed a hierarchy of objectives and explored various possible scenarios, a strategy to achieve the objectives and ultimately the vision, must be put in place. A way to do this is to mentally deconstruct the business because the changing economics of information threatens to fragment established value chains into multiple businesses (Evans & Wurster 1997:71-82). The invention of new businesses should also be considered at the business network redesign stage (Gouillart & Kelly 1995:193). The generic strategy to be followed to achieve the ultimate objective and vision of each degree of transformation is indicated below (Venkatraman 1991:150):

1. LE. Reduce costs and/or improve service.
2. II. Elevate IT as a strategic resource.
3. BPR. Reengineer the business with IT lever.
4. BNR. Create a virtual organisation and occupy a central position in the network. Invent new businesses.
5. BSR. Identify new business as well as potential threats.

2.4.7 *Duration*

Duration is typically important for project management. It is, however, also important for top management to understand the expected duration of a transformation up front, to align it with the strategic agenda, and not have unrealistic expectations. The typical duration of each degree of transformation, based on the research of Talwar (1997:7), is indicated below:

1. LE. 0 – 3 months.
2. II. 3 – 12 months.
3. BPR. 12 – 36 months.
4. BNR. 7 – 10 years.
5. BSR. Not applicable because it is ongoing and seen as an outcome.

2.4.8 *Business Rules and Norms*

The three value disciplines of operational excellence, product leadership and customer intimacy lead to very different business models. The incompatibilities between these business models make it impossible for one business to excel at all three disciplines (CSC Foundation 1994:3). Pine II *et al* (1993:118-119) provide the rules and norms of mass customisation when they assert that the future should be shaped by each successive order and quote Nissan's vision for the year 2000:

> *"Five As: any volume, anytime, anybody, anywhere, and anything".*

By studying the economics playing out in the television industry Evans & Wurster (1997:81) propose two different value propositions in the world of universal connectivity. One is a focus on popular content, like viewers flocking to hit shows irrespective of which channel they are on, and the other is a focus on navigation, like a branded search engine pushing content toward receptive viewers. The rules and norms for each value discipline as suggested by the CSC Foundation (1994:3); for mass customisation as suggested by Pine II *et al* (1993:118–119) and for internetworked brand as suggested by industry Evans & Wurster (1997:81) are as follows:

1. LE. Process, product-driven. Conformance, "one size fits all" mindset.
2. II. Concept, future-driven. Experimentation and 'out-of-the-box' mindset.
3. BPR. Customer-driven. Variation and 'have it your way' mindset.
4. BNR. Future shaped by each successive order. Anything, anywhere, anytime, anybody, any volume.
5. BSR. Focus on popular content, or on navigation. Unbundled functions.

2.4.9 *Summary*

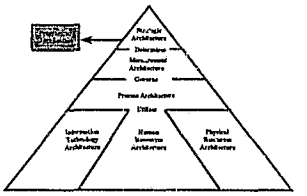
This section has attempted to align the most important strategic concerns that need to be considered before determining the measures and programme architecture per degree of transformation. Although there is no generic or optimal business strategy, for each business must creatively envision its own future, this

taxonomy can serve to highlight the possible implications of the eight dimensions addressed across the five degrees of transformation. It does not imply, for instance, that the pursuit of operational efficiency at the highest level of transformation is wrong, but that the potential benefits are not as great as pursuing an Internetworked Brand model. This can be equated to saying it was more advantageous to pursue mass production with the advent of the industrial age than to pursuing customisation. The following section will examine the elements of the programme architecture.

Table 1: Taxonomy of Strategic Architecture

Strategic Architecture		Degree of IT-Enabled Business Transformation				
		Evolutionary Degrees		Revolutionary Degrees		
		Local Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
2.4.2	Mobilisation	Define rationale for firm specific areas for exploitation	Articulate the logic for technological and organisational integration	Define rationale for strategy and IT alignment	Articulate the logic of network redesign for the focal firm	Identification of new scope of business
2.4.3	Vision	Operational excellence (mass production)	Product Leadership	Customer intimacy	Mass customisation (mass customer intimacy)	Internetworked brand
2.4.4	Objectives	Efficiency	Efficiency and effectiveness	Cut intermediaries out	Hook clients in to value-added services	Redefine *raison d'être*
2.4.4	Scenarios	CAD and CAM	Digitised receipt of tax returns	Batterymarch Financial Management corporation; Boeing	Baxter ASAP System; CIGNA TED System; Wal-Mart; Target Stores	American Airlines SABRE System; McKesson's Economost System; Otis Elevator OTISLINE System; GE's Direct Connect System; Levi Strauss Personal Pair; Amazon.com; Britannica On-Line; Dell Technology Navigator; Nike
2.4.5	Scope and Benchmarking	Tasks in a process	End to end process	All processes	Entire organisation	Entire organisation
2.4.6	Strategies	Reduce costs and/or improved service	Elevate IT as a strategic resource	Re-engineer the business with IT lever	Deconstruct current organisation; Create a virtual organisation and occupy a central position in the network; Invent new businesses	Identify new business as well as potential threats
2.4.7	Duration	0 - 3 months	3 - 12 months	12 - 36 months	7 - 10 years	N/A
2.4.8	Business Rules and Norms	Process, product-driven; Conformance, 'one size fits all' mindset	Concept, future-driven; Experimentation and 'out-of-the-box' mindset	Customer driven; Variation and 'have it your way' mindset	Future shaped by each successive customer order; Anything, anywhere, anytime, anybody, any volume	Focus on popular content, or on navigation; Unbundled function

2.5 Programme Architecture



2.5.1 Introduction

Pellegrinelli & Bowman (1994:125) advocate projects and programmes as appropriate vehicles for revolutionary business transformation. Their research confirms that the *'status quo'* cannot overthrow the *'status quo'*. The original objectives are simply dissipated as the strategy moves into implementation. The degree of IT-enabled business transformation, therefore, determines the project and programme structure and resourcing levels. This assertion is supported by Cash *et al* (1994:409), who assert that the stimulus and scope of change are important determinants of who will participate at what levels and phases. This section explores the participants, drawn from Cash *et al* (1994:410), Peppard & Rowland (1995:214) and Spoornet architecture (1996:1-120) in terms of their role and level of participation across the change spectrum.

2.5.2 Sponsor/Champion

The sponsor is a senior manager who sees the big picture and has a significant business stake in the project success. In large-scale business transformation, it is his responsibility to articulate a strong, clear vision and set the goal and tone for the project (Cash *et al* 1994:409-410). The sponsor is usually the Chief Executive Officer (CEO) and he is also the overall champion (Peppard & Rowland 1995:212). He must see the project as top priority; be able to provide the necessary resources (people, money); be a diplomat; manage criticism, and chair the steering committee (Cash *et al* 1994:409; Benjamin & Levinson 1993:32). Any mismatch between the scope of the project and the authority of the sponsor is likely to cause problems. If the sponsor is the CEO or Chief Operating Officer (COO) then the project may include any of the company's processes. If the sponsor is a business unit head, then the scope is generally confined to the processes within that unit (Manganelli & Klein 1994:53). The most appropriate person to sponsor the project is therefore the most senior person responsible for all the functional areas involved, and it must be the CEO for all revolutionary transformation. The ideal sponsor for each degree of transformation is, therefore, as follows:

1. LE. Functional Head.
2. II. Manager responsible for all functions the process crosses.
3. BPR. CEO or COO.
4. BNR. CEO appointed from the value network[4].

5. BSR. CEO appointed from the value constellation[5].

2.5.3 *Steering Committee*

The steering committee consists of senior-level managers representing the major functional areas to be affected by change. Initially they play an active rôle in helping to determine the scope of the project (Cash *et al* 1994:409-410). They should be intimately involved in creating the revolutionary strategy. Subsequently they provide guidance, insight and meet once or twice a month, for a half-day to review project status, next steps, identify impact of issues and resolve conflicts (Pellegrinelli & Bowman 1994:128). According to Cash *et al* (1994:410) conflict is inevitable, since existing processes and systems tend to reward local optimisation, and operational management is consequently loathe to make decisions that benefit the larger organisation, but sub-optimise their function. As in the case of the sponsor, it is apparent that the only way to get alignment, commitment and decisions that benefit the larger organisation is if representatives from all affected functional areas are members of the steering committee. In the case of business network redesign and business scope redefinition by implication the CEOs of all businesses in the network that are affected must reside on the steering committee. The most appropriate steering committee representatives for each degree of transformation are therefore as follows:

1. LE. All sub-divisional heads.
2. II. Heads of all functions the process crosses.
3. BPR. All functional heads.
4. BNR. CEOs of businesses in the value network.
5. BSR. CEOs of businesses in value constellation.

2.5.4 *Project and Programme/s Manager*

The implementation of "revolutionary" strategy requires the bypassing of existing systems, structures, and hierarchies. The framework for initiating, directing and realising change should be separate from the procedures born of the prevailing paradigm. The disciplines of project and programme management are an alternative (Pellegrinelli & Bowman 1994:127). A programme consists of a range of projects each addressing a component of the strategy. It differs from a project in that it does not necessarily have a single objective, or a finite time horizon. The programme manager is responsible for the decomposition of strategic initiatives into sequential, tightly defined projects, which facilitate the incorporation of learning achieved during implementation. He is responsible to see that crucial interfaces are not overlooked, and keeps the overall programme aligned across all the functions (Pellegrinelli & Bowman 1994:128-130). It is reasonable to assume that the scope of evolutionary degrees of transformation would generally not warrant the services of a programme manager, but that a project manager will

Notes:
4 Chain of interconnected businesses.
5 Group of associated businesses.

suffice. BPR in contrast involves all business processes, which would require programme co-ordination. BNR (which involves several businesses), and BSR (which involves ongoing improvement), in most cases, would justify the appointment of a programmes manager co-ordinating the activities of each related businesses programme. This alignment responsibility of programme management as well as a responsibility matrix used in Spoornet architecture (Spoornet predictable service core team 1998:4) is depicted in figure 5.

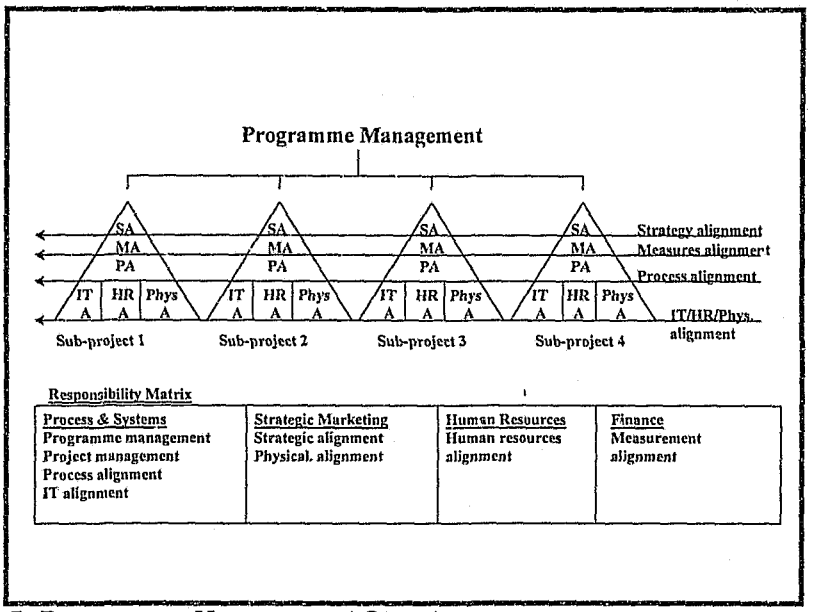


Figure 5: Programme Management Structure
Source: Spoornet predictable service core team (1998:4).

Martinez (1995:53) states that most of the rôles are a partnership, except for overall accountability, vision and change management, which are the business leaders' rôle and with technology and project management being IT's responsibility. The appropriate rôle player for each degree of transformation is, therefore, as follows:

1. LE. Functional supervisor as project manager.
2. II. Neutral cross-functional project manager.
3. BPR. Company programme manager.
4. BNR. Business network programmes co-ordinator.
5. BSR. *Ad-hoc* project/logistics co-ordinator.

2.5.5 Process Owner

Process owners are those people who will be responsible for co-ordinating the activities through the process (Peppard & Rowland 1995:213). They are

responsible for a specific process and the re-engineering thereof. On completion they take ownership of the process. They need to coach employees and make them feel part of the process (Obeng & Crainer 1994:173). Process owners are usually individuals who manage one of the functions involved in the process that will be re-engineered (Hammer & Champy 1993:102-108). The appropriate process owner, for each degree of transformation, is therefore as follows:

1. LE. A sub-divisional head who has the respect of his peers.
2. II. A functional head central to the end-to-end process.
3. BPR. Functional heads central to the re-engineered processes.
4. BNR. Functional heads of all businesses in defined value network.
5. BSR. Functional heads of all businesses in value constellation.

2.5.6 Re-engineering Teams

Re-engineering teams consist of operating managers and professionals with process expertise. There is cross-functional representation; all at the same level. They are charged with: (1) identifying specific processes to be redesigned; (2) understanding and measuring existing processes; (3) identifying IT levers; and (4) designing and building a prototype of the new process (Cash *et al* 1994:411). Experience at Spoornet (1996:85) has taught that it is advisable to include human resources' representation to gain insight into the processes so they can develop training material and competency profiles. Union representation is also advisable to gain buy-in and communication to the shop floor. The appropriate rôle players, for each degree of transformation, are therefore as follows:

1. LE. Local staff plus process, IT and HR expertise and union representation.
2. II. Staff from all functions the process crosses plus process, IT and HR expertise and union representation.
3. BPR. Staff from all functions central to the re-engineered processes plus process, IT and HR expertise and union representation.
4. BNR. Staff from all businesses in defined value network plus process, IT and HR expertise and union representation.
5. BSR. Staff from all businesses in value constellation plus process, IT and HR expertise and union representation.

2.5.7 Change Partners

Many business processes, such as purchasing, order fulfilment and after-sales service directly involve participants outside the organisation. They have a stake in the outcome or relevant know-how. Change partners are therefore drawn from the organisation's network of relationships, customers, distributors, suppliers, and consultants (Eccles *et al* 1994:411). The appropriate change partners on which to focus, for each degree of transformation, would therefore be as follows:

1. LE. Since local exploitation has a distinct operational focus, current key suppliers would be the main change partners on which to focus.

2. II. Since this involves an end-to-end process, current key customers or suppliers would be the main change partners on which to focus.
3. BPR. Since this redesign is still predominantly internally focused current key customers and suppliers would be the main change partners on which to focus.
4. BNR. Since this entails a complete external business network redesign, customers, suppliers and other partners in the defined value network will need to be involved.
5. BSR. Since this entails a complete external business network redesign, customers, suppliers and other partners in the value constellation may need to be involved.

2.5.8 Process and System Integrators

Although in transformations there is an overall vision, and goals towards which all development teams must work, the details are emergent, that is, learnt along the way. Furthermore, the more functions included in the transformation, the more development needs to be modularised for separate focused teams to work on, if progress is to be made. Baldwin & Clark (1997:85) propose the following *modus operandi*, based on the global disparate development of the personal computer, to co-ordinate this process smoothly:

> Modularity in design and production. Information is partitioned into visible design rules and hidden design parameters. The visible design rules are decisions that affect subsequent design decisions. They fall into three categories:
>
> 1. Architecture. Specifies the modules and their functions which will be part of the system.
> 2. Interfaces. Describe how the modules interact.
> 3. Standards. Measures a module's conformity to the design rules (and their relative performance to one another if more than one prototype is developed).
>
> Work can now be split among independent, disparate teams, each pursuing a different sub-module.

As argued in paragraph 2.4.4 the **programme manager** is responsible for defining what modules and related functions will be part of the system (the architecture). The **technology architect** is responsible for defining the interfaces and standards. Although the visible design rules are defined, hidden design parameters evolve. This scenario creates the necessity in large programmes to assign a **process integrator** responsible to see that all processes are integrated across the whole programme during development, and a **systems integrator** responsible to see that all systems are integrated across the whole programme during development. The **process integrator** is responsible for the integrated process sign-off and the **systems integrator** for the integrated system test sign-off. As one progresses up the transformation trajectory, so more key customers,

key suppliers and other partners in the value network need to be included in this ongoing integration effort. The appropriate process and systems integrators, for each degree of transformation, would therefore be as follows:

1. LE. Local Integration by re-engineering team.
2. II. Internal process and system integrator.
3. BPR. Process and system integrators from current key customers and suppliers.
4. BNR. Process and system integrators from customers, suppliers, and other partners in defined value network.
5. BSR. Process and system integrators from customers, suppliers, and other partners in the value constellation.

2.5.9 Implementation Teams

The analytical skills necessary at the design stage are not necessarily what is needed for implementation. The implementation team needs to be skilled at motivating others to change; attentive to details; excellent communicators, well connected and respected (Cash *et al* 1994:412). In Spoornet a full- time deployment manager is assigned to co-ordinate the release roll-out which includes IT, HR and physical components. This person is responsible to see that all the applicable elements of these components are properly packaged for specific audiences and the roll-out appropriately sequenced.

Spoornet also established release implementation teams, responsible to deploy to their areas, drawn from a cross-section of connected and respected members of the line ranks. In doing this, buy-in to the programme was established, communication improved and the focus was on details. As one navigates the transformational trajectory so the scope increases from isolated tasks, integrated cross-functional tasks, end-to-end processes, inter-company networks to the total scope of business using a constellation of independent suppliers (Hope & Hope 1997:100). Obviously as this scope increases so more, firstly internal, then also external, members need to be involved in deployment. The more members involved, the more complex deployment becomes. The appropriate implementation teams, for each degree of transformation, would therefore be as follows:

1. LE. Local Implementation by re-engineering team.
2. II. Deployment manager, trainers, release implementation teams.
3. BPR. Deployment manager, and sub-deployment managers, trainers, release implementation teams from current key customers and suppliers in the value chain.
4. BNR. Deployment manager, and sub-deployment managers, trainers, release implementation teams from customers, suppliers and other partners in defined value network.
5. BSR. Deployment manager, and sub-deployment managers, trainers, release implementation teams from customers, suppliers and other partners in value constellation.

2.5.10 *Release Framework for Flexible and Modular Development*

Although the visible design rules may be defined the product design (hidden parameters) evolves iteratively, incorporating customer needs and alternative technical solutions as they are learnt (users do not always know what they want). To co-ordinate this process smoothly Iansiti & MacCormack (1997:108-117) propose that the concept development and implementation phase overlap. They call this "flexible product development process".

Baldwin & Clark (1997:92) maintain that problems with incomplete or imperfect modularisation tend to appear only when the modules come together and work poorly as an integrated whole. This creates a mixture of legacy, new immature and new mature processes that are not aligned or compatible. They assert that management has an obligation to develop a framework within which the development teams must work. To address this Spoornet adopted the programme management framework in paragraph 2.5.4 and a *modus operandi* of ongoing time-boxed releases. Each release consists of a number of sub-modules with overlapping time-boxed phases (all phases overlap as each group learns from the other in a prototyping mode). The sub-modules are then all deployed to a specific audience in a release package which includes the IT, HR and physical components. This life cycle is depicted in figure 6.

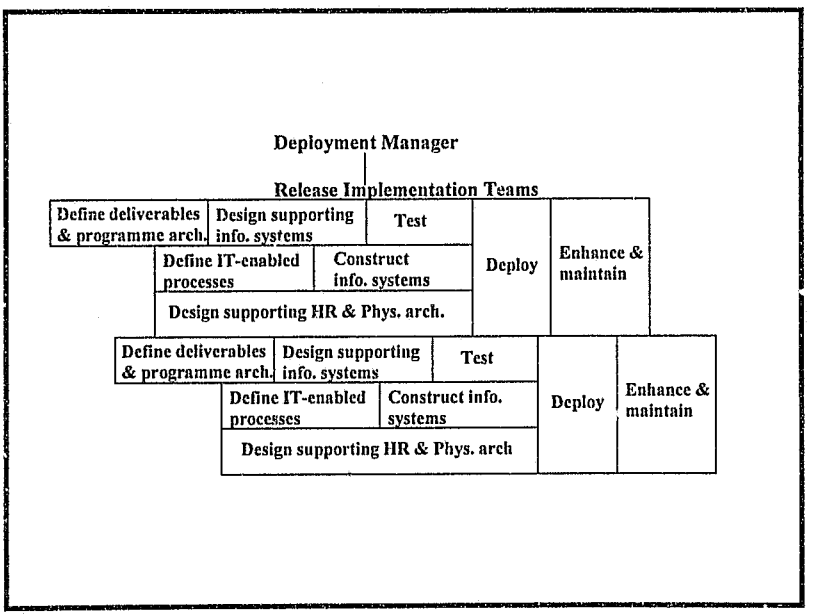


Figure 6: Release Framework for Flexible and Modular Development
Source: Spoornet Predictable Service Core Team (1998:5).

The full development of the product can take several releases with the first release being a working prototype. This approach is also supported by Cash *et al* (1994:414) who assert that effective managers create an organisational climate for

continuous innovation because small improvements maintain customer relations; keep costs under control; and invigorate and motivate employees.

Each degree up the transformation trajectory constitutes a phase with several releases. These phases could be done sequentially, overlap, done in parallel or skipped altogether. This release framework would therefore look as follows:

1. LE. Phase 1: Release 1 – x
   Defined:
   - Sub-modules
   - Interfaces and standards
   - Time-boxes

2. II. Phase 2: Release 1 – x
   Defined:
   - Sub-modules
   - Interfaces and standards
   - Time-boxes

3. BPR. Phase 3: Release 1 – x
   Defined:
   - Sub-modules
   - Interfaces and standards
   - Time-boxes

4. BNR. Phase 4: Release 1 – x
   Defined:
   - Sub-modules
   - Interfaces and standards
   - Time-boxes

5. BSR. Phase 5: Release 1 – x
   Defined:
   - Sub-modules
   - Interfaces and standards
   - Time-boxes

2.5.11 Summary

This section has attempted to position all the key rôle players specifically involved in IT-enabled business transformation across the change spectrum. In so far as "virtual internetworked" companies are concerned, it is possible that fewer parties will need to be involved as companies start using Internet standards that increasingly enable inter-operability of systems regardless of brand or size (Tapscott 1996:109). This would, however, demand a proliferation of integrated, networked, open, and client-server technology architectures, which is not yet the case. An analysis of the function of other parties who are involved in most traditional IT system implementations, such as data base administrators, security

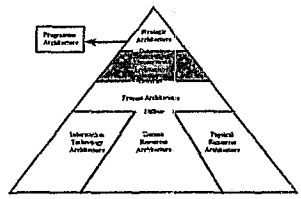
and control specialists, analysts, programmers and users is beyond the scope of this research report. Ultimately, IT-enabled business transformation is everyone's responsibility (Markus & Benjamin, 1997:55).

The following section will examine the elements of the measurement architecture.

Table 2: Taxonomy of Programme Architecture

Programme Architecture		Degree of IT-Enabled Business Transformation				
		Evolutionary Degrees		Revolutionary Degrees		
		Local Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
2.5.2	Sponsor/Champion	Functional Head	Manager responsible for all functions the process crosses	CEO or COO	CEO appointed from the value network	CEO appointed from the value constellation
2.5.3	Steering Committee	All sub-divisional heads	Heads of all functions the process crosses	All functional heads	CEO's of all businesses in defined value network	CEO's of all businesses in value constellation
2.5.4	Project or Programme/s Manager	Functional supervisor as project manager	Neutral cross-functional project manager	Company programme manager	Business Network programmes co-ordinator	*Ad-hoc* project/logistics co-ordinator
2.5.5	Process Owners	A sub-divisional head who has the respect of his peers	A functional head central to the end-to-end process	Functional heads central to the re-engineered processes	Functional heads of all businesses in defined value network	Functional heads of all businesses in value constellation
2.5.6	Re-engineering Teams	Local staff plus process, IT and HR expertise and union representation	Staff from all functions the process crosses plus process, IT and HR expertise and union representation	Staff from all functions central to the re-engineered processes plus process, IT and HR expertise and union representation	Staff from all businesses in defined value network plus process, IT and HR expertise and union representation	Staff from all businesses in value constellation plus process, IT and HR expertise and union representation
2.5.7	Change Partners	Current key suppliers	Current key customers or suppliers	Current key customers and suppliers	Customers, suppliers and other partners in the defined value network	Customers, suppliers and other partners in the value constellation
2.5.8	Process and System Integrators	Local integration by re-engineering team	Internal process and system integrator	Process and system integrators from current key customers and suppliers	Process and system integrators from customers, suppliers and other partners in defined value network	Process and system integrators from customers, suppliers and other partners in the value constellation
2.5.9	Implementation Teams	Local implementation by re-engineering team	Deployment manager, trainers, release implementation teams	Deployment manager, and sub-deployment managers, trainers, release implementation teams from current key customers and suppliers in the value chain	Deployment manager, and sub-deployment managers, trainers, release implementation teams from customers, suppliers and other partners in defined value network	Deployment manager, and sub-deployment managers, trainers, release implementation teams from customers, suppliers and other partners in value constellation
2.5.10	Release Framework for Flexible and Modular Development	Phase 1: Release 1 – x Defined: Sub-modules Interfaces & standards Time-boxes	Phase 2: Release 1 – x Defined: Sub-modules Interfaces & standards Time-boxes	Phase 3: Release 1 – x Defined: Sub-modules Interfaces & standards Time-boxes	Phase 4: Release 1 – x Defined: Sub-modules Interfaces & standards Time-boxes	Phase 5: Release 1 – x Defined: Sub-modules Interfaces & standards Time-boxes

2.6 Measurement Architecture



2.6.1 *Introduction*

The traditional financial measures such as Return on Investment (ROI) or Return on Assets (ROA) worked well in the industrial era, but are out of step with the skills and competencies businesses are trying to develop today (Kaplan & Norton 1992:71). Kaplan & Norton (1996:75) assert:

> *"As companies around the world transform themselves for competition that is based on information their ability to exploit intangible assets has become far more decisive than their ability to invest in and manage physical assets".*

The Balanced Score Card (BSC) developed by Kaplan & Norton (1993:134) provides a way to translate a vision or high-level strategy into goals and measures for four different constituencies: financial, internal process, innovation and learning, and customers. The process of building a balanced score card creates a framework for managing an organisation's various change programmes. Organisations not using a balanced score card are unable to turn vision into action consistently as they alter strategy and processes. The score card also focuses managers on improving or re-engineering those processes most critical to the organisation's strategic success, and highlights gaps in employees' skills and in information systems. It further closes the gap between the mission statement and employees' knowledge of how their day-to-day actions contribute to realising the vision (Kaplan & Norton 1996:78-83). In light of the aforementioned, this section explores the implementation of the BSC across the transformation trajectory.

2.6.2 *Balanced Score Card*

The BSC forms the backbone of the transformation design and the instrument panel with which to guide it (Gouillart & Kelly 1995:77; Letza 1996:75). The four constituencies of the BSC are shareholders, stated as financial goals; customers, stated as customer goals; internal organisation, stated as operational or process goals; and future capabilities' perspective, stated as learning and innovation (Kaplan & Norton 1993:134). Generally learning and innovation targets drive operational measures, and operational achievements generate positive customer results which consequentially improves financial performance (Gouillart & Kelly 1995:77). When forming a business network, the BSC measures of all participants in the network should ideally be aligned. Although every business must workshop their individual BSC measures, some potential measures based

on the visions and objectives hypothesised in section 2.3 have been derived from the literature, to illustrate how they will have to change with each degree of transformation, failing which transformation will be constrained. These measures are as follows:

- **Financial**
  Businesses striving for market leadership in the following disciplines generic focus should be as follows:

1.	Operational excellence.	On cost control.
2.	Product leadership.	On risk management.
3.	Customer intimacy.	On yield management (CSC Foundation 1994:3).
4.	Mass customisation.	On uniqueness and value of contributions (Pine II *et al* 1993:115).
5.	Internetworked brand.	On network economies of scale (Evans & Wurster 1997:80).

- **Customer**
  A *mass production business striving for operational excellence and efficiency* traditionally is supply-driven and seeks sales' volumes to reduce unit costs. A business innovating new products should measure product demand; one seeking customer intimacy, lifetime value (CSC Foundation 1994:3); one seeking mass customisation, order-fit; and seeking to leverage their brand and customer base on a dynamic internetworked business, brand loyalty (Evans & Wurster 1997:81).

- **Process**
  Businesses striving to improve their processes to achieve in the following areas generic focus should be as follows:

1.	Operational excellence.	On supply chain optimisation.
2.	Product leadership.	On product development and time-to-market.
3.	Customer intimacy.	On customer service (CSC Foundation 1994:3).
4.	Mass customisation.	On flexibility and responsiveness (Pine II *et al* 1993:117).
5.	Internetworked brand.	On internetworking (Tapscott 1996:55).

- **Innovation and Learning**
  In Tayloristic, functionally orientated businesses, skills in individual tasks are important, because division of labour is important (CSC Foundation 1994:3). In integrated businesses cross-functional teamwork is important (Hammer & Champy 1993:81) and empowered workers striving to achieve customer intimacy require a good grasp of overall business concepts (CSC Foundation 1994:3). In the dynamically changing environment of mass customisation multi-skilling is important (Pine II *et al.* 1993:111), and, with the internetworked brand business, constant learning while you perform is inherent in knowledge work (Tapscott 1996:198).

The measures across the transformation trajectory are therefore as follows:

1.	LE.	Financial:	Cost control.
		Customer:	Sales volume.
		Process:	Supply chain optimisation.
		Innovation & Learning:	Tasks.
2.	II.	Financial:	Risk management.
		Customer:	Product demand.
		Process:	Product development and time-to-market.
		Innovation & Learning:	Teamwork.
3.	BPR.	Financial:	Yield management.
		Customer:	Lifetime value.
		Process:	Customer service.
		Innovation & Learning:	Business.
4.	BNR.	Financial:	Uniqueness and value of contributions.
		Customer:	Order-fit.
		Process:	Flexibility and responsiveness.
		Innovation & Learning:	Multi-skilling.
5.	BSR.	Financial:	Network economies of scale.
		Customer:	Brand loyalty.
		Process:	Internetworking.
		Innovation & Learning:	On-line custom university.

2.6.3 Target Gains

At the **evolutionary degrees of transformation** IT is embedded in existing processes and the gains are incremental. At the **revolutionary degrees of transformation** the processes are re-engineered, exploiting the possibilities IT provides. Re-engineering is about achieving quantum leaps in performance (Hammer 1993:33). The target gains therefore increase across the transformation trajectory and are an important input in determining resource allocation to the programme. Talwar (1997:7) provides the following target gains across the transformation trajectory:

1. LE. Five to twenty percent in the process.
2. II. Greater than fifty percent in the process.
3. BPR. Greater than fifty percent in the organisation.
4. BNR. Greater than fifty percent in the organisation.
5. BSR. Ongoing improvement.

2.6.4 Developing a Key Performance Indicator Tree

Developing a Key Performance Indicator (KPI) tree, which is a hierarchy of measures cascading down from the BSC measures to the bottom of the business,

creates a golden thread that links the cause-effect pathways of organisational performance (Gouillart & Kelly 1995:87). In the **evolutionary** stages of transformation the KPIs will have to be developed from the bottom up since there is not the luxury to re-engineer processes to align with a business BSC. In the **revolutionary** stages KPIs will be the drivers of the process re-engineering. In a networked organisation each business in the network will have to align their BSC goals and measures, and consequential KPIs (or those already serendipitously aligned will cluster). An interim step is to identify Key Performance Areas (KPA) from the measures, as was done in Spoornet. This assists in defining the scope of an end-to-end process. The KPI tree will therefore be developed across the transformation trajectory as follows:

1. LE. Bottom-up.
2. II. Bottom-up, internal.
3. BPR. Top-down along the value chain.
4. BNR. Align with suppliers and other partners in defined value network.
5. BSR. Align with suppliers and other partners in value constellation.

2.6.5 Activity-Based Costing and Service Level Assessment

If the current processes have not been assessed in terms of the cost of doing them, and the value they create, and been related to the bottom line, then it should at least be done for the new process. This information can be provided by implementing Activity-Based Costing (ABC) and Service Level Assessment (SLA) (Gouillart & Kelly 1995:98). SLA is done by mapping the costs incurred by the service provider to the value gained by the service receiver (Gouillart & Kelly 1995:115). At evolutionary level this can only be done for existing processes (since they are not re-engineered). At business network redesign level ideally all partners in the network will be included in the exercise. ABC and SLA should therefore be developed across the transformation trajectory as follows:

1. LE. On existing processes within function.
2. II. On existing processes across functions internally.
3. BPR. Ideally on old and new processes along value chain.
4. BNR. Ideally include suppliers and other partners in defined value network.
5. BSR. Ideally include suppliers and other partners in value constellation.

2.6.6 Process Accounting

Spoornet realised that accounting cannot be left functionally orientated if proper measures and dynamics are to be realised in terms of processes. Accounting must also become process orientated, so costs, income and profit can be identified per process. This, however, can only take place once all processes have been identified and documented in terms of activities. As the business extends beyond its boundaries, so the value added along the value chain will have to be considered, and then the value network and, ultimately, the value generated (Tapscott 1996:87). Gouillart & Kelly (1995:98) recommend creating an activity cost map for each process, based on the activity-based costing and service level

assessment, to determine the value of each to the business. Process accounting should therefore be centred across the transformation trajectory as follows:

1. LE. Not applicable because organisation is still functionally orientated.
2. II. Internal process centred.
3. BPR. Value chain centred. Value added.
4. BNR. Value network centred. Value added.
5. BSR. Value constellation centred. Value generated.

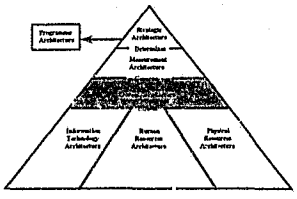
2.6.7 Summary

The measurement architecture in terms of the BSC has become pivotal to successful re-engineering and business transformation. The integration thereof into existing databases and information systems is also critical. It cannot be a separate system alongside existing transactional systems, but must be wired into processes and systems to form a real-time executive information system. The cause of process failures can then be pinpointed to activity level and steps taken to improve or re-engineer the process. In dynamically changing value networks or clusters each molecule in the cluster may simply have to be treated as a "black box" and measured in terms of its value added or generated. The following section will discuss the elements of process architecture.

Table 3: Taxonomy of Measurement Architecture

Measurement Architecture		Degree of IT-Enabled Business Transformation				
		Evolutionary Degrees		Revolutionary Degrees		
		Local Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
2.6.2:	Balanced Scorecard					
	Financial:	Cost control	Risk Management	Yield management	Uniqueness and value of contributions	Network economies of scale
	Customer:	Sales volume	Product demand	Lifetime value	Order 'fit'	Brand loyalty
	Process:	Supply chain optimisation	Product development & time-to-market.	Customer service	Flexibility & Responsiveness	Internetworking
	Innovation & Learning:	Tasks	Teamwork	Business	Multi-skilling	On-line custom university
2.6.3	Target gains	5 - 20% in the process	>50% in the process	>50% in the organisation	>50% in the organisation	Ongoing improvement
2.6.4	KPA and KPI trees	Bottom-up	Bottom-up, internal	Top-Down along the value chain	Align with suppliers and other partners in defined value network	Align with suppliers and other partners in value constellation
2.6.5	ABC and SLAs	On existing processes within function	On existing p[illegible]ses across functions internally	Ideally on old and new processes along value chain	Ideally include suppliers and other partners in defined value network	Ideally include suppliers and other partners in value constellation
2.6.6	Process accounting	Not applicable	Internal process centred	Value chain centred. Value added	Value network centred. Value added	Value constellation centred. Value Generated

2.7 Process Architecture



2.7.1 *Introduction*

The process of each degree of transformation has a different nature and focus stretching from local mechanistic[6] to global organic[7]. Failure to take cognisance of these differences on the transformation trajectory will constrain the transformation progress.

Davenport (1993:5) describes a process as:

> *"....simply a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an enterprise, in contrast to a product focus emphasis on what".*

Instead of embedding outdated processes in silicon and software, we should obliterate them and use the power of modern IT to redesign them radically (Hammer 1990:104). This section explores and classifies the derivation of the business rules, the identification and understanding of the current processes (Hammer 1996:14; Davenport 1993:137-152), and the derivation of the new process (Davenport 1993:153-156; see also Peppard & Rowland 1995:197) across the transformation trajectory.

2.7.2 *Scale and Scope of Re-engineering Required for Each Degree of Transformation*

It is important to understand the scale and scope of re-engineering improvement required before beginning (Peppard & Rowland 1995:9-11). This will assist in determining the programme architecture, the duration, risk and potential benefits. Scope refers to the number of departments or organisations the process crosses. A process with a narrow scope usually takes place within a single function. Scale refers to what the process is performing, which could be a simple set of tasks or a highly complex set of interrelated activities. This concept is depicted in figure 7.

Notes:

6 Rigid like a machine, lacking originality.

7 Whole with dynamically changing interdependent parts compared to living social community.

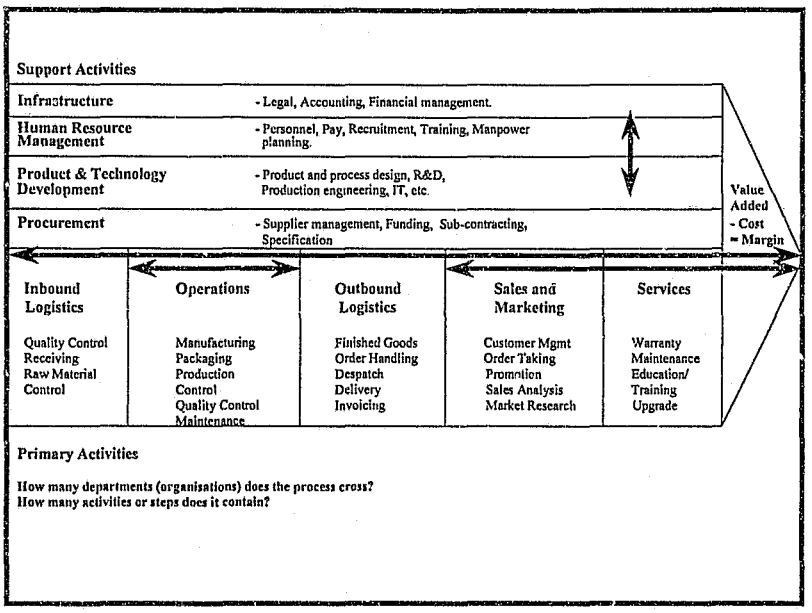


Figure 7: Scale and Scope of Processes
Source: Derived from Peppard & Rowland (1995:11) and Ward & Griffiths (1996:218).

Venkatraman (1991:128-138) delineates the scope in each degree of transformation as follows:

1. LE. Superimpose IT on basic industrial age process within functions.
2. II. Superimpose IT on basic industrial age process across functions.
3. BPR. Re-engineer business process exploiting IT.
4. BNR. Re-engineer business network exploiting IT.
5. BSR. Re-engineer industry.

2.7.3 Focus of Business Processes

Although it is ultimately the BSC measures that determine the focus of processes, this section aims to clarify further the discrepancy in focus between the degrees of transformation. The CSC Foundation (1994:3) research indicates that business processes for the operational excellence model should focus on end-to-end supply chain optimisation and JIT with the emphasis on efficiency and reliability. Business processes for the product leadership model should focus on product development, time-to-market and communications with the emphasis on breakthroughs and, for the customer intimacy model, on customer service and marketplace management with the emphasis on flexibility and responsiveness. Business processes for the mass customisation model should focus on constantly changing modules with the emphasis on an architecture for co-ordinating autonomous operating units in a dynamic network (Pine II *et al* 1993:109-115). Business processes for the Internetworked brand model should focus on new

capabilities with the emphasis on network economies of scale (Evans & Wurster 1997:79-81). The focus of business processes across the transformation trajectory should therefore be as follows:

1. I.E. End-to-end supply chain optimisation, JIT. Emphasis on efficiency and reliability.
2. II. Product development, time-to-market and market communications. Emphasis on breakthroughs.
3. BPR. Customer service, marketplace management. Emphasis on flexibility and responsiveness.
4. BNR. Constantly changing modules. Emphasis on architecture for co-ordinating autonomous operating units in a dynamic network.
5. BSR. New capabilities. Emphasis on network economies of scale.

2.7.4 Selecting Processes to be Re-designed

In the previous chapter it was argued that KPAs and KPIs derived from the BSC will determine which processes to focus on and that this is a top-down approach. A bottom-up survey of the process landscape to identify processes that are candidates for innovation is also advisable. Both the overall listing of processes and the focus on those requiring immediate innovation initiatives are crucial to the success of innovation efforts (Davenport 1993:27). If a mismatch between the top-down and bottom-up processes arises this should be explored iteratively to determine the final priority. The appropriate number of processes in a business is between ten and twenty (Davenport 1993:28).

Following is a list of fourteen representative business processes (Magee *et al* 1997:3):

1. Customer fulfilment.
2. Inventory management and logistics.
3. Marketing to sales.
4. Supplier management.
5. Financial analysis management.
6. Human resources.
7. Production and operations management.
8. Product design and engineering.
9. Lease and capital asset management.
10. Logistics.
11. Supply chain management.
12. Distribution.
13. Customer service management.
14. Market selection and management.

A combination of service performance based on SLA in terms of the service receiver, and activity formulated from activity-based costing can also assist in selecting processes for re-engineering (Gouillart & Kelly 1995:116). Four criteria which might further help to guide process selection are: (1) the process's centrality

to the execution of the firm's business strategy, (2) process health, (3) process qualification (does it have a committed sponsor), and (4) manageable project scope (Davenport 1993:32). The former method is more appropriate for evolutionary change where cost and effectiveness are the strategic drivers. The latter method is more appropriate for revolutionary change because processes are not only being improved, but expanded and even created to achieve a strategic objective which is not just focusing on efficiency or effectiveness. Ultimately all the priorities must be reconciled with the BSC. Processes should therefore be selected for re-design across the transformation trajectory as follows:

1. LE. Activity cost and value rating (effectiveness and importance).
2. II. Activity cost and value rating (effectiveness and importance).
3. BPR. Most central to achieving business strategy.
4. BNR. Most central to achieving business strategy.
5. BSR. Most central to achieving business strategy.

2.7.5 Understanding Current Process

There are at least four reasons (Davenport 1993:137) to document existing processes:

1. It facilitates communication among participants.
2. It is an essential input to migration and implementation planning, useful for understanding the magnitude of anticipated change.
3. It ensures problems in an existing process are not repeated.
4. It provides a measure of the value of the new process.

When modelling processes a structured approach is advantageous so models can be shared amongst groups and built upon. The most widely accepted structured method for IT process modelling is the Integrated Definition Methodology (IDEF) model, of which several variants exist. IDEF0 provides functional decomposition, IDEF1X provides data modelling, IDEF3 provides process modelling and IDEF4 provides object modelling (Magee *et al* 1997:1).

It is self-evident that the scale and scope of documentation will be determined by the degree of transformation undertaken. Current processes should therefore be documented across the transformation trajectory as follows:

1. LE. Document existing process in IDEF within function.
2. II. Document existing process in IDEF across function.
3. BPR. Document existing process in IDEF across value chain.
4. BNR. Document existing process in IDEF across value network.
5. BSR. Document existing process in IDEF across value constellation.

2.7.6 *Mechanistic to Organic*

It is important for process designers to note how processes metamorphose from mechanistic, isolated jobs in rigid vertical silos on a continuum through teams in horizontal silos to a dynamic network of modules with an architecture to link them. (Pine II *et al* 1993:109-115). Tapscott (1996:51) states:

> *"The old corporation is being dis-aggregated, replaced by dynamic molecules and clusters of individuals and entities that form the basis of economic activity".*

The degree of transformation desired will, therefore, dramatically influence the way processes must be designed. Processes across the transformation trajectory should therefore be designed as follows:

1. LE. Mechanistic isolated tasks in vertical silos.
2. II. Integrated tasks.
3. BPR. Cross-functional teams in horizontal silos.
4. BNR. Modules with linking architecture.
5. BSR. Clusters of molecules.

2.7.7 *Possible Impact of IT on Processes*

A process designer should consider all tools that can help enable a process. IT and information are among the most powerful. Nine categories of opportunities for IT to support processes are depicted in table 4 (Davenport & Short 1990:17; Davenport 1993:50).

Although all these categories should be considered at every degree of transformation, automation capabilities can make its dominant impact at the local level, contributing towards efficiency. Information capabilities and tracking can make the biggest contribution to efficiency and effectiveness as was done by the paper mill studied by Zuboff and tracking by Federal Express (Davenport 1993:52) at the integration level. Disintermediating and Integrative capabilities can contribute most to cutting out intermediaries as demonstrated by the electronic trading of the New York Stock exchange and by case managers in hospitals for patient care (Davenport 1993:54). Geographical and Sequential capabilities could contribute most to managing a virtual networked organisation as demonstrated by General Motors for designing, sourcing and manufacturing components world-wide, and concurrent engineering used by Kodak (Davenport 1993:52). Capturing and distributing Intellectual assets is something a redefined, informationalised organisation would advance towards considering the competitive resources of the information economy are information, knowledge, skills and ideas as opposed to raw materials, real estate and cheap labour (Grulke 1997:1;Tapscott 1996:6-9). The analytical ability of computers could be used to good advantage right across the change spectrum. The possible impact of IT on processes across the transformation trajectory is therefore as follows:

1. LE. Automational capabilities.
2. II. Informational and tracking capabilities.

3. BPR. Dis-intermediating and integrative (case management) capabilities.
4. BNR. Geographical and sequential capabilities.
5. BSR. Intellectual capabilities.

Table 4: Impact of IT on Processes

Impact	Explanation
Automational	Eliminating human labor from a process
Informational	Capturing process information for purposes of understanding
Sequential	Changing process sequence, or enabling parallelism
Tracking	Closely monitoring process status and objects
Analytical	Improving analysis of information and decision making
Geographical	Coordinating processes across distances
Integrative	Coordination between tasks and processes
Intellectual	Capturing and distributing intellectual assets
Disintermediating	Eliminating intermediaries from a process

Source: Davenport & Short (1990:17) and Davenport (1993:51)

2.7.8 Process Principles and Attributes

Before re-engineering a process, the process attributes or principles should be established. These are as non-quantitative adjuncts to process objectives, constituting a vision of the process operation in a future state. This is an effective means of engaging senior managers in discussions about visions for new processes (Davenport 1993:129). Examples of principles across the transformation trajectory taken from Davenport (1993:130), and one from Spoornet (1996:105), are as follows:

1. LE. Information must be captured once only.
2. II. Case managers must co-ordinate all aspects of a patient's stay.
3. BPR. Offer direct shipments from manufacturing to customers, no warehouses.
4. BNR. Render invoices and payments electronically.
5. BSR. Link order management systems world-wide, but keep them local.

2.7.9 Designing New Process

Innovating new designs for processes is best accomplished in a series of workshops, and brainstorming is an effective means of encouraging creativity. Large whiteboards and large pieces of coloured paper and string have been used successfully in this process (Davenport 1993:154-155). Spoornet successfully employed brown paper and yellow post-it notes in this process that also helped to arrive at a work breakdown structure. Once a number of alternatives have been generated they must be assessed for feasibility in terms of relative benefits, costs, risks, and time-frames, and an optimum design selected. As with the documentation of the current process a structured approach is advantageous when sharing models amongst groups. To be consistent the most widely

accepted method for IT process modelling, IDEF, should be employed to document these new processes once consensus has been reached. If one is building a virtual network of businesses then obviously all the partners should be represented in the generation of at least the high-level process. Each sub-partner could then generate their own sub-processes in accordance with the set interfaces and standards. It is self-evident that the scale and scope of new process design will be determined by the degree of transformation undertaken. New processes should therefore be approached across the transformation trajectory as follows:

1. LE. Not applicable because processes are not being redesigned.
2. II. Not applicable because processes are not being redesigned.
3. BPR. Brainstorm new processes with key customers and suppliers in the value chain.
4. BNR. Brainstorm new processes with key customers and other partners in value network.
5. BSR. Brainstorm new processes with key customers and other partners in value constellation.

2.7.10 Biore-engineering

Gouillart & Kelly (1995:163) advance an approach that differs in at least five fundamental ways from "classic" re-engineering. The focus is on:

1. Generating "learning loops" within all corporate systems simultaneously.
2. The system of cause and effect relationships.
3. Top-down through the lens of the BSC.
4. To build connectors to and from the BSC.
5. To generate and configure learning loops that will have the greatest positive impact on the measures of the BSC.

Process designers should bear these principles in mind while designing processes. These cause and effect and learning loops will have to include all partners in virtual and Internetworked businesses. Biore-engineering should therefore be approached across the transformation trajectory as follows:

1. LE. Not applicable because processes are not being redesigned.
2. II. Not applicable because processes are not being redesigned.
3. BPR. Map cause and effect across value chain and build in learning loops.
4. BNR. Map cause and effect across value network and build in learning loops.
5. BSR. Map cause and effect scenarios across value constellation.

2.7.11 Tools

In June 1996 the Gartner Group published the matrix in figure 8 of selected BPR tool vendors. In their report Magee *et al* (1997:5) state that enterprises will still need to purchase multiple tools for process diagramming, simulation, and IT modelling and construction. They maintain that multiple evolving and disjointed techniques and tools for BPR and applications development, from numerous

vendors, will continue to challenge multiple user constituencies through 1998 (0.8 probability). Whilst a business is still internally focused niche tools could be considered. Once a virtual network of businesses is considered then it would be beneficial in terms of interfaces, standards and approaches if all partners were using the same tool-set. At the higher degrees of transformation the tool market leaders should therefore be first choice. Tools should therefore be considered across the transformation trajectory as follows:

1. LE. Low-cost rudimentary tool.
2. II. Low-cost rudimentary tool.
3. BPR. Leaders, challengers.
4. BNR. Leaders.
5. BSR. Leaders.

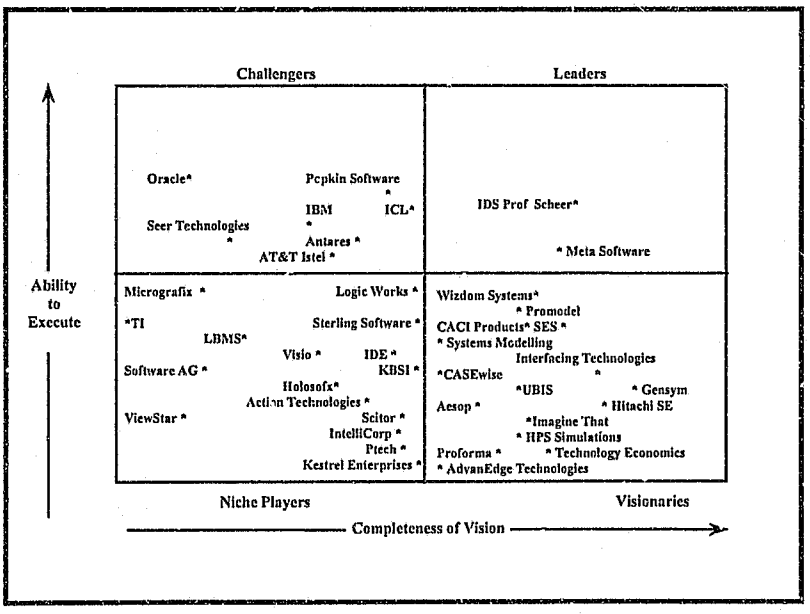


Figure 8: Selected BPR Tool Vendors
Source: Magee *et al* (1997:5).

2.7.12 Summary

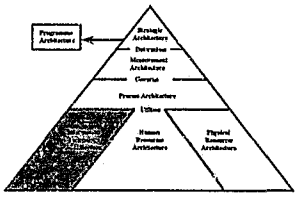
Once the strategic architecture has been defined and the measurement architecture determined, the processes which they govern can be addressed. Business problems do not lie in the performance of individual tasks and activities, the units of work, but in the processes: how the units fit together into a whole. It is, however, also becoming increasingly obvious that in the age of networked intelligence (Tapscott 1996:1) we need to go far beyond just processes, to clusters of professional molecules dynamically interacting. Whilst the process is being re-engineered the mechanisms it uses, IT, human and physical resources need to be

considered. The elements of these architectures will be discussed in the following three sections.

Table 5: Taxonomy of Process Architecture

Process Architecture		Degree of IT-Enabled Business Transformation				
		Evolutionary Degrees		Revolutionary Degrees		
		Local Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
2.7.2	Scale and scope of process re-engineering	Superimpose IT on basic industrial age process within functions	Superimpose IT on basic industrial age process across functions	Re-engineer business process exploiting IT	Re-engineer business network exploiting IT	Re-engineer industry
2.7.3	Focus of business processes	End-to-end supply chain optimisation, JIT; Emphasis on efficiency and reliability	Product development, time-to-market and market communications; Emphasis on breakthroughs	Customer service, marketplace management.; Emphasis on flexibility and responsiveness	Constantly changing modules; Emphasis on architecture for co-ordinating autonomous operating units in a dynamic network	New capabilities; Emphasis on network economies of scale
2.7.4	Selecting processes for re-design	Activity cost and value rating (effectiveness and importance)	Activity cost and value rating (effectiveness and importance)	Most central to achieving business strategy	Most central to achieving business strategy	Most central to achieving business strategy
2.7.5	Understand current process	Document existing process in IDEF within function	Document existing Process in IDEF across function	Document existing process in IDEF across value chain	Document existing process in IDEF across existing value network	Document existing process in IDEF across existing value constellation
2.7.6	Mechanistic to organic	Mechanistic isolated tasks in vertical silos	Integrated tasks	Cross-functional teams in horizontal silos	Modules with linking architecture	Clusters of molecules
2.7.7	Possible impact of IT on processes	Automational capabilities	Informational, tracking capabilities	Dis-intermediating, integrative (case management)	Geographical, sequential capabilities	Intellectual capabilities
2.7.8	Process principles and attributes	Information must be captured once only	Case managers must co-ordinate all aspects of a patient's stay	Offer direct shipments from manufacturing to customers - no warehouses	Render invoices and payments electronically	Link order management systems world-wide, but keep them local
2.7.9	Design new process	Not applicable	Not applicable	Brainstorm new processes with key customers and suppliers in value chain	Brainstorm new processes with suppliers and other partners in defined value network	Brainstorm new processes with suppliers and other partners in Value constellation
2.7.10	Biore-engineering	Not applicable	Not applicable	Map cause and effect across value chain and build in learning loops	Map cause and effect across value Network and build in learning loops	Map cause and effect scenarios across value constellation
2.7.11	Tools	Low-cost rudimentary tool	Low-cost rudimentary tool	Leaders, challengers	Leaders	Leaders

2.8 IT Architecture



2.8.1 Introduction

For each level of transformation there is an enabling technology which, if not utilised, will constrain the business's ability to progress. The need to reach a global customer base has driven many enterprises to develop international partnerships. In this process they relocate marketing and manufacturing facilities, open their supply and value chains to external providers, and begin the process of building unified, geographically dispersed networks, data management systems and technology infrastructures (Magee *et al* 1997:1). This trend, and the proliferation of remote and mobile workers, which the Gartner Group (Magee *et al* 1997:1) expects to reach forty percent of the workforce by the year 2000, is a harbinger of the virtual corporation. IT strategies for user and systems management, data access, security and communications will have to be adapted to cater for these changes in the corporation. Following are some guidelines and technologies that should be considered because of their ability to transform industrial age organisations into Internetworked businesses.

2.8.2 Technology Requirements

Information systems for the operational excellence model should focus on integrated low-cost transaction systems where the system is the process. Information systems for the product leadership model should focus on person-to-person communication systems with technologies that enable co-operation. The customer intimacy model should concentrate on developing a rich customer database whilst linking internal and external information with strong analytical tools (CSC Foundation 1994:3). For the mass customisation model information systems should focus on technologies that allow everyone to view customer information simultaneously and automate links between modules (Pine II *et al* 1993:115). Business units should be viewed as networked clients and servers, working in a modular, flexible organisation structure (Tapscott 1996:83). For the Internetworked brand-leveraged model, information systems should focus on the richness (bandwidth, customisation, interactivity) and reach (connectivity) of communications that are essential for a brand-leveraged, mass customisation, globally Internetworked business in order to optimise network economies of scale (Evans & Wurster 1997:74). The technology requirements across the transformation trajectory are therefore as follows:

1. LE. Integrated low-cost transaction systems. The system is the process.

A system that can speed up personal learning.

2. II. Person-to-person communication systems. Technologies enabling co-operation/ collaboration.
3. BPR. Rich customer database, linking internal and external information. Strong analytical tools. Networked clients and servers.
4. BNR. Technologies that allow everyone to view customer information simultaneously, and automates links between modules.
5. BSR. Rich (bandwidth, customisation, interactivity) and reach (connectivity) communications essential. Information symmetry and random access.

2.8.3 Key Enabling Technology

Tapscott (1996:74–94) proposes a transformation trajectory with key enabling technologies that, although he does not use the same terminology, closely resemble Venkatraman's (1994:74) transformation trajectory. The key enabling technologies in ascending order are: personal multimedia, workgroup computing, enterprise infostructure, inter-enterprise computing, and the Internet. To show how closely the model resembles Venkatraman's, it is depicted in figure 9.

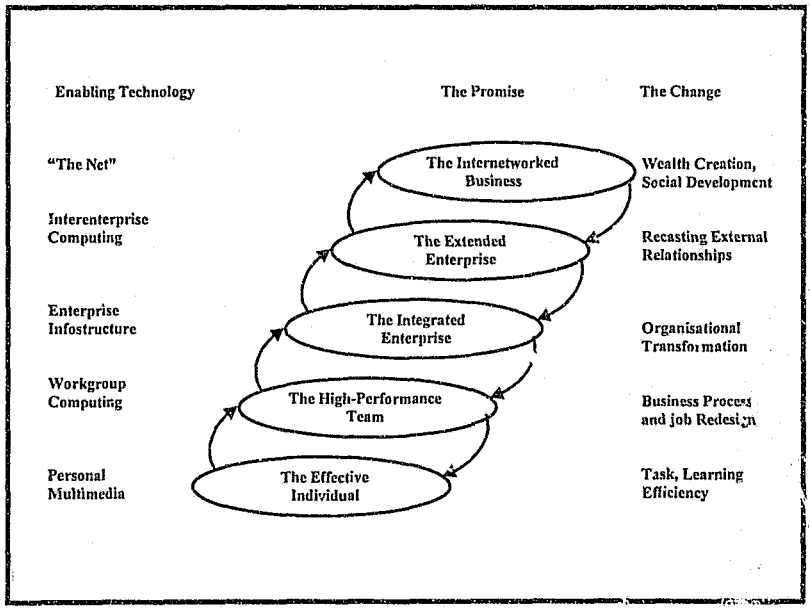


Figure 9: Business Transformation through the New Media
Source: Tapscott (1996:75)

These, and other supporting technologies, will be discussed below and positioned in the taxonomy where, if not implemented, would most likely become a constraint for the business to progress further along the transformation trajectory. The key enabling technology across the transformation trajectory is as follows.

1. LE. Personal multimedia.

2. II. Workgroup computing.
3. BPR. Enterprise infostructure.
4. BNR. Inter-enterprise computing.
5. BSR. The Internet.

2.8.4 Processing

2.8.4.1 Multimedia

This is the combination of text, image, video and audio information within a computer and communications environment. It integrates these media into compound digital documents and humanised styles of computing (Peppard & Rowland 1995:140). Using multimedia-based learning tools one can learn something complex in half the time and retain the knowledge for two to three times longer. This is imperative for the first step of transformation to make individuals effective at their tasks (Tapscott 1996:76).

2.8.4.2 Groupware

E-mail, electronic meeting systems (EMS), desktop video conferencing (DVC), workflow, business process re-engineering (BPR) and all electronic technologies that support person-to-person collaboration are categorised under the umbrella term "Groupware" (Coleman 1997:1). The significance of this group of technologies is that it facilitates the concept of self-reengineering (Coleman 1997:23). This becomes an imperative for the high-performance team (Tapscott 1996:80).

2.8.4.3 Intranet, Extranet and Internet-based Workflow Automation

Clients in the midst of BPR should examine process-oriented workflow products for sophisticated automation. "Workflow" is the automation of the passing of work between people. It involves defining rules that define what information will be routed and to whom (META TRENDS 1994:1). It begins by examining how documents, business forms, and other information move through an organisation and pinpoints bottlenecks (Peppard & Rowland 1995:130-143). Workflow could be used as a vehicle for BPR depending on the circumstances. In general, however, the process would be redesigned and then workflow systems implemented (Peppard & Rowland 1995:143). This means that once a process has been redesigned the next step for IT is to develop a workflow application that will determine any further IT requirements.

Intranet-based workflows are attacking cycle times, costs, productivity, quality and service with new standards, tools and methods, providing users with enterprise-wide, self-service services available twenty-four hours a day, three hundred and sixty-five days a year. Internally-focused Intranets will suffice while the focus is internal. Once the boundaries of the business network are expanded to an

external network, however, then the Internet will have to be used. Extranets linking companies with their suppliers using the Internet's standard protocols are now making switching almost costless (Evans & Wurster 1997:74). Using Internet-based workflows, enterprises can move into virtually limitless territory. Internet-based workflows are subsuming and extending services found in traditional electronic commerce (EC). Conventional interaction via electronic data interchange (EDI) requires business partners to agree on the protocols and data format. Internet-based technologies, however, allow an "open" architecture that can be used to exchange work items between partners or send information to a partner, with or without a workflow system installed. Partners do not need to agree on the usage of specific/proprietary software (Casonato 1996:1).

2.8.4.4 Executive Information Systems with Datamining Capabilities

An executive information system (EIS) delivers, analyses, and displays on an executive's personal computer information that gives him/her a clearer picture of key trends and events before it is too late to react (Keen 1991b:85). Thus it is imperative to integrate the BSC into existing databases and applications and make it meaningful. The problem is it must source the KPI information from different legacy databases that lack integrity. Sometimes the only solution is to "pipe" the data into a "datawarehouse", rationalise it, and then use client-based datamining to uncover new patterns among the data. Whether on-line analytical processing (OLAP), datawarehouses, datamarts or datamining is the correct architecture is still not clear (Asbrand 1997:68–71). Notwithstanding the aforementioned uncertainty, the integrated BSC remains an imperative to drive change from the BPR level onwards.

2.8.4.5 Dynamic Modelling

Dynamic modelling can be effectively used to diagnose problem situations and evaluate alternatives in a process before implementation. The modelling of business processes requires models that can reflect different abstraction levels, parallel activities and an explicit time dimension. Discrete-event simulation offers several useful tools and techniques for developing such models (De Vreede *et al* 1995:30–39). Spoornet effectively used a real-time, object orientated, expert system coupled to a simulator to improve train turnaround times on the coal line doing dynamic modelling. This technique is only of value if one is re-engineering processes at the BPR, BNR and BSR level.

2.8.4.6 Electronic Markets

Electronic markets are computer-based co-ordination systems that support or automate the full trading cycle for a large number of legally independent trading partners. Stock markets have already moved in this direction and the trend looks likely to gather momentum in more traditional areas of commerce in the future (Peppard & Rowland 1995:139). They may lower co-ordination costs for producers and retailers, lower physical distribution costs or eliminate retailers and wholesalers entirely (Benjamin & Wigand 1995:62; Malon 9:166-172).

They should be considered throughout the value chain and in addition to serving a dispersed network organisation, they can help create one.

2.8.4.7 Virtual Reality

Virtual reality is the simulation of real world events and responses in a computer-generated environment. It uses powerful three-dimensional (3-D) computer simulations and lets the user 'enter' a computer-generated world (Peppard & Rowland 1995:141). One such a 3-D world is available on the Internet at http://www.FutureWorld.com (accessed in October 1997). In one of its applications one is able to build offices, towns and complete virtual worlds and interact with other people in it. With this technology it is envisaged architects and engineers could take clients on full walk-throughs of buildings not yet built (Peppard & Rowland 1995:141). It should be considered throughout the value chain, and if made available on the Internet, could aptly serve a dispersed network organisation.

2.8.4.8 Artificial Intelligence

Artificial intelligence (AI) is a heading for technologies such as neural networks, case-based reasoning systems and expert or knowledge-based systems. These systems perform a degree of analysis previously done by humans (Peppard & Rowland 1995:130) It has also been deployed in Compaq Customer Service and American Express Credit Management (Peppard & Rowland 1995:132). It should be considered throughout the value chain, and if made available on the Internet, could become invaluable to a dispersed network organisation.

2.8.4.9 New Collaborative Environments

New collaborative environments are being developed which should be used in the new economy. Generic graphical user interfaces (GUIs) are progressing to tailored multimedia user interfaces (MUI's). The mouse is progressing to the mole, a 3-D mouse. Hypertext markup language (HTML) is progressing to virtual reality markup language (VRML). multi-user domains (MUDs) (virtual worlds) are progressing to MUDs object-oriented (MOOs) and to multimedia MOOs (MMOOs), and use of avatars (graphical images of oneself) is increasing (Tapscott 1996:116). These modern technology tools should be considered for the Internetworked business.

In summary the processing technologies that need to be considered across the transformation trajectory are as follows:

1. LE. Multimedia.
2. II. Groupware.
3. BPR. Intranet-workflow, EIS, datawarehouse, datamining, dynamic modelling.
4. BNR. Extranet-workflow, electronic markets, virtual reality, artificial intelligence.

5. BSR. Internet-workflow, MUIs, MUDs, MMOOs, VRML, avatars, simulation.

2.8.5 Databases

2.8.5.1 Hierarchical and Relational Database Models

Depending on the nature of the application the hierarchical or relational database models may be appropriate at the local or internal integration level. These models facilitate data-sharing in a common database that reduces redundancy and anomalies and increases integrity. The relational model has the added benefit of not only data independence, but structural independence too. This means the database scheme can be changed without affecting the database management system's ability to access the data (Rob & Coronel 1993:13–31).

2.8.5.2 Object Orientation

Rob & Coronel (1993:418) describe object orientation (OO) as a set of design and development principles based on the idea of conceptually autonomous structures. Each autonomous structure represents a real-world entity with the ability to interact with itself and with other objects. The Internet has promoted the usefulness of objects. Software is becoming molecular. Huge complex applications are giving way to smaller "applets" which traverse the Internet as the user needs them. These "Lego-like" pieces enable rapid assembly of software rather than its laborious crafting, and they will be vital to fast-track organisations (Tapscott 1996:116) OO should already be introduced at the BPR stage to lay a foundation for further transformation.

2.8.5.3 Client Server and Distributed Data

Tapscott (1996:99) states:

> *"Network centric computing for the internetworked enterprise. Client/server computing for the dynamic client/customer service organisation. The network becomes the computer. The enterprise becomes a network".*

With client/server technology, software is not limited to one machine, but can be processed co-operatively on various computers on the network. Besides processing, the database may also be distributed. A logically related database may therefore be stored over two or more physically independent sites (Rob & Coronel 1993:375). It should already be introduced at the BPR stage. This will drive the push towards a flat networked business, and form an ideal platform for later internetworking.

2.8.5.4 Hypertext Markup Language Files

The hypertext transfer protocol (HTTP) controls the retrieval of hypertext markup language files (HTML) by your web browser (Randall 1997:93). HTML allows one to "hotlink" between documents on different computers around the world.

Hypertext has now become hypermedia, so the link can be a photograph, video clip, sound or compound document that, in turn, links one to another document (Tapscott 1996:111). This is tantamount to a global multimedia networked filing system. The internetworked brand business must exploit this technology together with the intelligent "agents" that accumulate information about users to build virtual factories and match demand and supply.

In summary the database technologies that need to be considered across the transformation trajectory are as follows:

1. LE. Hierarchical.
2. II. Relational.
3. BPR. Object orientation.
4. BNR. Client server and distributed database structures.
5. BSR. HTML files.

2.8.6 Networks

2.8.6.1 From Area Networks to Internetwork

While attempting to achieve operational excellence locally no more than a local area network (LAN) may be necessary. While attempting internal integration to improve product development a wide area network (WAN) will be necessary and as the business starts to integrate with external partners a metropolitan area network (MAN) may be necessary. At this stage proprietary protocols such as IBM's system network architecture (SNA) may suffice (Madnick 1991:36–49). As the business increases its network and scope a comprehensive (transmission, data access and telepresence), open (published) and non-proprietary (free) protocol like Transmission Control Protocol/Internet Protocol (TCP/IP) developed for the Internet will become necessary. In order to achieve the benefits of a real virtual factory by exploiting the virtual value chain, the services of an Internetwork information broker will have to be attained or created (Upton & McAFee 1996:131-133).

2.8.6.2 Global Two-way Broadband Communication

Many companies are currently vying to provide the Internet with broadband capacity, fully interactive, two-way communication offering full-colour, full-motion video. The backbone will most likely be fibre optic cables (Tapscott 1996:103). Bill Gates and Craig McCaw (cellular telephone pioneer) have formed a company, Teledesic, which proposes to loft several hundred low orbit satellites to provide a two-way broadband service globally (Gates 1995:271). This bandwidth is an imperative for the internetworked business.

2.8.6.3 Electronic Data Interchange

EDI eliminates intermediate steps in processes that rely on the transmission of paper-based instructions and documents by performing them electronically, computer-to-computer (Keen 1991b:79; Konsynski 1993:126). UK retailer, Tesco, has automated its entire transaction chain for recording sales, amending and checking stock records, re-ordering goods, receiving and checking invoices and making payment (Peppard & Rowland 1995:138). The advantages of this technology in a dispersed networked company are that all standard business transactions can be fully automated across distances with no human intervention. Gates (1995:157) asserts:

> *"It's unclear whether EDI will evolve fast enough or whether other standards that are richer will emerge. It is clear that the Internet will be the network used for electronic business-to-business communications".*

In summary the network technologies that need to be considered across the transformation trajectory are as follows:

1. LE. LANs and proprietary standards.
2. II. WANs.
3. BPR. MANs, TCP/IP and an Intranet.
4. BNR. Extranet, EDI and national two-way broadband capacity.
5. BSR. The Internet and global two-way broadband capacity.

2.8.7 Level of Application Systems Integration

Merrill Lynch's Cash Management Account is an example of successful exploitation of IT for strategic benefits because of the organisation's ability to interrelate its set of activities using a common IT platform to offer an integrated product. The success of this system, the Baxter ASAP System and McKesson Economost order entry systems were not localised exploitation of IT, but a result of integration of business processes supported by these systems (Venkatraman 1991:135). The internal integration level is basically a consolidation of the processes' crossing functions with integrated systems support. The challenge, therefore, for most organisations is how to get integrity into their disparate, functionally derived databases for useful management information. At business process design level there is a complete reconfiguration of the tasks, again with integrated systems support. This might entail a complete rewrite of virtually all legacy systems, and core data should be structured up front. At business network redesign level four distinct natures of exchange exist, transactions (EDI), inventory (available and visible), process and expertise (Venkatraman 1991:146-147). If information is unstructured transactions, then the challenge is not so great, but if it is high, as in knowledge, then data integrity across the network is a major challenge. The data integrity that needs to be considered across the transformation trajectory is therefore as follows:

1. LE. Not applicable except at a local level.
2. II. Data Integrity across all functions imperative for MIS.

3. BPR. Data Integrity across all processes imperative for MIS.
4. BNR. Data Integrity across business network imperative for MIS.
5. BSR. Data Integrity across changing business constellation imperative for MIS.

2.8.8 Summary

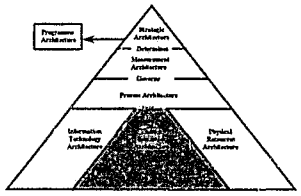
The old "command-and–control computing" based on the mainframe with peripherals in a hierarchy must change to suit the new networked organisation. In the molecular networked organisation dispersed throughout the world what is required is a client/server, object-oriented, internetworked information technology architecture. With this technology global networks of human intelligence will collectively transform the organisation and business as we know it. Only people can design new systems, and decide how they want to live. Information technology is driving the change through the opportunities, which were never before possible, it creates. IT is raising the minimum threshold of competition in virtually every industry.

The following section will discuss the elements of the human resources architecture.

Table 6: Taxonomy of Information Technology Architecture

IT Architecture	Degree of IT-Enabled Business Transformation				
	Evolutionary Degrees		Revolutionary Degrees		
	Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
2.8.2 Technology requirements	Integrated low-cost information systems. The system is the process. System that can speed up personal learning	Person-to-person communication systems. Technologies enabling co-operation/collaboration	Rich customer database, linking internal and external information. Strong analytical tools. Networked clients and servers	Technologies that allows everyone to view customer information simultaneously. Automates links between modules	Rich (bandwidth, customisation, interactivity) and reach (connectivity) of communications essential. Information symmetry and random access
2.8.3 Key Enabling Technology	Personal Multimedia	Workgroup Computing	Enterprise infostructure	Inter-enterprise computing	"The Internet"
2.8.4 Processing	Multimedia	Groupware	Intranet-workflow, EIS, data warehouse, data mining, dynamic modelling	Extranet-workflow, electronic markets, virtual reality, artificial intelligence	Internet-workflow, MUIs, MUDs, MMOOs, VRML, avatars, simulation
2.8.5 Databases	Hierarchical	Relational	Object orientation	Client server, DDBS.	HTML files
2.8.6 Networks	LAN, proprietary standards	WAN	MAN, TCP/IP, Intranet	Extranet, EDI, national 2 way broadband capacity	Internet, global 2 way broadband capacity
2.8.7 Systems Integration	Not applicable	Data integrity across all functions imperative for MIS	Data integrity across all processes imperative for MIS	Data integrity across business network imperative for MIS	Data integrity across changing business constellation imperative for MIS

2.9 Human Resources Architecture



2.9.1 Introduction

For each level of transformation there is an appropriate human resource architecture which, if not adopted, will constrain progress. Process centring, which can greatly improve performance, is incompatible with existing organisations' structure, personnel, management styles, cultures, reward and measurement systems (Hammer 1996:8). IT can also replace managers (Hammer 1996:130-131). This section explores the implications of restructuring, revitalising and renewal addressing jobs and structures, measurement and reward systems, values and beliefs, across the change spectrum. Furthermore, the principles of communication are discussed (Hammer & Stanton 1995:142-151).

2.9.2 Organisation and Skills

Organisation and skills for the operational excellence model should focus on central authority, low level of empowerment and high skills at the core of the organisation. Organisation and skills for the product leadership model should be *ad hoc*, organic and cellular with high skills abounding in loose-knit structures and the customer intimacy model should allow empowerment close to the point of customer contact with high skills at the boundary of the organisation (CSC Foundation 1994:3). Organisation and skills for the mass customisation model should focus on a dynamic network forming instant teams with a high value on diversity of skills (Pine II *et al* 1993:110-115). The organisation and skills for the internetworked brand model should resemble a hyperarchy after the hyperlinks of the world wide web. The deconstructed value chain within a business; the deconstructed value chain within an industry and the amorphous and permeable corporate boundaries characteristic of companies in "Silicon Valley" (California) are all hyperarchies (Evans & Wurster 1997:75). The organisation and skills that need to be considered across the transformation trajectory is therefore as follows:

1. LE. Central authority, low level of empowerment. High skills at the core of the organisation.
2. II. *Ad hoc*, organic and cellular. High skills abound in loose-knit structures.
3. BPR. Empowerment close to point of customer contact. High skills at the boundary of the organisation.
4. BNR. Dynamic network. Instant team. High value on diversity of skills.
5. BSR. Hyperarchy.

2.9.3 *Jobs and Structures*

Hammer (1996:xv) asserts:

> *"Before long it will be as quaint to speak of workers and managers and jobs as it already is to speak of knights and squires and quests".*

As a company transforms from the industrial age, functionally orientated model to process centring everyone acquires a new rôle (Hammer 1996:75-76). Old functional departments lead to narrowly specialised jobs and organisation, but integrated processes require multi-dimensional jobs that are best organised into process teams (Hammer 1993:81). Structures change from hierarchical to flat (Hammer 1993:77). Executives change from scorekeepers to leaders (Hammer 1993:79). Workers who have jobs and are focused on boss, activity and task change to professionals who have careers and are focused on achieving an objective (Hammer 1996:45-50). The departmental manager focused on the department's tasks changes to that of process owner, process manager or process leader, focused on the successful realisation of a complete end-to-end process.

A transformed process-centred company will, therefore, have a business leader who provides the overall vision for the business, shapes the thinking and attitudes of the people, and knits together its processes (Hammer 1996:132–134). The business leader will head a process council consisting of all process owners and heads of key support groups whose role it is to address the needs of the business as a whole (Hammer 1996:86). Process owners have responsibility in three areas; design, coaching, and advocacy, which is an ongoing, dynamic responsibility (Hammer 1996:75-76). Processes are executed by process performers, who work for the customer or themselves, and are made up into process teams (Hammer 1996:88-90). Coaches hire and develop human resources (Hammer 1996:118). Coaches head up centres of excellence where skills are enhanced and people are developed. These centres of excellence are not simply the old functional departments, but their vestiges: what is left when the work is removed and placed into process teams (Hammer 1996:122). Membership of the centre of excellence is probably permanent, like the engineering or accounting fraternity, but assignment to a process team is not (Hammer 1996:127).

The above is all focused inside one company. When one moves to business network redesign, processes do not begin and end at company boundaries, but cross corporate walls. In terms of jobs the rule has changed from whoever benefited from work should perform it to whoever is best equipped to do it should perform it (Hammer 1996:175). This mindset will alter companies' scope and, in terms of structures will lead to what Jack Welch of GE calls "boundarylessness", the dissolution of all walls within and around a business (Hammer 1996:182). The transformation of the organisational structure across the transformation trajectory is depicted in figure 10.

The organisation and skills that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Narrow focused jobs, managers, supervisors and workers.
2. II. Multi-dimensional jobs, managers, supervisors and workers.
3. BPR. Process-centred jobs, business leaders, coaches, centres of excellence, process council, process owners, process teams and process performers.
4. BNR. Process-centred business network. Job done by whoever is best equipped.
5. BSR. Boundarylessness.

2.9.4 Measurement and Reward Systems

Measures are an enormously important tool for shaping people's attitudes and behaviours and play a central rôle in converting unruly groups into disciplined teams (Hammer 1996:16). People who perform multi-dimensional jobs and who are organised into teams must be recruited, evaluated, and paid by means of appropriate management systems (Hammer 1993:81). Performance measures shift from activity to results (Hammer & Champy 1996:40). Advancement shifts from performance to ability (Hammer 1993:74). The BSC with its goals and measures that are translated into KPIs should be used to base reward for performance on (Gouillart & Kelly 1995:163).

The management systems for the operational excellence model should be "command and control" with standard operating procedures and focus on cost control. Management systems for the product leadership model should reward individuals' innovative capacity with development focusing on risk and exposure, and the customer intimacy model should focus on customer-equity measures like lifetime value and yield management (CSC Foundation 1994:3). In the mass customisation model managers are co-ordinators with success depending on how well they perfect links. Compensation should be per module based on uniqueness and value of contribution (Pine II *et al* 1993:110-115). Management in the internetworked brand organisation should be fluid, team-based collaboration (Evans & Wurster 1997:75). The management, measurement and reward systems that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Command and control, standard operating procedures, and cost control.
2. II. Reward individuals' innovative capacity. Risk and exposure management.
3. BPR. Customer-equity measures like lifetime value. Yield management.
4. BNR. Managers are co-ordinators. Success depends on how well they perfect links. Compensation per module based on uniqueness and value of contribution.
5. BSR. Fluid team-based collaboration.

2.9.5 *Values and Beliefs (Culture Change)*

The process design must be used to shape the attitudes, values and behaviours of staff, which is culture (Bainbridge 1996:129). The management systems, and how people's work output is measured and paid, shape employees' values and beliefs (Hammer 1993:81). In process-centred organisations processes are managed, not departments, budgets or people (Hammer 1996:80).

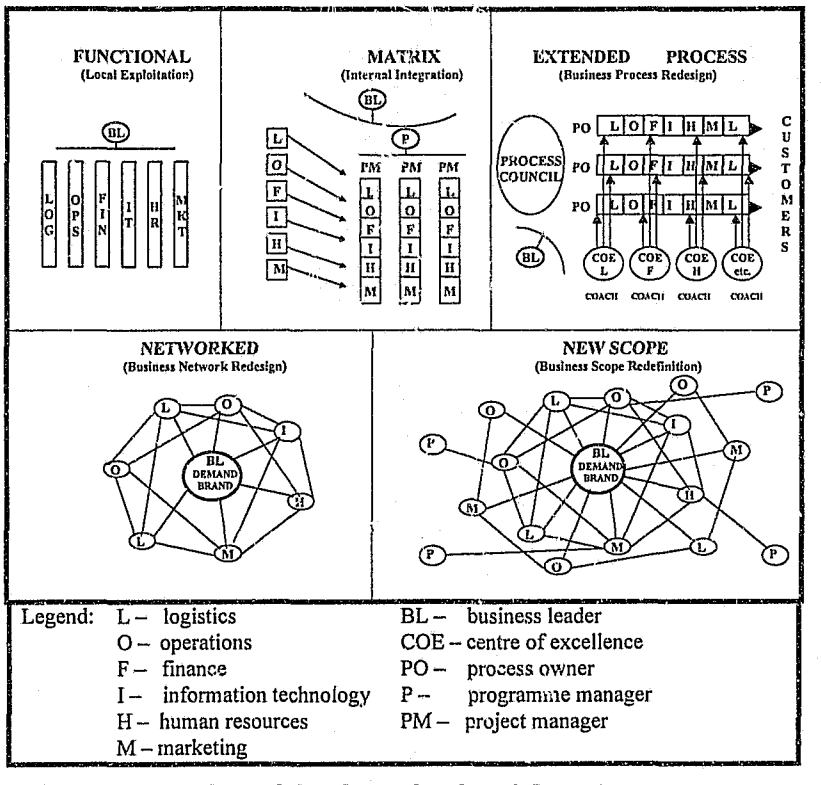


Figure 10: Transformation of the Organisational Structure
Source: Adapted from Hammer (1996:126); Hope & Hope (1997:91)

The psychological contract in the old company culture was obedience and diligence in exchange for security (Hammer 1996:156). At present companies cannot guarantee security and the new contract in process-centred companies is initiative for opportunity (Hammer 1996:158). Without security, loyalty to a company has been replaced with commitment to business success (Hammer 1996:158). A company must adopt deep system values which do not change, but support change itself. Self-examination and self-criticism are the prime deep system values that must also include humility, a restless curiosity and probing inquisitiveness. A systemic and institutional capacity for change may be a company's single most valuable asset (Hammer 1996:224). The values and beliefs that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Obedience and diligence (compliance) in exchange for security.
2. II. Initiative for opportunity.
3. BPR. Commitment to business success.
4. BNR. Restless curiosity through self-examination, self-criticism and humility.
5. BSR. Systemic and institutionalised capacity for change.

2.9.6 Training and Education

A task-oriented organisation hires people and expects them to follow rules. Re-engineered companies make their own rules. These people have to exercise judgement and therefore need education, as opposed to training (Hammer 1993:71). A skills or competency model needs to be defined first then an education strategy can be designed. The education programme must be aligned to the measurement system. Ideally education programmes should be tracked down through measurements to bottom-line results (Gouillart & Kelly 1995:163). Industrial age companies have narrow and simple tasks that are supervised so specific skills must be taught. In the process-centred company, jobs are big and complex, so the employee must be educated and skilled (Hammer 1996:42-43). It is an absolute requirement for all tasks in a process-centred company for people to be "big picture" thinkers, to see how the parts connect and also to have good communication skills (Hammer 1996:234-236). In the new company people need to be professionals, who can be expected to achieve goals on their own (Hammer 1996:47). The essence of a company is not what it sells or how it operates, but rather its character, culture and personality. Action follows character, and it is the character (work habits, resilience, tenacity, ambition, and willingness to learn) that determines future success (Hammer 1996:249–254). The training and skills that that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Narrow and simple tasks.
2. II. Big and complex range of tasks.
3. BPR. Big picture. Communication.
4. BNR. Professional education.
5. BSR. Character, work habits, resilience, tenacity, ambition, and willingness to learn.

2.9.7 Communication

Failure to communicate is one of the fundamental things that can go wrong with re-deployment (Marshall & Yorks 1994:90; Rosenthal & Wade 1993:57; Aghassi 1994:196). Education and communication are the linchpins of successful change because they are a means of tackling resistance, changing culture and ensuring buy-in. Communication needs to break down into five areas; process, method, rationale, progress and changes. The content must be tailored to the audience which encompasses suppliers, customers, project teams, authorities and other stakeholders, such as shareholders, banks, owners, investors, operations, support functions, managers, the board, part-timers and new recruits. Communication can take the form of launch events, brochures, newsletters, briefing packs, notice

boards, e-mail, grapevine, presentations, videos, interactive presentations, team briefings, seminars, training courses, books, walk-throughs, demonstration systems and one-to-one briefings (Bainbridge 1996:229-237). The scope of communication that needs to be considered across the transformation trajectory is therefore as follows:

1. LE. Within function with rationale. Process and progress with suppliers.
2. II. Across functions with rationale. Process and progress with suppliers and customers.
3. BPR. Across functions with rationale. Process and progress with suppliers and customers and overview to all other stakeholders.
4. BNR. Detail of process and methods with rationale. Process and progress to all business partners in network. Overview to all other business partner stakeholders.
5. BSR. Detail of process with methods and rationale. Process and progress to all business partners in network. Overview to all other business partner stakeholders.

2.9.8 Labour Relations

In industrial age companies there is a hierarchy of workers, supervisors and managers. Managers and supervisors are largely administrators who do non-value adding work. Simple task-orientated jobs are pre-defined by managers. Workers get simple task orientated jobs. "Management can eliminate jobs at any time. My job is therefore an oxymoron" (Hammer 1996:50). In order to avoid exploitation workers use collective bargaining by forming unions. At the lower end of the change spectrum it is therefore necessary to include the unions in all change at the outset, since virtually all jobs will be affected.

After business process redesign the managing and doing of the new jobs will be merged (a case worker manages himself) (Hammer 1996:43). Non-value adding work will be eliminated. These process-centred jobs will be complex requiring professionals who have careers (Hammer 1996:50). Professionals have a knowledge base and a set of values that distinguish them from other groups of employees (Carnall 1995:28). Professionals will work for the customer or himself. Compensation will be results based, and there will be no hierarchy (Hammer 1996:59). There will therefore be no rôle for unions. The level of union involvement that needs to be considered across the transformation trajectory is therefore as follows:

1. LE. Hierarchy. Involve unions.
2. II. Hierarchy. Involve unions.
3. BPR. Hierarchy. Involve unions.
4. BNR. No hierarchy. Professionals. No rôle for unions.
5. BSR. All professionals.

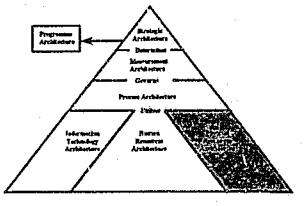
2.9.9 Summary

Organisations are changing from command and control hierarchies to empowered professionals in hyperarchies. Narrow, focused jobs are becoming boundaryless. Values and beliefs are changing from obedience and diligence to an institutionalised capacity for change. Workers are being replaced by professionals. Across the change spectrum different levels of this metamorphosis exist. Organisations must decide where they are and where they want to be on the transformation trajectory, and ensure their change programme is appropriately designed and aligned. People are the most important aspect to change, since only they can decide how they want to work, live or play, and create the future. The following section will discuss the elements of the architecture of physical resources (excluding human resources).

Table 7: Taxonomy of Human Resource Architecture

HR Architecture		Degree of IT-Enabled Business Transformation				
		Evolutionary Degrees		Revolutionary Degrees		
		Local Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
2.9.2	Organisation and skills	Central authority, low level of empowerment. High skills at the core of the organisation	*Ad hoc*, organic and cellular. High skills abound in loose-knit structures	Empowerment close to point of customer contact. High skills at the boundary of the organisation	Dynamic Network. Instant Team. High value on diversity of skills	Hyperarchy
2.9.3	Management, measurement and reward systems	Command and control, standard operating procedures, and cost control	Reward individuals innovative capacity. Risk and exposure management	Customer-equity measures like lifetime value. Yield management	Managers are co-ordinators. Success depends on how well they perfect links. Compensation per module based on uniqueness and value of contribution	Fluid team-based collaboration
2.9.4	Jobs and structures	Narrow focused jobs, managers, supervisors and workers	Multi-dimensional jobs, managers, supervisors and workers	Process centred jobs, business leaders, coaches, centres of excellence, process council, process owners, process teams, process performers	Process-centred business network. Job done by whoever is best equipped	Boundarylessness
2.9.5	Values and beliefs	Compliance (in exchange for security)	Initiative (for opportunity)	Commitment (to business success)	Restless curiosity (through self-examination, self criticism and humility)	Institutionalised capacity for change (systemic)
2.9.6	Training and education	Narrow and simple tasks	Big and complex range of tasks	Big picture thinkers. communication	Professional education	Character, work habits, resilience, tenacity, ambition, and willingness to learn
2.9.7	Communication	Within function with rationale. Process and progress with suppliers	Across functions with rationale. Process and progress with suppliers and customers	Across functions with rationale. Process and progress with suppliers and customers and overview to all other stakeholders	Detail of process and methods with rationale. Process and progress to all business partners in network. Overview to all other business partner stakeholders.	Detail of process with method and rationale. Process and progress to all future planned business partners in network. Overview to all other business partner stakeholders
2.9.8	Labour relations	Hierarchy. Involve unions	Hierarchy. Involve unions	Hierarchy. Involve unions	No hierarchy. Professionals. No role for unions	All professionals

2.10 Physical Resource Architecture



2.10.1 Introduction

For each level of transformation there is an appropriate physical resources architecture which, if not adopted, will constrain progress. The configuration of physical infrastructure and the facilities' network deserve special attention because they are expensive (Gouillart & Kelly 1995:129). Business process re-engineering shifts the business from a functional, divisional or product view to a process view (Davenport 1993:1). It also, depending on the degree of transformation, may shift from a production line to a case worker approach; from individual to team working; from sequential to parallel tasks; integrate customers and suppliers; automate data transfer, and eliminate data recapture (Peppard & Rowland 1995:180-192). The operations' strategy is derived by building a high-level value chain to support the goals and measures defined in the BSC and then assigning KPIs, such as cycle time, cost, responsiveness, service, product line, and quality, which drive the operations strategy (Gouillart & Kelly 1995:125). In this process the utilisation and design/layout of physical resources will most likely need to change. Where the business network is redesigned many tasks may be outsourced or subcontracted eliminating the need for internal infrastructure. This section explores and classifies considerations regarding new product development, manufacturing process types, and aspects that are common to all parts of the operational system.

2.10.2 New Product Development

Besides the traditional product-development process four contemporary approaches appear in recent literature:

- **Traditional product-development process**
  These development processes are highly structured. A future product is designed, developed, transferred to production, and rolled out to the market in clearly articulated, sequential phases. This is the typical development method of the old, functionally orientated and mechanistic industrial age factory (Iansiti & MacCormack 1997:108).

- **Concurrent engineering**
  Following the example set in Japan many companies are now developing new products and production systems in parallel. This results in significantly

reduced lead-times from concept to customer, and a leap in quality performance (Peppard & Rowland 1995:58). This is aligned with the concept of internal integration of process and systems.

- **Flexible product development**
  With the rise of the world wide web (WWW) market needs and the technologies required to satisfy them sometimes change radically, even as the product is under development. In response companies have pioneered a flexible product design process that allows design to continue even after implementation has begun. Concept development and implementation phase overlap. The product design evolves iteratively, incorporating customer needs and alternative technical solutions as they learn. This concept has been successfully used by many Internet companies, but also by companies like Booz and Allen, using their Intranet, and the New Zealand Americas Cup winners in the building of their boat (Iansiti & MacCormack 1997:108-117). This product development approach is suitable for a customer intimacy strategy to give customers what they want, and cut out intermediaries.

- **Mass customisation**
  A product or service is customised to each discerning customer's needs. Mass customisation calls for flexibility and quick responsiveness. In an ever-changing environment, people, processes, units, and technology reconfigure to give customers exactly what they want. Managers co-ordinate independent, capable individuals, and an efficient linkage system is crucial. To achieve mass customisation, processes must first be turned into modules, and an architecture for linking them be designed (Pine II *et al* 1993:115-118). This is the next step up the ladder of transformation. After business process redesign, to satisfy selected customers in an intimate way, companies can turn these processes into modules, and progress to serving every customer in an intimate way, thereby hooking them in to these value-added services. Where capabilities do not exist internally, these can be outsourced to partners, resulting in business network redesign.

- **Modularity in design and production**
  The computer industry has dramatically increased its rate of innovation through modularity. Modularity is a strategy for organising complex products and processes efficiently. A modular system is composed of units (or modules) that are designed independently, but still function as an integrated whole. Information is partitioned into visible design rules and hidden design parameters. The visible design rules are decisions that affect subsequent design decisions. They fall into three categories:

  1. Architecture. Specifies the modules and their functions which will be part of the system.
  2. Interfaces. Describes how the modules interact.
  3. Standards. Measures a module's conformity to the design rules (and their relative performance to one another if more than one prototype is developed).

The hidden design parameters only affect the local module. Work is split among independent teams, each pursuing a different sub-module. Module designers rapidly move in and out of joint ventures, technology alliances, subcontracts, employment agreements, and financial arrangements as they compete to innovate. If a company has successfully managed to position itself centrally in a virtual network then this is the next step to maintain it, like the 1980s battle between Apollo Computer and Sun Microsystems proved (Baldwin & Clark 1997:85-90).

The new product development approaches that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Traditional product planning.
2. II. Concurrent engineering.
3. BPR. Flexible product development.
4. BNR. Mass customisation.
5. BSR. Modularity.

2.10.3 Operational Systems

A primary driver of the process design will be the customer delivery lead time. The complexity, cost and production lead-time will also affect the choice of operational system, but the advent of concurrent engineering, flexible development, modularity in design, virtual inventory and the virtual factory have greatly reduced these variables. There are, nevertheless, still only three choices of operational systems to deliver a product or service (Peppard & Rowland 1995:64):

- **Make for stock/Provide for use**
  Where products and services are produced before they are demanded. This is important when availability is a key pre-condition of sale. This is tantamount to the traditional mass-production company which is bureaucratic and hierarchical. Under close supervision workers repeat narrowly defined, repetitive tasks. The result is low-cost, standard goods and services (Pine II *et al* 1993:116). This is an appropriate strategy for a company striving for local efficiency and operational excellence. A company striving for internal integration, efficiency and effective products should still follow this operational strategy, but just be more innovative with its product design.

- **Make to order/Perform to order**
  When products and services are only produced when ordered. This takes greater time than satisfying the demand from stock. This is an appropriate strategy for a company who is satisfied with its operational efficiency and product effectiveness and is now striving for customer intimacy.

- **Assemble to order**
  Components are made and held in stock ready for assembly. Lead-time and variety of goods held in stock can be reduced. This is largely what mass

customisers do. As described by Pine II *et al* (1993:116) a sales representative of Motorola sits with the customer and designs a tailored pager, out of a possible 29 million, that exactly meets his requirements. These specifications are then downloaded to the factory. Motorola is held up to be a mass customisation leader. This is an appropriate strategy for a company striving to hook its customers into value-added services.

A company who has redesigned its virtual network, and occupies a central position therein, could effectively leverage its network to both make to order and/or assemble to order, depending on whether the components were in stock or not.

The operational systems that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Make for stock/ provide for use.
2. II. Make for stock/ provide for use.
3. BPR. Make to order/perform to order.
4. BNR. Assemble to order.
5. BSR. Make to order/perform to order, and assemble to order.

2.10.4 Capacity Management

Matching supply and demand in operations is crucial for success in providing a proper service and meeting lead-times. In operations, supply and demand are known as load and capacity. Load is the demand placed on the system. Capacity is the ability of the system to deal with the demand. Output is the actual rate at which the load is being processed. Three generic strategies are often applied in managing capacity (Peppard & Rowland 1995:66).

- **Level**
  Where the operation maintains its output at a constant rate and uses stocks and demand manipulation to balance the load on the system. This is an appropriate strategy for a traditional, functionally-orientated industrial age company striving for local efficiency. Once having achieved efficiency, this remains an appropriate strategy for a company seeking product effectiveness.

- **Chase**
  Appropriate where capacity is variable to meet changes in demand. Its use is predominantly where capacity resources are flexible and relatively inexpensive. This is an appropriate strategy for a company that has achieved efficiency and effectiveness and is now striving to cut out intermediaries with a client intimacy strategy.

- **Coping**
  Where demand exceeds capacity and a strategy for dealing with the situation is devised. This is an appropriate strategy for a company that has achieved efficiency, effectiveness, and client intimacy and is striving to hook its

customers into mass customised value-added services. Building up a virtual network could be interpreted as a coping tactic. Coping is still an appropriate tactic for companies moving beyond this level of transformation, using modularity in design, and leveraging off their brand (like Nike) (Hamel 1997:24).

The capacity management approaches that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Level.
2. II. Level.
3. BPR. Chase.
4. BNR. Coping.
5. BSR. Coping.

2.10.5 Inventory Management

Inventories (stocks) can be stored throughout the value chain. They can be used as a buffer for disruptions, but are costly since they tie up capital. There are three types of stock, raw materials stock, work-in-progress and finished goods stock. Three generic strategies are often applied in managing stock replenishment (Peppard & Rowland 1995:69):

- **Re-order period**
  Where orders are placed at specific time periods with quantity dependent on level of stocks.

- **Re-order level**
  Where orders are placed when stock falls below a pre-determined level and quantities are fixed. These are appropriate strategies for traditional, functionally orientated industrial age companies striving for local efficiency.

- **Material requirements planning**
  Time-phased determination of stock requirements based on a dis-aggregation of a finished product into its component parts. This is an appropriate strategy for a traditional, functionally orientated industrial age company striving for efficiency and effectiveness through internal integration because it does not focus only on local exploitation.

- **Logistics**
  The position of the inventory is also key. Logistics covers all aspects of the storage and movement of materials between countries, sites and within sites (Peppard & Rowland 1995:70). Companies striving to cut intermediaries out with a client intimate strategy will have to attain competencies in logistics, lest the logistic providers get closer to the customer.

- **Virtual inventory**
  Information technology has made it viable to manage the total inventory of the organisation as if it were located in one single warehouse, where in reality it is geographically dispersed (Peppard & Rowland 1995:71). Companies striving to create a virtual network and occupy a central position therein to hook customers into value-added services will have to attain competencies in managing virtual inventory, otherwise they will not be able to achieve this.

The inventory management approaches that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Period and level.
2. II. MRP.
3. BPR. MRP and logistics.
4. BNR. Logistics and virtual inventory.
5. BSR. Logistics and virtual inventory.

2.10.6 Manufacturing Process Types

It is important that the manufacturing process selected matches the market the company is catering for. Using the wrong method would either be very inefficient or very costly. Five main categories of manufacturing types exist (Peppard & Rowland 1995:84), plus two virtual manufacturing processes:

- **Repetitive or assembly lines**
  Very high volume and a standard product type, mass production. Division and specialisation of labour is used.

- **Continuous**
  Very high volume standard products normally fully automated. Repetitive and continuous manufacturing processes are appropriate strategies for traditional, functionally orientated industrial age companies striving for efficiency through local exploitation since high volumes reduce unit costs.

- **Batch processes**
  The volume for each batch is larger, but the variety is less. Batch manufacturing processes are not only focusing on reducing unit costs locally, but beginning to tailor production to demand and are appropriate for a company striving for efficiency and effectiveness through internal integration.

- **Projects**
  Unique one-off development of product, or mass customisation.

- **Job shops**
  A wide variety of products demanded in small volumes. Project and job shop manufacturing process types will have to be included in the competencies of

companies striving to cut out intermediaries out through a customer intimate strategy so they are able to give customers exactly what they want.

- **Virtual factory**
  Upton and McAfee (1996:126) maintain that in a real virtual factory, the network is the factory. They advise that AeroTech Service Group, which is based in St Louis, Missouri, has built a highly effective, virtual factory with McDonnell Douglas Aerospace. They state that for a large-scale, virtual factory to succeed it must:

  1. Be able to accommodate network members whose IT sophistication varies enormously.
  2. Cope with a constantly churning pool of suppliers and customers while maintaining a high level of security.
  3. Give its members a great deal of functionality, including the capacity to transfer files between computers, the power to access common pools of information, and the capability to access and utilise all the programs on a computer located at a distance (Upton and McAfee 1996:123-125).

  A virtual factory will greatly assist in achieving mass customisation, since expertise can be levered globally to customise a product or service. New economies of scale can also be achieved on the demand side by providing global Internet access.

- **Virtual value chain/constellation**
  Hope & Hope (1997:100) state:

  > *"...technology is driving organisations in a new direction where they will be viewed as systems rather than physical entities. ... Such an organisation might indeed exist without any physical elements, merely comprising virtual value chains and a knowledge structure that links virtual inputs with market needs".*

  They use Gant, an American garment brand that uses its knowledge infrastructure to co-ordinate market needs and channels with a constellation of independent suppliers as an example. Nike is also hailed as a successful virtual organisation that retains its design and marketing expertise in-house, but sub-contracts its manufacturing to its Asian partners. Nike has leveraged its brand from running shoes to all sports apparel. British Airways apparently has advanced plans to become a virtual airline, retaining its route structure, brand and yield management systems, and out-sourcing everything else (Hope & Hope 1997:100-101). Rayport & Sviokla (1995:75-85) refer to this virtual world as "marketspace" and state that it creates five new principles:

1. The law of digital assets.	Digital assets, unlike physical ones, are not used up.
2. New economies of scale.	Global individual access simultaneously across the Internet.
3. New economies of scope.	Co-ordination across markets to

	provide a broader line of products and services.
4. Transaction cost compression.	Transaction costs along the virtual value chain (VVC) are lower than their counterparts along the physical value chain (PVC).
5. Re-balancing supply and demand.	Sensing a demand and connecting it to a source of supply.

At this highest stage of IT-enabled business transformation the business not only customises its current product or service line, but redefines its scope. The manufacturing process types that need to be considered across the transformation trajectory are therefore as follows:

1. LE. Assembly lines and continuous.
2. II. Batch processes.
3. BPR. Job shops and projects.
4. BNR. Virtual factory.
5. BSR. Virtual value chain, constellation.

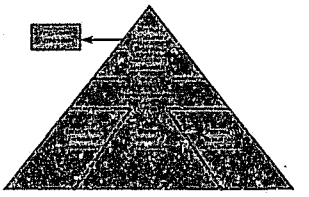
2.10.7 Summary

Automation applied to an inefficient operation will entrench the inefficiency. Automation applied to the incorrect operations strategy will entrench the wrong strategy. For this reason businesses should consider carefully what physical architecture would ultimately be appropriate before entrenching it. Both Boeing and Chrysler are collaboratively and concurrently building virtual vehicles before real ones using a computer-aided, three-dimensional interactive application and including over 500 suppliers in a dozen countries (Tapscott 1996:145–149). If this is becoming the minimum threshold in design and manufacturing then even the most heavily production-orientated companies must re-evaluate their situation. As stated in the introduction, the configuration of physical infrastructure and the facilities network deserve special attention because they are costly.

Table 8: Taxonomy of Physical Resource Architecture

Physical Architecture		Degree of IT-Enabled Business Transformation				
		Evolutionary Degrees		Revolutionary Degrees		
		Local Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
2.10.2	New Product Development	Traditional product planning	Concurrent engineering	Flexible product development	Mass customisation	Modularity
2.10.3	Operational Systems	Make for stock/ provide for use	Make for stock/ provide for use	Make to order/perform to order	Assemble to order	Make to order/perform to order, and assemble to order
2.10.4	Capacity Management	Level	Level	Chase	Coping	Coping
2.10.5	Inventory Management	Period and Level	MRP.	MRP and logistics	Logistics and virtual inventory	Logistics and virtual inventory
2.10.6	Manufacturing Process Types	Assembly lines and continuous	Batch processes	Job shops and projects	Virtual factory	Virtual value chain, constellation

2.11 Complete Architecture and Final Synthesised Taxonomy



2.11.1 Introduction

This section presents the complete IT-enabled business transformation architecture built up in the previous sections. It reduces the seven taxonomies to one, consisting of only the principal element drawn from the individual architectures. This principal taxonomy can be used by top management to reach agreement on the high level alignment of the seven architectures. Once agreement has been reached on the principal taxonomy the individual taxonomies can be referred to.

2.11.2 Complete IT-Enabled Business Transformation Architecture and Principal Taxonomy

The complete IT-enabled business transformation architecture, as built up through an in depth literature review is depicted in figure 11.

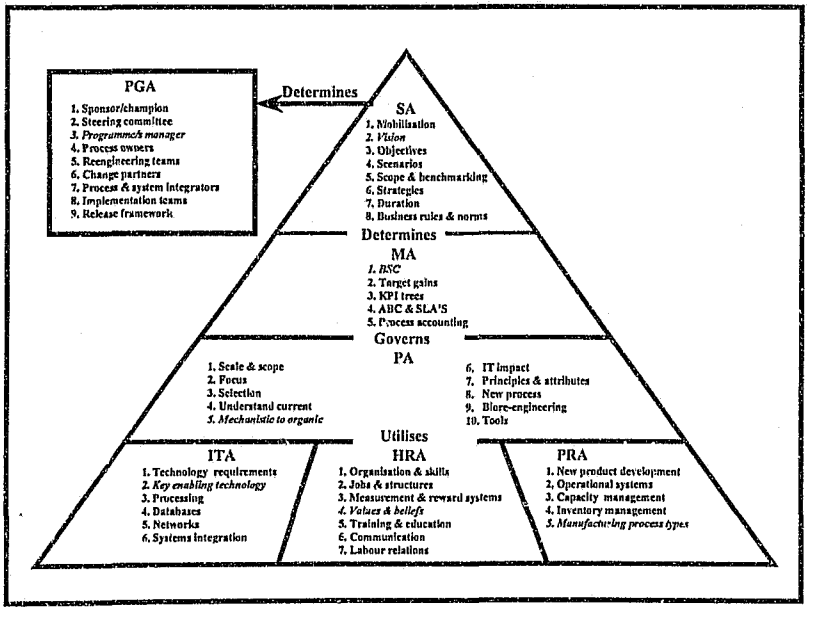


Figure 11: Complete IT-Enabled Business Transformation Architecture

The complete architecture is divided into the following seven sub-architectures: strategic architecture (SA), measurement architecture (MA), process architecture (PA), information technology architecture (ITA), human resources architecture (HRA), physical resources architecture (PRA) and programme architecture (PGA). The SA describes the end result and business principles that help determine the PGA and MA. The MA governs the PA that utilises the ITA, HRA and PRA.

The seven sub-architectures are divided into fifty elements that must be addressed during an IT-enabled business transformation. Each of these fifty elements has been plotted across the five degrees of IT-enabled business transformation, resulting in a taxonomy of 250 classifications (depicted at the end of each architectural sub-section). The principal (those from which all others can be deduced) element in each of the seven sub-architectures is used to derive the principal taxonomy shown in figure 12. Once senior management has gained agreement on the principle taxonomy, the other forty-seven categories can be addressed.

Architecture	Degree of IT-Enabled Business Transformation				
	Evolutionary Degrees		Revolutionary Degrees		
	Local Exploitation	Internal Integration	Business Process Redesign	Business Network Redesign	Business Scope Redefinition
Strategic Architecture: Vision	Operational Excellence (Mass Production)	Product Leadership	Customer Intimacy	Mass Customization (Mass Customer Intimacy)	Internetworked Brand
Programme Architecture: Manager	Functional Supervisor as Project Manager	Neutral Cross-Functional Project Manager	Company Programme Manager	Business Network Programmes Co-ordinator	Ad-hoc Project/ Logistics Co-ordinator
Measurement Architecture: BSC Fin: Cust: Proc: L. & L.:	Cost control Sales volume Supply chain opt. Tasks	Risk management Product demand Prod. dev/T.T. mkt. Teamwork	Yield mngt. Lifetime value Customer service Business	Value of contr. Order "fit" Flex. & response Multi-skilling	Network ec. of scale Brand loyalty Internetworking Custom university
Process Architecture: Mech. to Organic	Mechanistic isolated tasks in vertical silos	Integrated tasks	Cross-functional teams in horizontal silos	Modules with linking architecture	Clusters of molecules
IT Architecture: Enabling Technology	Personal Multimedia	Workgroup Computing	Enterprise Infostructure	Interenterprise Computing	"The Net"
HR Architecture: Values & Beliefs	Compliance	Initiative	Commitment	Restless curiosity	Institutionalised capacity for change
Physical Resource Architecture: Manufacturing	Assembly Lines Continuous	Batch Processes	Job Shops Projects	Virtual Factory	Virtual Value Chain/ Constellation

Figure 12: Principal Taxonomy of IT-Enabled Business Transformation Architectures

To illustrate the use of the taxonomy: if a business is striving to be an internetworked brand, similar to Levi Strauss or Nike, then it would outsource all its manufacturing to the global lowest cost producer, its factory would be virtual. If a business is striving to be the Nike manufacturer, then it would need to be operationally excellent with assembly-line manufacturing. The five architectures in between these two extremes would similarly have to be aligned.

2.11.3 Summary and Conclusion

Functionally-based organisations preserve the integrity of skills, but create silo's, SBU-based organisations facilitate focus, but not learning across business units, matrix-based organisations get stifled in-between, core competence-based organisations generate new business, but lose focus, and process-based organisations solve cross-functional process dysfunctions, but create tunnels (Gouillart & Kelly 1995:292). The BSC with its cause-effect learning loops help solve these problems, but is still difficult to implement in large organisations because it must be integrated into legacy systems. With the economies of scale and scope becoming less significant the new networked business model may be the most appropriate. Each company should mentally deconstruct itself, and with cognisance of the implications shown in the taxonomy decide what degree of transformation is appropriate, and then plot a suitable IT-enabled transformation trajectory.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology in an attempt to justify the process undertaken to develop the IT-enabled business transformation architecture and taxonomies. The research question and objectives are stipulated and the research methodology is described. The case study units of analysis and the research samples are explained and justified. The data collection and analysis methods are described and defended. Finally efforts made to assure the construct, internal and external validity and reliability of the research are discussed.

3.2 Research Question and Objectives

This research aimed to show that it is possible to describe an appropriate methodology for the seven business architectures across the five levels of IT-Enabled Business Transformation. The research also intended to show that the description of the methodology could be concise while, at the same time, allowing meaningful discussion on the associated issues and complexities. The following question was evaluated:

How can the five degrees of IT-enabled business transformation be used as the basis for deriving a taxonomy of methods? And in so doing:

1. Assist management in clarifying "what" degree of IT-enabled business transformation, as defined by Venkatraman (1994:73-86), they are trying to perform.
2. Assist management in plotting a trajectory to achieve this business transformation.
3. Provide management with a road map for the implementation of the transformation, the "how", which maintains congruency between strategy, measurement, process, technology, human and physical resources.
4. Identify under-developed areas (where pitfalls are) in IT-enabled business transformation for future research.

3.3 Research Design

The following diagram, figure 13, documents the research design highlighting the different methodologies utilised.

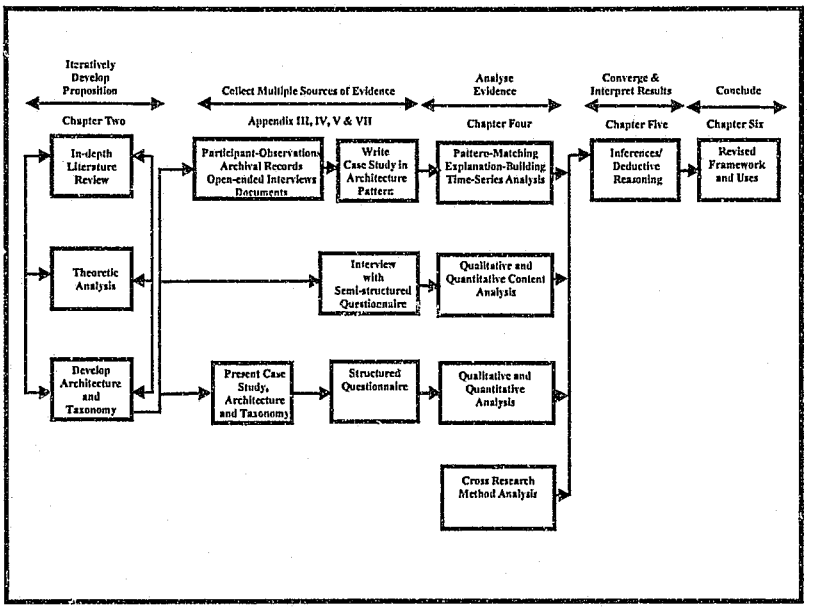


Figure 13: Depiction of Research Design
Based on: (Leedy 1997:105-169; Yin 1994:49)

The research process depicted above is described below:

- **Iterative Development of Proposed Frameworks (chapter two)**
  An in-depth literature review was undertaken. A theoretic analysis of this literature produced an IT-enabled business transformation architecture and seven sub-taxonomies, to aid transformations. The seven sub-taxonomies were synthesised into one principal taxonomy.

- **Multiple Sources of Evidence Collection**
  Using the IT-Enabled Business Transformation Architecture and seven sub-taxonomies as a pattern, a case study of Spoornet's predictable service IT-enabled business transformation programme was written (see appendix VII). Qualitative and quantitative evidence (Leedy 1997:105-110) on the applicability of the architecture and the principal taxonomy was collected through semi-structured interviews with ten senior managers in Spoornet. The case study was also presented to a focus group of nine executives and managers with varying degrees of IT-enabled transformation exposure and further qualitative and quantitative evidence on the applicability of the frameworks gathered by means of a structured questionnaire (see appendix III and IV).

- **Analysis of Evidence (chapter four)**
  The case study was analysed using pattern-matching, explanation-building and, where applicable, time-series analysis (Yin 1994:118). Content analysis (Krippendorf 1980:21) was done on the data collected in the interview and questionnaire survey. The data from the three research methods was first

analysed independently and then as one combined entity (methodological triangulation) (Yin 1994:92).

- **Interpretation of Results (chapter five)**
  Deductive reasoning was used to draw inferences from the individual and combined analysis and arrive at converged conclusions.

- **Conclusion (chapter six)**
  The frameworks were refined, guidelines for their use defined and areas for further research identified.

3.4 Research Unit of Analysis and Samples

3.4.1 Case Study Unit of Analysis

Only a case study could convey the holistic and meaningful characteristics of a vast and complex subject like IT-enabled business transformation. The predictable service IT-enabled business transformation programme conducted in Spoornet, the rail division of Transnet, starting in the early 1990s and still in progress was chosen as a unit of analysis. It was chosen because:

1. It fulfilled all the requirements of an IT-led, company-wide, complex, ambitious and current IT-enabled business transformation.
2. It represented a unique opportunity to shed light on the process of IT-enabled business transformation.
3. The researcher is a participant-observer and therefore has intimate knowledge of the case.

3.4.2 Semi-Structured Interviews

The focal point of the research was the case study, and all the multiple sources of evidence, one of which was semi-structured interviews, were converged into a single study. The sample for semi-structured interviews was chosen from Spoornet senior management who were known to be familiar with both the case study and knowledgeable on IT-enabled business transformation. The sample represented more than seventy percent of the total population of senior management in Spoornet who were known to fit this criteria. Their responses were based on the proposed frameworks relationship to their personal evaluation of the case study. This allowed triangulation among different evaluators to be performed (investigator triangulation) (Yin 1994:92). The entire population could have been interviewed, but after ten interviews saturation had been reached in terms of the split-half technique (Krippendorf 1980:69). Randomly dividing the sample into two equal parts produced the same conclusions.

3.4.3 *Questionnaire Survey*

Non-propability sampling was used because the respondents were a convenience sample (Leedy 1997:204) opportunistically chosen. As already stated the focal point of the research was the case study, and all the multiple sources of evidence were converged into a single study. To present the case to, and evaluate the proposed frameworks against nine knowledgeable Master of Commerce (IT) students, six of whom had been involved in IT-enabled business transformation, represented a unique opportunity to evaluate perspectives on the same data set (theory triangulation) (Yin 1994:92). They were all from different companies and represented seven different industries; actuaries and healthcare, telecommunications, motor manufacturing, IT consultancy, banking, engineering and transport. Their organisations ranged from less than one thousand to greater than forty thousand employees. This was also an attempt to confirm the domain to which the study's findings could be generalised (external validity) (Yin 1994:33).

3.5 Data Collection Methods

3.5.1 *Case Study*

Documents, archival records, open-ended interviews and direct participant-observations were used as data sources to compile the case study. These multiple sources of evidence were converged into a single study (data triangulation) (Yin 1994:92). To address the potential problems of construct validity besides these multiple measures of the same phenomenon, an attempt was made to establish a chain of evidence and five of the key informants were requested to review the case study report. To improve reliability all evidence collected was placed into a database categorised into the seven architectures of the proposed IT-enabled business transformation architecture.

3.5.2 *Semi-Structured Interviews*

Ten face-to-face semi-structured interviews were held (see appendix III). The average length of the interview was seventy-five minutes. All the interviews were recorded, written notes were taken and they were transcribed (see appendix IV). Interviews were used because the questionnaire can be more complex, response bias is low, information quality is superior and richer because superficial responses can be probed. An acknowledged drawback is that respondents may provide socially desirable responses (Czaja & Blair 1996:48).

3.5.3 *Questionnaire Survey*

The case study was presented to a focus group of nine executives and managers with varying degrees of IT-enabled transformation exposure. Upon completion of the presentation they were requested to complete a structured questionnaire on their own (see appendix III). The respondents were offered help if they had any problems interpreting the questions, but none was required. The structured questionnaire was chosen for this survey to maximise the use of limited time. The

purpose of this survey was to further validate the findings of the case study and semi-structured interview and assess to what extent they can be generalised.

3.6 Data Analysis Approach

3.6.1 Case Study

Pattern-matching, explanation-building and a time-series analysis as described by Yin (1994:106-108) were used to analyse the case study in an attempt to improve the internal validity. The case study was written in the pattern of the proposed IT-enabled business transformation architecture and taxonomy. The data collected were analysed in terms of how well they matched the generalised requirements of the proposed IT-enabled business transformation architecture and taxonomy. Explanations were built as to how and why they matched or deviated and, in one instance, a time-series analysis was done to explain how and why priorities were changing over time.

3.6.2 Semi-Structured Interviews

Content analysis was perceived as the most appropriate method of analysis in terms of the semi-structured interviews. Krippendorf (1980:21) defines content analysis as:

> *"Content analysis is a research technique for making replicable and valid inferences from data to their context".*

To present the data they were summarised into absolute frequencies and converted to relative frequencies (percentages) (Krippendorf 1980:109). For one question the mode was found to be the most appropriate (Howell 1995:50). The data was coded into an ordinal scale (Howell 1995:16) and placed into a computer spreadsheet (see appendix V) to test for any significant correlations between the variables.

3.6.3 Questionnaire Survey

The same technique used on the semi-structured interview data was used to present and analyse the questionnaire data. The data were summarised into absolute frequencies and converted to relative frequencies. The mode was used for one question. The data were coded into an ordinal scale and placed into a computer spreadsheet to test for any significant correlations between the variables. Uniform distributions between some individual categories and the average for all categories were also tested for significant deviations (Krippendorf 1980:109:112).

3.7 Convergence and Interpretation

The individual analysis provided multiple measures of the same phenomena, i.e.:

1. How pr[illegible]matic IT-enabled transformation is.
2. What problems are experienced.
3. In which architecture most problems arise.
4. How complete the IT-enabled transformation frameworks are.
5. If the frameworks assisted in identifying the degree of transformation.
6. If the frameworks help in maintaining congruency across architectures.
7. If the frameworks assisted in plotting a transformation trajectory.
8. To what extent the architectures in the taxonomy are aligned.
9. To what extent the principal taxonomy addresses the key element of the architecture.
10. If the frameworks are useful and contribute to successful transformation.

The analysis of the evidence from the structured interviews, case study and questionnaire survey was combined and analysed as a single study to strengthen the construct validity and reliability of the findings. Deductive reasoning was then used to draw inferences from the individual and combined analysis and arrive at converged conclusions.

3.8 Triangulation

As already stated, four types of triangulation (Yin 1994:92) were performed in an attempt to corroborate facts or phenomena and thereby improve validity and reliability:

1. Data triangulation.	The case study used multiple sources of evidence, participant-observations, documents, archival records and open-ended interviews to corroborate facts.
2. Investigator triangulation.	The interviewees used their personal evaluation of the case study to assess the validity of the proposed theoretical IT-enabled business transformation architecture and taxonomy. All their evidence was combined.
3. Theory triangulation.	The case study was presented to the questionnaire respondents and they all expressed their perspectives of the proposed theoretical IT-enabled business transformation architecture and taxonomy on the same case study data set. All their evidence was combined.
4. Methodological triangulation.	Three methods were used to collect evidence: • Semi-structured interviews. • A case study. • A structured questionnaire. All three methods' findings were converged.

3.9 Summary

An in-depth literature review was undertaken. A theoretic analysis of this literature produced an IT-enabled business transformation architecture and seven sub-taxonomies. The seven sub-taxonomies were synthesised into one principal taxonomy presented in section 2.10.2 of this research report. Using all the frameworks as a pattern a case study of an IT-enabled business transformation programme in Spoornet was written. The case study was analysed using pattern-matching and explanation building. Semi-structured interviews to assess the two frameworks were held with ten members of senior management from different disciplines in Spoornet. Qualitative and quantitative evidence was gathered from these interviews. The case study was also presented to a focus group of nine executives and managers with varying degrees of IT-enabled transformation exposure and further qualitative and quantitative evidence on the applicability of the frameworks gathered by means of a structured questionnaire. The evidence was analysed independently and then combined. Deductive reasoning was then used to draw inferences from the individual and combined analysis and arrive at converged conclusions. The frameworks were refined, guidelines for their use defined and areas for further research identified. The evidence is presented and analysed in the following chapter.

CHAPTER FOUR: PRESENTATION AND ANALYSIS OF THE EVIDENCE

4.1 Introduction

Chapter four presents and describes the results of the data collection. Data gathering consisted of a case study (see appendix VII), ten seventy-five minute interviews, and nine questionnaire surveys based on a presentation of the case study. The case study is analysed using a combination of pattern-matching and explanation building, and one time-series analysis. The descriptive survey data is analysed using content analysis as described in chapter three. Each question is analysed separately in terms of each research design, and then the results are converged.

4.2 Demographics of the Sample

The interviewees came entirely from Spoornet senior management. Their responsibilities, however, were diverse and ranged from the heads of Process and Systems, Operations, Strategic Marketing, and COALlink to Organisation Development. The case study was of a Spoornet IT-enabled business transformation. The survey respondents were managers from a diverse set of companies in Gauteng in South Africa. One questionnaire was too incomplete and misunderstood (ticks where there should have been numbers) to be evaluated, and had to be discarded. There was a significant difference in the size of the companies ranging from less than one thousand to more than forty thousand employees.

4.3 Is There a Problem with IT-Enabled Transformation?

4.3.1 Case Study

In the case study, the CEO challenged the company to achieve ninety percent on time delivery by the end of 1996. By mid 1998:

- Only thirty-five percent on time delivery had been achieved.
- Approximately thirty-four percent of customers could furnish the correct destination of consignments a week in advance (essential to build trip plans).
- Customers rarely furnished the correct wagon release time in advance.
- Blockouts at destinations were still prevalent and uncontrollable.
- The management of customers' logistics across the value chain had been implemented at only a few top customers.

This illustrates that the organisation was falling far short of its initial targets as do more than seventy percent of organisations as indicated in the literature.

4.3.2 *Semi-Structured Interviews*

The interviewees were asked if there were problems with IT-enabled business transformation and to cite examples. One hundred percent of respondents indicated the company experienced problems with IT-enabled business transformation. Twenty percent, however, qualified their statements. One asserted Spoornet was better than most at transformation, but was over-ambitious. Another contended that even if IT were excluded, the change is a significant industrial transformation.

4.3.3 *Questionnaire Survey*

The respondents were requested to indicate if there are problems with IT-enabled business transformation. Eighty-eight percent of respondents indicated that it is problematic. Twelve percent of the respondents replied to the contrary, but there is no apparent indication that this perception influenced the subsequent replies compared with the other respondents.

4.3.4 *Cross Research Method Analysis*

All three research methods indicate overwhelmingly that there is a problem with IT-enabled business transformation. The relative degree of problems was not tested in the survey or interview since, without a benchmark, this is a nebulous argument. The case study indicates a convolution of systemic problems causing the organisation to fall far short of its objectives.

4.4 What Problems are Experienced with IT-Enabled Business Transformation

4.4.1 *Case Study*

The case study indicates that 4 levels of change are being tackled in parallel:

- Turn strategy (demographics).
- Business orientation (from socialistic to capitalistic).
- Industrial age transformation from supply/push to demand/pull.
- IT-enabled transformation.

All four changes require human resources to acquire new knowledge, learn new skills and adopt different attitudes. The degree to which personnel between and within the various business areas have internalised these competencies differs. The simultaneous impact of these four changes, combined with the disparity in competency acquirement, has made the cause and effect problems extremely convoluted. The rate of change is being constrained by the lack of competency of a critical mass.

4.4.2 *Semi-Structured Interviews*

The interviewees were asked what type of problems they experienced with IT-enabled business transformation. Eleven different problems were cited seventeen times as summarised below from most to least:

Problem	Percentage
Competency to deal with IT-enabled transformation uneven/ only pockets of understanding / lack of real ownership	18
Transformation not properly structured / no proper tasking	12
In execution	12
IT responsible for thought leadership, selling and delivery	12
Lack of skills	12
Two levels of radical change – from supply/push to demand/pull plus IT.	6
Greater than 50% of personnel illiterate and/or scared of technology	6
Management cannot concur on tactical needs/misalignment/lack of conceptual skills	6
Changing half of leadership whilst undergoing change constrains progress	6
Integrating eleven cultures whilst undergoing change constrains progress	6
Dealing with political agendas whilst undergoing change constrains progress	6

The large disparity of problems was unexpected and a discussion surrounding this issue is presented in the following chapter.

4.4.3 *Questionnaire Survey*

This question was not posed directly in the questionnaire since it was felt to be too open-ended. In the space provided for comments, however, one respondent indicated that the success of IT-enabled business transformation relied, to a great extent, on line and senior managers being involved in the whole process. He asserted that in essence it is human intervention and communication intensive.

4.4.4 *Cross Research Method Analysis*

The eleven problems cited in the interview could be categorised into the four problems identified in the case study. Four categories of eleven different problems were therefore identified. The most relevant common denominator in all three research designs, however, is human resources and their competencies. All the problems identified can be placed into this category.

4.5 In which Architecture do Most Problems Exist?

4.5.1 Case Study

The case study indicates there were problems in at least five of the seven architectures. To begin with there were unrealistic expectations in the strategic architecture. Notwithstanding the high expectations there was a lack of ownership by process owners in the programme architecture causing a perceived lack of success with a resultant demoralising effect. There was also no golden thread in the measurement architecture making it difficult to achieve the BSC objectives. An obviously overly diverse IT Architecture made it difficult to build up a high skills base for each environment. Failure to work closely with the unions in the human resource architecture also caused resistance.

4.5.2 Semi-Structured Interviews

The interviewees were asked in which architectures most problems exist. All seven architectures were cited sixteen times as summarised below from most to least:

Architecture	Percent
Human Resource Architecture	38
Information Technology Architecture	25
Process Architecture	13
Strategic Architecture	6
Programme Architecture	6
Measurement Architecture	6
Physical Resource Architecture	6

4.5.3 Questionnaire Survey

The respondents were asked in which architecture most problems were experienced. Four of the seven architectures were cited, as summarised from most to least, below:

Architecture	Percent
Human Resource Architecture	38
Strategic Architecture	38
Process Architecture	12
Physical Resource Architecture	12

4.5.4 Cross Research Method Analysis

Although the question attempted to pinpoint the architecture that caused the most problems, on average the three research designs identified that seventy-six percent of the architectures are problematic. The three research designs' evidence corroborates each other's findings that the problems are not isolated, but

holistic. The case study highlights that the problems have a cause - effect relationship.

4.6 Completeness of IT-Enabled Transformation Frameworks

4.6.1 Case Study

The data collected in the case study fit well into the elements of the IT-enabled business transformation frameworks. The organisational background, macro-economic issues and implementation issues had, however, to be added to communicate a comprehensive picture. This once again highlights the holistic and systemic nature of organisational change. These items have, nevertheless, specifically been excluded from the scope of the frameworks. The frameworks would therefore appear to be complete.

4.6.2 Semi-Structured Interviews

The interviewees were asked if the IT-enabled business transformation architecture covered all aspects. Seventy percent of the interviewees indicated they believed it covered all the critical aspects. Thirty percent qualified their response with the following assertions:

- All the aspects are systemic.
- It accentuates IT at the expense of cash flow.
- It is complete from an IT point of view.

Thirty percent contended it was not complete for the following reasons:

- It lacks the element competency.
- It requires a reference architecture.
- It is not detailed enough.

4.6.3 Questionnaire Survey

The respondents were asked to what degree they believed the IT-enabled business architecture contributed to ensuring all aspects were covered. Seventy-five percent of interviewees indicated that it contributed either a lot or greatly to ensuring all aspects are covered. Twenty-five percent believed it contributed only a little and none believed it contributed nothing. There is a fairly high correlation between whether the respondents had been involved in an IT-enabled transformation and how the completeness of the architecture was rated for coverage (0.522), but is not significant since seventy–five percent of respondents were involved and fifty percent indicated great coverage. There is also no correlation between the size of the respondents' organisation and how the completeness was rated.

4.6.4 *Cross Research Method Analysis*

The case study indicates a good coverage. A seventy percent positive response was gained in the interviews and a seventy-five percent positive response in the questionnaire. The combined average is seventy-two point five percent. Owing to the systemic nature of change there are other elements that need to be considered, such as macro-economic trends and project management, but these are explicitly excluded from the scope of the architecture.

4.7 Assistance in Clarifying the Degree of IT-Enabled Transformation Undertaken

4.7.1 *Case Study*

The case study quotes Spoornet's vision as:

> *"The leader in providing profitable freight logistic solutions. In living the vision we will be conscious of and contribute to the ideals of South Africa".*

This indicates they are striving towards product leadership, based on information, which is also a business scope redefinition (and could be defined as an internetworked brand). Their professed path to achieve this is to first achieve operational excellence, then get into client intimate relationships. Their target of ninety percent predictability also indicates a certain minimum threshold of industrial age product leadership. The factory is focussing on the first two degrees, and sales on the upper three degrees. What the factory cannot provide, sales will sub-contract. The only degree not explicitly articulated is mass customisation, but this may simply be a natural outcome of continuously attempting to tailor services.

4.7.2 *Semi-Structured Interviews*

Ninety percent of interviewees responded positively when asked if the taxonomy assisted them in defining what degree of transformation they were trying to perform. Three qualified their replies with the statements that it would give them a fair idea, help them focus and that it was a good analytical tool. Another pointed out that one should actually ask the customers how they perceived the company. Ten percent were not sure and asserted that they were trying to address the first three degrees simultaneously.

4.7.3 *Questionnaire Survey*

The respondents were asked to what degree they believed the IT-enabled business transformation taxonomy contributed to clarifying the degree of transformation undertaken. Eighty-eight percent of respondents believed the taxonomy would assist a lot or greatly. Thirteen percent believed it would contribute a little. There is a fairly strong correlation between the size of the

company and the respondent's answer (0.567). It is, however, not significant enough to indicate any bias related to the size of the company.

4.7.4 Cross Research Method Analysis

The case study clearly demonstrates that the degree of transformation being addressed can be identified. A ninety percent positive response was gained in the interviews and an eighty-eight percent positive response in the survey. The combined average is a high, eighty-nine percent.

4.8 Assistance in maintaining Congruency Between the IT-Enabled Transformation Architectures

4.8.1 Case Study

The case study indicates that Spoornet is predominantly focusing on achieving a minimum threshold of operational excellence and product leadership in the factory. Through client intimate relationships and a network of alliances, sales are building up a branded logistics competence. The factory is focused largely on costs, volumes, tasks and compliance. Sales are focused largely on customisation, order "fit" and flexibility. The factory is therefore providing the foundation, and sales are pulling them up the change spectrum. There is congruency between the proposed frameworks and the Spoornet architecture.

4.8.2 Semi-Structured Interviews

The interviewees were asked if the taxonomy assisted in maintaining congruency between strategy, programme, process, technology, human and physical resources. One hundred percent of the interviewees felt the taxonomy would assist with maintaining congruency. One of the interviewees remarked that it would assist providing the contents were correct. The same interviewee, however, felt the alignment of the architectures was largely true. Another interviewee commented:

> *"It will help move one from unconsciously creating incongruity, to consciously being aware of it".*

4.8.3 Questionnaire Survey

The respondents were asked to what degree they believed the taxonomy assisted in maintaining congruency between strategy, programme, process, technology, human and physical resource architectures. Sixty-three percent of the respondents indicated they felt the taxonomy contributed either a lot or greatly towards maintaining congruency between the architectures. Thirty-eight percent felt it contributed only a little and none felt it contributed nothing.

4.8.4 *Cross Research Method Analysis*

The case study illustrates that different parts of the organisation can focus on different degrees of transformation simultaneously, and the taxonomy is still useful in maintaining congruency. One hundred percent of interviewees felt the taxonomy contributed to maintaining congruency and sixty-three percent of survey respondents felt it contributed a lot or greatly. Combined this is a high average of eighty-one percent.

4.9 Assistance in Plotting an IT-Enabled Transformation Trajectory

4.9.1 *Case Study*

Spoornet has plotted an IT-enabled business transformation trajectory. The trajectory is also loosely based on Treacy & Wiersma (1993:84-93), and Venkatraman (1994:74). Their trajectory only addresses three levels, business process redesign; business network redesign, and business scope redefinition. The paths to market leadership are operational excellence, client intimacy and product leadership. The framework proposed in this report merely adds two higher paths, mass client intimacy and internetworked brand. Although Spoornet have not articulated these paths, their actions indicate that they are moving in this direction.

4.9.2 *Semi-Structured Interviews*

The interviewees were asked if the taxonomy assisted in plotting a trajectory to achieve a transformation. Seventy percent of the interviewees felt the taxonomy would assist in plotting a transformation trajectory. Thirty percent felt it would only help conceptually because it is a requirement, but not in detail, since it does not provide practical steps. One of the interviewees made the following observation:

> *"Left to right are actually competency levels, it is about competency creation".*

4.9.3 *Questionnaire Survey*

The respondents were asked to what degree they believed the taxonomy assisted in plotting a trajectory to achieve business transformation. Sixty-three percent of the respondents felt it assisted a lot in plotting a trajectory. Thirty-eight percent felt it would only assist a little. None felt it would not assist at all or assist greatly.

4.9.4 *Cross Research Method Analysis*

The case study illustrates that Spoornet is using the proposed trajectory, although the higher levels are not defined. Seventy percent of interviewees felt that the taxonomy would assist with plotting an IT-enabled business transformation. Sixty-three percent of the survey respondents indicated it would assist a lot. Combined this is an average of sixty-seven percent.

4.10 Extent to which the Architectures in the Taxonomy are Aligned with the Degrees of Transformation

4.10.1 Case Study

The case study illustrates that Spoornet had aligned its factory predominantly with operational excellence. In this area it was focused on costs, volumes, suppliers, tasks and compliance. Spoornet's sales were predominantly aligned with client intimacy at the time. In this area they focused on yield, lifetime value, service, business, teams, commitment and imposed a job shop or project approach on the factory. This dualism caused it to have a company programme manager and an enterprise infostructure. Although dualistic, there is a close match with the relevant architectures in the taxonomy.

4.10.2 Semi-Structured Interviews

The interviewees were asked if the architectures in the taxonomy were aligned with the degrees of transformation. Eighty percent of the interviewees felt the architectures in the taxonomy are aligned with the degrees of transformation. Twenty percent asserted it was largely a representative clustering, but they were not completely satisfied. Those that were not satisfied felt the architectures were not mutually exclusive, and that other architectures may apply. They also felt that organisations could deliberately play in different architectures.

4.10.3 Questionnaire Survey

The respondents were asked to what extent the architecture is aligned with the degrees of IT-enabled transformation. The respondents indicated the alignment of the architectures is as summarised below:

Architecture	Badly	Fair	Good	Excellent
Strategic	0	13%	75%	13%
Programme	0	38%	63%	0
Measurement	0	63%	38%	0
Process	0	13%	88%	0
IT	13%	13%	63%	13%
HR	0	63%	38%	0
Physical Resource	0	75%	25%	0
Average	**1.8%**	**40%**	**56%**	**3.8%**

4.10.4 Cross Research Method Analysis

The case study illustrates a close match with the degrees of transformation in the principal taxonomy. Eighty percent of the interviewees felt the architectures in the taxonomy are aligned with the degrees of transformation. More than fifty-nine

percent of the questionnaire respondents indicated the alignment was good or excellent. Combined this is a high average of seventy percent.

4.11 Extent that the Principal Taxonomy Addresses the Key Element of each Architecture

4.11.1 Case Study

The case study indicates that initially mobilisation was critical. Once mobilisation had been achieved criticality shifted to the programme architecture, and then on to process and IT. Closer to the first implementation HR became the most important. This circle began to repeat with each release, but sometimes shifted as shortcomings were identified. This demonstrates that no one element is more important than another. It depends on the individual situation. The case study, nevertheless, highlights that the key element chosen within each architecture, is the most descriptive.

4.11.2 Semi-Structured Interviews

The interviewees were asked if the principal taxonomy of IT-enabled transformation addressed the key elements of each architecture. The interviewees responded as summarised below:

Architecture	Mode	Percentage
Strategic	Vision	90
Programme	Programmes Manager	90
Measurement	BSC	100
Process	Mechanistic to Organic	80
IT	Key Enabling Technology	90
HR	Values and Beliefs	90
Physical Resource	Manufacturing Type	80

4.11.3 Questionnaire Survey

The respondents were asked to indicate the most critical element in each architecture. They indicated the critical element of each architecture is as summarised below:

Architecture	Mode	Percentage
Strategic	Vision	75
Programme	Sponsor/champion	50
Measurement	BSC	50

Architecture	Mode	Percentage
Process	Selection	38
IT	Technology requirements	38
HR	Organisation and skills	50
Physical Resource	Capacity management	38

Had the question asked what the most descriptive element in each architecture is, it is believed the answer would have been different.

4.11.4 Cross Research Method Analysis

The case study illustrates that the key element changes over time depending on the circumstance. It confirms, however, that the elements chosen are the most descriptive. The interviewees and survey respondents only concur on twenty-nine percent of the elements. When the interview and survey results are combined the results are as summarised below:

Architecture	Mode	Percentage
Strategic	Vision	83
Programme	Programmes Manager	56
Measurement	BSC	78
Process	Mechanistic to organic	44
IT	Key enabling technology	56
HR	Values and beliefs	50
Physical Resource	Manufacturing type	56

These are still high percentages in favour of the elements chosen. Even in the process architecture the second highest was only seventeen percent.

4.12 Contribution to Successful IT-Enabled Transformations

4.12.1 Case Study

Each element of the IT-enabled business transformation architecture could retrospectively be populated by case study data. The relevant degree of transformation being pursued and progress in each element is identifiable. Had these models been available at inception, it would at minimum have provided a common framework for discussion and alignment. This is necessary because

most parties to a transformation come from different disciplines, functions and backgrounds, and do not share a common mental model.

4.12.2 Semi-Structured Interviews

The interviewees were asked if the frameworks were useful to them and/or the organisation. One hundred percent of interviewees believed the IT-enabled business transformation architecture and taxonomy are useful to the organisation. Thirty-percent qualified their positive response. One contended it would be of most use to a programme director whilst another stated it should drop down a level and a third mentioned that there are no silver bullets. One authenticated her response by asserting:

> *"It forces one to think through the all eventualities systemically, which one seldom does".*

4.12.3 Questionnaire Survey

The respondents were asked to what extent the IT-Enabled Business Transformation Architecture and Taxonomy contributes to successful transformation. Eighty-eight percent of respondents indicated that they believed the IT-Enabled Business Transformation Architecture and Taxonomy contributed a lot to successful transformation. Five percent indicated that it contributed a little, and none indicated it contributed either greatly or nothing.

4.12.4 Cross Research Method Analysis

The case study illustrates that the models could have been gainfully employed to serve as a common framework for discussion and alignment. One hundred percent of interviewees believed the IT-enabled business transformation architecture and taxonomy are useful. Eighty-eight percent of survey respondents indicated that they believed they contributed a lot to successful transformation. The combined average is ninety-four percent.

4.13 Overall Observations

4.13.1 Are there any Better IT-Enabled Business Transformation Frameworks?

The interviewees were asked if they had seen better IT-enabled business transformation frameworks than these. One hundred percent indicated that they had not. Thirty percent qualified this statement by stating they had seen different or simpler models, but not equivalent models. One authenticated his reply by stating:

> *"It is far richer than the normal models that are available".*

4.13.2 Refinements to the Frameworks

Interviewees were asked if they could make any refinements or additions to the frameworks. Twenty percent believed the two frameworks should be combined into one three-dimensional framework. Ten percent pointed out that it represented deconstruction and growth, and a shift from being a puppet to a puppeteer. The same ten percent requested that it be put onto the company Intranet. Ten percent argued they are actually frameworks.

4.14 Summary

This chapter presented the findings of the research, separately in terms of each research design, and converged to ascertain if the findings are corroborative. The next chapter will view these multiple sources of evidence as a single study and through inference draw conclusions. The multiple sources of data used in the case study and across the three research designs represents data triangulation. The three research methods represent methodological triangulation (Yin 1994:92).

CHAPTER FIVE: INTERPRETATION OF RESULTS

5.1 Introduction

Chapter five interprets the results of the data collection presented in the previous chapter. The multiple research methods, using multiple data sources, are converged to draw single conclusions. The multiple sources and measurements of the same phenomenon, and the triangulation thereof to draw single conclusions should contribute to the overall quality, reliability and construct validity of the conclusions. The use of three research methods should add to the ability to generalise the findings. As Kaplan and Duchon (1988:583) found in their research:

> *"...the most important conclusion is the need for a variety of approaches to the study of information systems.....no one method can provide the richness that information systems, as a discipline, needs for further advance".*

5.2 Effects of Demographics on the Sample

5.2.1 Case Study

The multiple sources of evidence used to develop the case study allowed a broader range of historical, attitudinal, and behavioural issues to be addressed. The findings are, therefore, more convincing since converging lines of inquiry, a process of triangulation, was developed. Although replication was not tested through multiple case studies, the case study coincides with the findings of the literature review that seventy percent of IT-enabled business transformation projects fall far short of their targets.

5.2.2 Semi-Structured Interviews

No demographic effect could be discerned among the chief executives from the specialist business, strategic marketing or operations environments. The findings were the same between IT and other staff. The chief executive, COALlink, was found to rate the issues currently important in his organisation, as key, quite out of context in relation to the other interviewees (forty-three percent as opposed to an average of eight percent).

5.2.3 Questionnaire Survey

Notwithstanding that the respondents came from a wide variety of industries with staff compliments of less than 1000 to greater than 10 000, all respondents indicated there are problems with IT-enabled transformation and no demographic trend could be discerned in their responses to the frameworks. All members of the sample were students of information systems. It could be argued that this

skewed the result, but it is more true to assert that all respondents are well read and informed on the subject area, which **strengthens** the result.

The five questions with possible responses on a continuum ranging from nothing, a little, a lot, to greatly, never received more than thirty-seven percent of responses in the second lower quartile and no less than sixty-three percent in the upper half. There were no responses in the lowest quartile. This is a fairly uniform distribution, which once again indicates no demographic biases.

5.3 Convergence of Multiple Sources of Evidence

The analysis of the evidence from the structured interviews, case study and survey was converged for purposes of interpretation. This provides multiple measures of the same phenomenon. The case study has already adopted this approach. This should strengthen the construct validity and overall quality of the findings.

5.4 Problems with IT-Enabled Transformation

The problems are diverse, with ten interviewees raising eleven issues on average only one-and-a-half times each. The case study illustrates the cause and effect relationships are convoluted and systemic. Although the problems appear in various architectures, they all stem from human resources and their lack of competencies: either knowledge, skills, attitude or cognitive ability. This is not a surprising finding, since organisations comprised people. Since transformation is about creating competencies, this should be the prime focus of management through all seven architectures. This will be incorporated into the framework. The research confirms the literature review findings that IT-enabled business transformation is a complex problem. The findings of all three research designs are extremely positive. It is therefore concluded that IT-enabled business transformation is problematic.

5.5 Completeness of IT-Enabled Transformation Frameworks

Competency was once again raised and, as indicated in the aforementioned paragraph, will be incorporated into the framework. The observation that it is from an IT point of view, and accentuates IT is acknowledged. The frameworks are not meant to imply that certain existing industrial age issues, like productivity and cash flow, become any less important, but that they should already be mastered and information age issues become the new challenges. It also does assert that certain industrial economic principles, such as economies of scale and scope, will become irrelevant as organisations move up the transformation spectrum. The assertion that it should contain a reference architecture is tantamount to a benchmark, which is included. The argument that it should contain more detail cannot be entertained since it is a generic framework, generalised from detail, which is specific per instance. That all the problems are systemic is also acknowledged. The research confirms that the elements derived from the literature review cover all aspects of IT-enabled business transformation. It is

therefore concluded that the proposed IT-enabled business transformation frameworks are complete.

5.6 Clarifying the Degree of IT-Enabled Transformation Undertaken

The argument that more than one "degree" could be addressed simultaneously is acknowledged. This highlights that the degrees are not necessarily sequential, and, for an organisation that wishes to transform rapidly, should not be approached in this manner. It would actually be beneficial for organisations to experiment with higher degrees of transformation whilst predominantly focusing on a lower degree. By the time the focus falls on the higher degree they will have learnt lessons which would help to reduce the risk. If the focus is not predominantly on one degree for a period of time, however, this may dilute the focus and concomitant effectiveness. The literature is not conclusive in its findings in this regard, and this may be an area for future research. All three research designs findings are positive. It is therefore concluded that the proposed IT-enabled business transformation taxonomy assists in clarifying the degree of IT-enabled transformation undertaken.

5.7 Maintaining Congruency Between the IT-Enabled Transformation Architectures

The case study aptly illustrates a dualistic approach with the factory aligned with the operational excellence architecture and sales aligned with the client intimacy architecture. This demonstrates that sales have a higher degree of competence on the change spectrum then the factory. Sales policy is to outsource all the lacking competencies, thereby creating a networked company. If the factory does not develop the competency to manage this virtual networked organisation, one of the other players will reap the benefit. This observation demonstrates the value of the taxonomy in maintaining congruency. All three research designs findings are positive. It is therefore concluded that the proposed IT-enabled business transformation taxonomy assists in maintaining congruency.

5.8 Plotting an IT-Enabled Transformation Trajectory

The case study aptly illustrates that the trajectory Spoornet is following, is aligned with taxonomy trajectory. The argument that the taxonomy is a requirement for a trajectory is acknowledged. The taxonomy is a framework or route map that each individual organisation must convert to its own detailed trajectory. The observation that the transformation trajectory is a competency creation trajectory is acknowledged and, as already stated, will be included in the framework. All three research designs findings are positive. It is therefore concluded that the proposed IT-enabled business transformation taxonomy assists in plotting a trajectory.

5.9 Alignment of the Architectures in the Taxonomy with the Degrees of Transformation

The argument that the architectures are not mutually exclusive and organisations could be in different ones simultaneously is acknowledged. The taxonomy is a guideline, and individual circumstances may exist that require organisations to mix dimensions of the architecture. The assertion that other architectures may exist is also acknowledged. The architecture descriptions are broad and were drawn from current literature on the relevant subjects. As such they largely represent current knowledge on the subject and cover most dimensions. Many lesser important ones may also exist. Researchers are also constantly gleaning new insights, which will undoubtedly lead to other architectures. All three research designs' findings are positive. It is therefore concluded that the architectures in the proposed IT-enabled business transformation taxonomy are aligned with the degrees of transformation.

5.10 Key Element of Each Architecture

The findings of all three research designs differ. The case study provides a clue to the reason for this. In the case study the most critical element changes over time, depending what phase of the transformation the organisation is in, or what problems are being experienced. The element the questionnaire respondents indicated most critical was therefore the one they had most recently experienced problems with; the one they experienced most problems with; or the one the case study accentuated as being most problematic. During the interview this phenomenon was identified and it was explained to each interviewee that the question really intended to ascertain which element was the most descriptive. This explanation caused most interviewees to agree with the chosen elements. When the interview results and the questionnaire results are combined, the outcome supports the chosen elements. The case study confirms that these are the most descriptive elements. It is therefore concluded that the chosen element in each architecture is key to describing the change trajectory.

5.11 Contribution to Successful IT-Enabled Transformations

The fact that all interviewees stated they had not seen better IT-enabled business transformation frameworks than those proposed indicates they are making a significant contribution. The assertion that they would be of most use to a programme director is based on the assumption that they would not assist the CEO in setting the corporate agenda, but in implementing it, because it focuses on alignment. Whilst accepting that there may be a myriad of other factors that may need to be considered, it is still contended that they can be a tool to assist the CEO in setting the corporate agenda, since they address the strategic transformation trajectory. There was not enough evidence to support the contrary. It is acknowledged there are no "silver bullets". All three research designs' findings are positive. It is therefore concluded that the proposed IT-enabled business transformation architecture and taxonomy contribute to successful transformation.

5.12 Refinements to the Frameworks

The following proposals have been incorporated into the frameworks:

- They be merged into one three-dimensional framework.
- They are about transformation from an industrial age commoditised puppet to an information age, in-demand puppeteer.
- They are about deconstruction, competency creation and growth.
- When merged it is a framework, present it as such.

The final framework is illustrated in figure 14 in the concluding chapter.

5.13 Summary

This chapter interpreted the results of the data analysis done in the previous chapter and inferred conclusions on each question. The three research methods' findings corroborated each other on seven of the eight questions posed. The dissimilar findings on the one question were as a result of a misinterpretation by respondents of a badly phrased question in the questionnaire survey. The recommendation to merge the business transformation architecture and principal taxonomy into one, and the other refinements have been adopted. The next chapter will evaluate the research in terms of its aims and objectives.

CHAPTER SIX: SUMMARY AND CONCLUSION

6.1. Introduction

Chapter six is the concluding chapter in which the research is evaluated in terms of the aims and objectives as stated in chapter one and three. The final three-dimensional framework is presented and reviewed. The highlights and unexpected findings of the research are discussed. The delimitations and limitations of the research are addressed. Guidelines for management and recommendations for future research are made.

6.2 Review of the Derived IT-Enabled Business Transformation Framework

The research has confirmed that the derived IT-enabled business transformation framework is representative of how an "industrial age" organisation can successfully be transformed into an "information age" organisation. Different situations will, however, require discretion to be exercised. As Baldwin & Clark (1997:88) assert:

> *"No strategy or sequence of moves will always work; as in chess, a good move depends on the layout of the board, the pieces one controls, and the skill and resources of one's opponent".*

But just like chess, there are set moves, guidelines on what to do and not do, and drills, to help you succeed. This array of learnt strategies and tactics, combined with intuition, common sense, innovation, intellect and experience is what helps chess players win. It is the same with this framework. Finally successful change programmes begin with results. (Schaffer & Thomson 1992:80) The final modified framework incorporating changes recommended by the interviewees is illustrated in figure 14 (see also appendix VI for a larger scale model).

6.3 Review of the Aim and Objectives of the Research

This research evaluated the following question:

How can the five degrees of IT-enabled business transformation be used as the basis for deriving a taxonomy of methods.

The objectives have been stated as follows:

1. To show that it is possible to describe an appropriate methodology for the seven business architectures across the five levels of IT-enabled business transformation.

- The research has shown that it is possible to describe an appropriate methodology for the seven business architectures across the five levels of IT-enabled business transformation in the form of a framework.

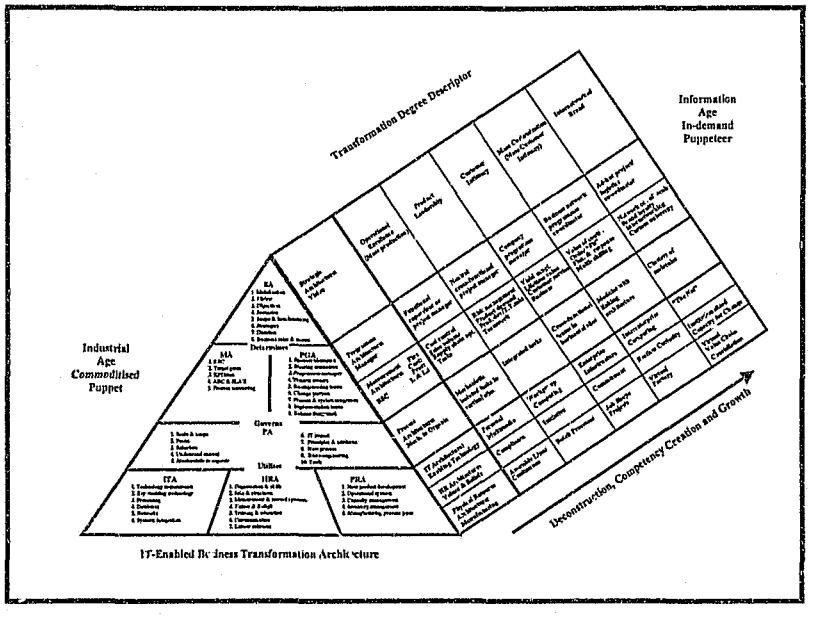


Figure 14: Final IT-Enabled Business Transformation Framework
(A larger scale model is in appendix VI)

2. To show that the description of the methodology can be concise while, at the same time, allowing meaningful discussion on the associated issues and complexities.

- The research has shown that the methodology, in the form of a framework, is useful; will contribute to the success of IT-enabled business transformations, and allows meaningful discussion on the associated issues and complexities. The research has not shown that it is brief ("concise" means meaningful in expression and brief) (The Concise Oxford Dictionary 1987. Sv "concise"). In retrospect, however, "brief" is a relative term. The fact that none of the interviewees had seen a better framework, indicates that a suitable balance has been struck between richness and briefness.

3. To assist management in clarifying "what" degree of IT-enabled business transformation, as defined by Venkatraman (1994), they are trying to perform.

- The research has shown that the framework does assist management in clarifying "what" degree of transformation they are trying to perform.

4. To assist management in plotting a trajectory to achieve this business transformation.

- The research has shown that the framework does assist management in plotting a trajectory to achieve a business transformation. Whether the degrees are sequential or not, however, could not be clarified and was identified as an area for further research.

5. To provide management with a road map for the implementation of the transformation, the "how", which assists in maintaining congruency between strategy, programme, measurement, process, technology, human and physical resources.

- The research has shown that the framework does provide management with a road map that assists in maintaining congruency between strategy, programme, measurement, process, technology, human and physical resources.

6. To identify under-developed areas (where pitfalls are) in IT-enabled business transformation for future research.

- The research discerned that IT-enabled business transformation is essentially about the creation of competencies (knowledge, skills and attitudes) in human resources in each of the business architectures. The lack of a competency in any of the architectures will constrain transformation. This and whether the degrees of transformation are sequential may be areas for future research. These aspects are further addressed in paragraph 6.5.

6.4 Guidelines for Management

The most important practical contribution this research report provides is the following set of management guidelines for the use of the frameworks:

1. Use the framework to raise management's awareness of the potential impact of IT on the organisation and the economy in general.
2. Use the framework as a discussion point to align all disciplines on a conceptual level.
3. Use the framework as an input to setting the corporate agenda.
4. Use the framework to pinpoint the organisation's current degree of transformation (or competency).
5. Use the framework to assist in aligning all seven business architectures.
6. Use the framework to identify which architectures are lacking competencies and constraining progress.
7. Use the framework as a discussion point to assist in planning a transformation trajectory.
8. Use the framework as a checklist that all elements have been addressed.
9. Ensure those responsible are aligning the sub-taxonomies with the main framework.

6.5 Suggested Areas for Further Research

This report highlights some areas where further research is suggested:

1. Study successfully IT-enabled transformed organisations to ascertain if the degrees must be traversed sequentially or if they are able to "leapfrog" degrees successfully (or address several simultaneously).
2. Study the relationship between organisations' ability to create the necessary competencies and their success at transformation.
3. Conduct a study to ascertain if organisations can successfully be transformed autocratically.
4. Conduct action research to establish an internetwork brand organisation from scratch and successfully dis-intermediate an industrial organisation from its customers (this will prove the threat to industrial organisations).
5. Further investigate and verify the framework and especially the sub-taxonomies proposed in this report.

6.6 Delimitation and Limitations of the Study

A "delimitation" addresses how the study was limited in scope, while a "limitation" identifies the potential weakness of the study. A delimitation may thus result in limitations to the study.

6.6.1 Delimitation

The main delimitation of the research is that external sampling was small (only eight respondents) and it was structured, not allowing for open questions and probing of superficial answers. Had semi-structured interviews been held with more external organisations it would have strengthened the external validity of the research and made it even more generalisable.

6.6.2 Limitations

Despite the limitations mentioned below, because of the data and methodological triangulation, it is believed this research is valid and reliable, and provides valuable insights both theoretical and practical, into the management of IT-enabled business transformation.

6.6.2.1 Researcher's Interpretation

In a study such as this the qualitative findings are subject to the interpretations of the researcher, and other explanations are possible. In analysing the evidence collected the researcher aimed to be as objective as possible. Readers of the research need to acknowledge the researcher's viewpoints and possibly draw their own inferences.

6.6.2.2 Sample Size and Data Collection

It may be argued that the two sample sizes (ten interviewees and eight questionnaire respondents) were relatively small in relation to all organisations that have experience with IT-enabled transformation. It could further be argued that since the framework implies a macro-economic information age trend the real population from which to sample is all organisations. This would detract from the research's generalisations.

6.6.2.3 Sample Selection

It may be argued that the method of sample selection for the external surveys (non-probability sampling) presents its own limitations because it was not random. In random sampling each individual in the sample has an equal probability of being selected which enables the researcher to generalise the findings of the research study to the entire business population.

6.7 Unexpected Findings

The large number of diverse problems all related to the incompetence (knowledge, skills and attitude) of people was unexpected. It implies the rate of change will tend towards the speed the competencies of all involved people can be raised, since each degree of transformation requires a new and specific level of competence.

6.8 Summary

In brief the aim of this research was to develop a taxonomy of methods to support the five degrees of IT-enabled business transformation as defined by Venkatraman (1994:73-86). The objectives of the research were met.

Organisations undertaking IT-enabled business transformation would have a framework to recognise their current level of transformation competency, identify incongruity in their organisation and change their transformation programme, and plot a transformation trajectory. The taxonomy of methods provide a guideline for management and academia that will contribute to the successful implementation of IT-enabled business transformation.

REFERENCES

Aghassi, H. 1994. Organisational Structures, People and Technology. In Coulson-Thomas, C. ed. *Business Process Re-engineering: Myth and Reality.* London: Kogan Page.

Ahmed, PK. & Simintiras, AC. 1996. Conceptualizing business process Reengineering. *Business Process Reengineering and Management Journal,* vol. 2, no. 2. pp. 73-92.

Andrews, DC. & Stalick, SK. 1994. *Business Reengineering. The Survival Guide.* Englewood Cliffs: Yourdon Press.

Asbrand, D. 1997. Is Datamining ready for the Masses? *Datamation.* Nov. pp. 68-71.

Bainbridge, C. 1996. *Designing For Change. A Practical Guide to Business Transformation.* Chichester: John Wiley & Sons Ltd.

Baldwin, Y. & Clark, KB. 1997. Managing in an Age of Modularity. *Harvard Business Review,* Sept/Oct. pp. 84-93.

Benhamou, E. 1994. The Community as an Electronic Proving Ground. In Coulson-Thomas, C. ed. *Business Process Re-engineering: Myth and Reality.* London: Kogan Page.

Benjamin, RI. & Levinson, E. 1993. A Framework for Managing IT-Enabled Change. *Sloan Management Review,* Summer. pp. 23-33.

Benjamin, R. & Wigand, R. 1995. Electronic Markets and Virtual Value Chains on the Information Superhighway. *Sloan Management Review,* Winter. pp. 23-72.

Business Process Management Journal. Developing re-engineering towards integrated process management. 1997. Bradford: MCB University Press. pp. 1-108.

Carnall, C. 1995. *Managing Change in Organisations.* Hertfordshire: Prentice Hall.

Caron, JR., Jarvenpaa, SL. and Stoddard, DB. 1994. Business Reengineering at CIGNA Corporation: Experiences and Lessons Learned From the First five Years. *MIS Quarterly,* Sept. pp. 233-249.

Cash, JI.Jr., Eccles, RG., Nohria, N. & Nolan, RL. 1994. *Building the Information-Age Organisation: Structure, Control, and Information Technologies.* Boston: IRWIN.

Casonato, R. 1996. The Internet Will Totally Transform Work Management. *Gartner Group* Report 12, December. pp. 1-5.

Champy, J. 1995. *Reengineering Management.* London: HarperCollins

Choi, CF. and Chan, SL. 1997. Business process reengineering: evocation, elucidation and exploration. *Business Process Management Journal,* vol. 3, no. 1. pp. 39-63.

Clemons, EK. & Row, M. 1988. McKesson Drug Company: A Case Study of Economost - A Strategic Information System. *Journal of Management Information Systems,* Summer, vol. 5, no. 1. pp. 36-50.

Coleman, D. 1997. Groupware: Collaborative Strategies for Corporate LANs and Intranets. *Collaborative StrategiesTM.* http://www.collaborate.com. pp. 61-106.

Coulson-Thomas, C. 1994. Initiating and Preparing for Reengineering. In Coulson-Thomas. C. ed. *Business Process Re-engineering: Myth and Reality.* London: Kogan Page.

CSC Foundation. 1994. Information Systems to Support Customer Intimacy. *CSC Foundation.* Final Report 95. pp. 1-32.

Czaja, R. & Blair, J. 1996. *Designing Surveys.* London: Pine Forge Press

Davenport, TH. 1993. *Process Innovation. Reengineering Work through Information Technology.* Boston: Harvard Business School Press.

Davenport, TH. 1994. Saving IT's Soul: Human-Centered Information Management. *Harvard Business Review,* Mar/Apr. pp. 119-131.

Davenport, TH. & Short, JE. 1990. The new industrial engineering: IT and Business Process Redesign. *Sloan Management Review,* Summer. pp. 11-26.

Davis, S. & Davidson, B. 1991. *2020 Vision.* New York: Simon and Schuster.

De Geus, A. 1997. The Living Company. *Harvard Business Review,* Mar/Apr. pp. 51-59.

De Vreede, GJ., Van Eijck, DTT. & Sol, HG. 1996. Dynamic Modelling for Re-engineering Organisations. *INFOR* vol. 34, No. 1, Feb. pp. 28-43.

De Wit, PWC. & Hamersma, SA. 1992. *Production and Operations Management.* Halfway House: Southern Book Publishers.

Deakins, E. & Makgill, H.H. 1997. What killed BPR? Some evidence from the literature. *Business Process Management Journal,* vol. 3., no. 1. pp. 81-109.

Drucker, PF. 1988. The Coming of the New Organisation. *Harvard Business Review,* Jan/Feb. pp. 45-53.

Drucker, PF. 1992. The New Society of Organisations. *Harvard Business Review,* Sept/Oct. pp. 95-104.

Duimering, PR., Safayeni, F. & Purdy, L. 1993. Integrated Manufacturing: Redesign the Organisation before Implementing Flexible Technology. *Sloan Management Review,* Summer. pp. 47-56.

Evans, PB. & Wurster, TS. 1997. Strategy and the New Economics of Information. *Harvard Business Review,* Sept/Oct. pp. 70-82.

Fitzgerald, B. & Murphy, C. 1994. The Practical Application of a Methodology for Business Process Re-engineeering. In Coulson-Thomas. C. ed. *Business Process Re-engineering: Myth and Reality.* London: Kogan Page.

Galliers, RD. 1992. Choosing Information Systems Research Approaches. In Galliers, R.D. ed. *Information Systems Research. Issues, Methods and Practical Guidelines.* Oxford: Blackwell.

Galliers, RD., Merali, Y. & Spearing, L. 1994. Coping with information technology? How British executives perceive the key information systems management issues in the mid 1990's. *Journal of Information Technology,vol.* 9 no. 3. Sept. pp. 223-238.

Gates, B. 1995. *The Road Ahead.* London: Penguin Books.

Ghoshal, S. & Bartlett, CA. 1996. Rebuilding Behavioral Context: A Blueprint for Corporate Renewal. *Sloan Management Review,* Winter. pp. 23-35.

Gouillart, FJ. & Kelly, JN. 1995. *Transforming the Organisation.* New York: McGraw-Hill.

Grulke, WE. 1997. From Value Chain to Marketspace. The Impact of Network-Centric Services. FutureWorld. http://www.futureworld.co.za. pp. 1-6.

Hall, G., Rosenthal, J. & Wade, J. 1993. How to Make Reengineering Really Work. *Harvard Business Review,* Nov/Dec. pp. 119-131.

Hamel, G. 1997. Killer Strategies. *Fortune*, No. 12. pp. 22-34.

Hamel, G. & Prahalad, CK. 1994. *Competing for the Future.* Boston: Harvard Business School Press.

Hammer, M. 1990. Reengineering Work: Don't Automate, Obliterate. *Harvard Business Review,* Jul/Aug. pp. 104-112.

Hammer, M. 1996. *Beyond Reengineering.* London: HarperCollinsPublishing.

Hammer, M. & Champy, J. 1993. *Reengineering the Corporation. A Manifesto for Business Revolution.* London: Nicholas Brealey Publishing.

Hammer, M. & Stanton, S.A. 1995. *The Reengineering Revolution Handbook.* London: HarperCollinsPublishing.

Hardaker, M. 1995. *Total Competitiveness. The seven Key Questions for Reengineering.* Berkshire: McGraw-Hill.

Holtham, C. 1994. Business Process Re-engineering - Contrasting what it is with what it is not. in Coulson-Thomas, C. ed. 1994. *Business Process Reengineering: Myth & Reality.* London: Kogan Page.

Hope, J. & Hope, T. 1997. *Competing in the Third Wave.* Boston: Harvard Business School Press.

Hopper, MD. 1990. Rattling SABRE - New Ways to Compete on Information. *Harvard Business Review.* May/June. pp. 118-125.

Howell, DC. 1995. *Fundamental Statistics for the Behavioral Sciences.* Belmont: Wadsworth.

Iansiti, M. & MacCormack, A. 1997 Developing Products on Internet Time. *Harvard Business Review,* Sept/Oct. pp. 108-117.

Kaplan, B. & Duchon, D. 1988 Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study. MIS Quarterly, Dec. pp. 571-583.

Kaplan, RS. & Norton, DP. 1992. The Balanced Scorecard – Measures that Drive Performance. *Harvard Business Review*, Jan/Feb. pp. 71-79.

Kaplan, RS. & Norton, DP. 1993. Putting the Balanced Scorecard to Work. *Harvard Business Review*, Sept/Oct. pp. 134-147.

Kaplan, RS. & Norton, DP. 1996. Using the Balanced Scorecard as a Strategic Management System. *Harvard Business Review*, Jan/Feb. pp. 75-84.

Keeble, P. 1995. A New Methodology for Business Process Re-engineering. *INFOR*, vol. 33, no.4, Nov. pp. 234-247.

Keen, PGW. 1991a. *Shaping the Future.* Boston: Harvard Business School Press.

Keen, PGW. 1991b. *Every Manager's Guide to Information Technology.* Boston: Harvard Business School Press.

Konsynski, BR. 1993. Strategic Control in the extended enterprise. *IBM Systems Journal*, vol. 32, no. 1. pp. 111-142.

Krippendorf, K. 1980. *Content Analysis. An Introduction to its Methodology.* London: Sage Publications.

Leedy, PD. 1997. *Practical Research Planning and Design.* New Jersey: Prentice Hall.

Letza, SR. 1996. The Design and Implementation of the Balanced Business Scorecard. An analysis of three companies in practice. *Business Process Reengineering and Management Journal*, vol. 2, no. 3. pp. 54-76.

Madnick, SE. 1991. The Information Technology Platform. In Scott Morton, M.S. ed. *The Corporation of the 1990's. Information Technology and Organisational Transformation.* Oxford: Oxford University Press.

Magee, F., Frick, V., Kirk, T., Kleinberg, K. and Andren, E. 1997. Managing Distributed Computing (MDC). Strategic Analysis Report. Creating IT Processes: Organizing Work Across Distributed Computing Boundaries. *Gartner Group*, Inc. pp. 1-5.

Magretta, J. 1998. The Power of Virtual Integration. *Harvard Business Review,* Mar/Apr. pp. 72-84.

Malone, TW., Yates, J. & Benjamin, RI. 1989. The Logic of Electronic Markets. *Harvard Business Review*, May/June. pp. 166-172.

Manganelli, RL. & Klein, MM. 1994. *The Reengineering Handbook. A Step-by-Step Guide To Business Transformation.* New York: AMACOM.

Markus, ML. & Benjamin, RI. 1997. The Magic Bullet Theory in IT-Enabled Transformation. *Sloan Managment Review,* Winter. pp. 55-68.

Marshall, R. & Yorks, L. 1994. Planning for a Restructured, Revitalised Organisation. *Sloan Managment Review, Summer.* pp. 81-91.

Martinez, EV. 1995. Successful Reengineering Demands IS/Business Partnerships. *Sloan Managment Review, Summer.* pp. 61-71.

McAdam, R. 1996. An Integrated Business Improvement Methodology to Refocus Business Improvement Efforts. *Business Process Re-engineering & Management Journal*, vol. 2, no. 1. pp. 63-71.

McFarlan, FW. & Nolan, RL. 1995. How to Manage an IT Outsourcing Alliance. *Sloan Managment Review,* Winter. pp. 9-23.

META TRENDS. 1994. Advanced Information Management Strategies. META Group Inc. 20 January. http://www.metagroup.com. pp. 57-60.

Miers, D. 1994. Use of Tools and Technology Within a BPR Initiative. In Couison-Thomas, C. ed. *Business Process Re-engineering: Myth and Reality.* London: Kogan Page.

Morris, D. & Brandon, J. 1993. *Reengineering Your Business.* New York: McGraw-Hill, Inc.

Obeng, E. & Crainer, S. 1994. *Making Re-engineering Happen.* London: Pitman Publishing.

Parker MM. 1996. *Strategic Transformation and Information Technology. Paradigms for Performing While Transforming.* London: Prentice-Hall.

Pellegrinelli, S. & Bowman, C. 1994. Implementing Strategy through Projects. *Long Range Planning*, vol. 27, no. 4. Elsevier Science Ltd. pp. 125-132.

Peppard, J. & Rowland, P. 1995. *The Essence of Business Process Re-engineering.* Englewood Cliffs: Prentice Hall.

Peters, T. 1994. *The Tom Peters Seminar. Crazy Times Call for Crazy Organisations.* London: MacMillan.

Peters, T. 1997. The Tom Peters 1997 Southern African Tour. Circle of Innovation. Colorpress. pp. 1-83.

Pine II, BJ., Victor, B. & Boynton, AC. 1993. Making Mass Customisation Work. *Harvard Business Review*, Sept/Oct. pp. 108-119.

Randall, N. 1997. Internet Tools. What Happens When You Click. *PC Magazine.* Feb. pp. 93-95.

Rayport, JF. & Sviokla, JJ. 1995. Exploiting the Virtual Value Chain. *Harvard Business Review*, Nov/Dec. pp. 75-85.

Remenyi, D., Money, A. & Twite, A. 1995. *Effective Measurement and Management of IT Costs and Benefits.* Oxford: Butterworth Heinemann.

Rob, P. & Coronel, C. 1993. *Database Systems. Design, Implementation and Management.* Belmont: Wadsworth.

Schaffer, RH. & Thomson, HA. 1992. Successful Change Programs Begin with Results. *Harvard Business Review*, Jan/Feb. pp. 82-89.

Scheer, AW. 1994. *Business Process Engineering.* Berlin: Springer-Verlag.

Scott Morton, MS. 1991. *The Corporation of the 1990's. Information Technology and Organisational Transformation.* Oxford: Oxford University Press.

Senge, P. 1990. *The Fifth Discipline.* New York: DoubleDay.

Short, JE. & Venkatraman, N. 1992. Beyond Business Process Redesign: Redefining Baxter's Business Network. *Sloan Management Review,* Fall. pp. 7-21.

Spoornet 1996. Predictable Service as Part of Spoornet's Transformation. pp. 1-120

Spoornet Predictable Service Core Team. 1998. Spoornet Joint Transformation Committee Training Material. *Spoornet Predictable Service Programme Working Papers.* pp. 1-35.

Talwar, R. 1994. Re-engineering - a Wonder Drug for the 90s? In Coulson-Thomas. C. ed. *Business Process Re-engineering: Myth and Reality.* London: Kogan Page.

Talwar, R. 1997. From Reengineering to Transformation and Beyond. *The Centre for Business Transformation.* London. Cited in Brown, A. City University Business School, London, workshop handout, July 30 - 31st, 1997 at University of Witwatersrand. pp. 1-8.

Tapscott, D. 1996. *The Digital Economy. Promise and Peril in the Age of Networked Intelligence.* New York: McGraw-Hill.

The Concise Oxford Dictionary. 1987. Sv "concise". Oxford: Oxford University Press.

Tichy, NM. & Sherman, S. 1995. *Control Your Destiny or Someone Else Will.* London: HarperCollinsPublishers.

Treacy, M. & Wiersma, F. 1993. Customer Intimacy and Other Value Disciplines. *Harvard Business Review.* Jan/Feb. pp. 84-93.

University of Witwatersrand. 1997. Survey of Key IT Issues. pp.1.

Upton, DM. & McAfee, A. 1996. The Real Virtual Factory. *Harvard Business Review.* Jul/Aug. pp. 123-133.

Venkatraman, N. 1991. IT-Induced Business Reconfiguration. In Scott Morton, M.S. ed. *The Corporation of the 1990's. Information Technology and Organisational Transformation.* Oxford: Oxford University Press.

Venkatraman, N. 1994. IT-Enabled Business Transformation: From Automation to Business Scope Redefinition. *Sloan Management Review,* Winter. pp.73-87.

Venkatraman, N. & Kambil A. 1991. The Check's Not in the Mail: Strategies for Electronic Integration in Tax Return Filing. *Sloan Management Review,* Winter. pp. 33-43.

Ward, J. & Griffiths, P. 1996. *Strategic Planning for Information Systems.* Chichester: John Wiley and Sons.

Williams, TJ. 1994. The Purdue Enterprise Reference Architecture. *Computers In Industry.* Elsevier Science B.V.

Yin, RK. 1994. *Case Study Research, Design and Methods.* California:Sage Publications.

Zairi, M. 1997. Business Process Management: a boundaryless approach to modern competitiveness. *Business Process Management Journal,* vol. 3, no. 1. pp. 64-80.

Zuboff, S. 1988. *In The Age of the Smart Machine. The Future of Work and Power.* New York: Basic Books.

APPENDIX I: IT-ENABLED TRANSFORMATION FRAMEWORKS

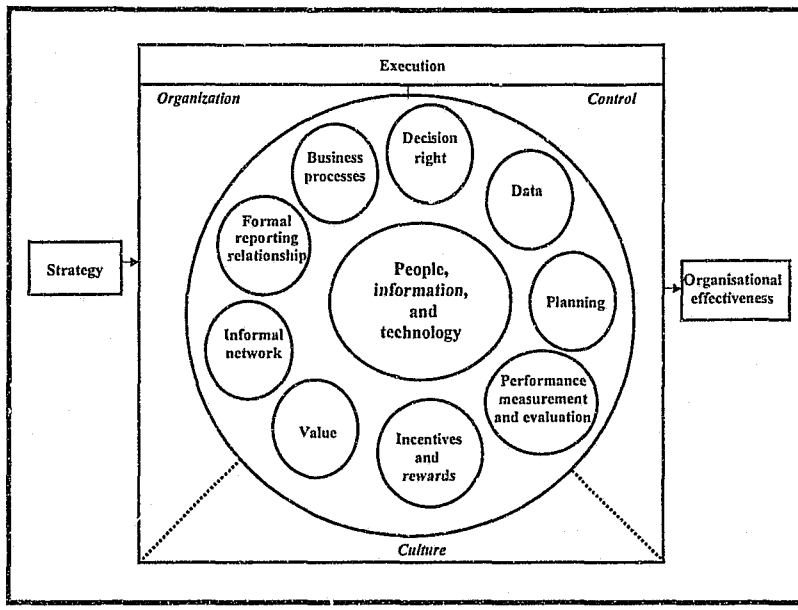


Figure 15: Organisational Prototype
Source: Cash *et al* (1994:413).

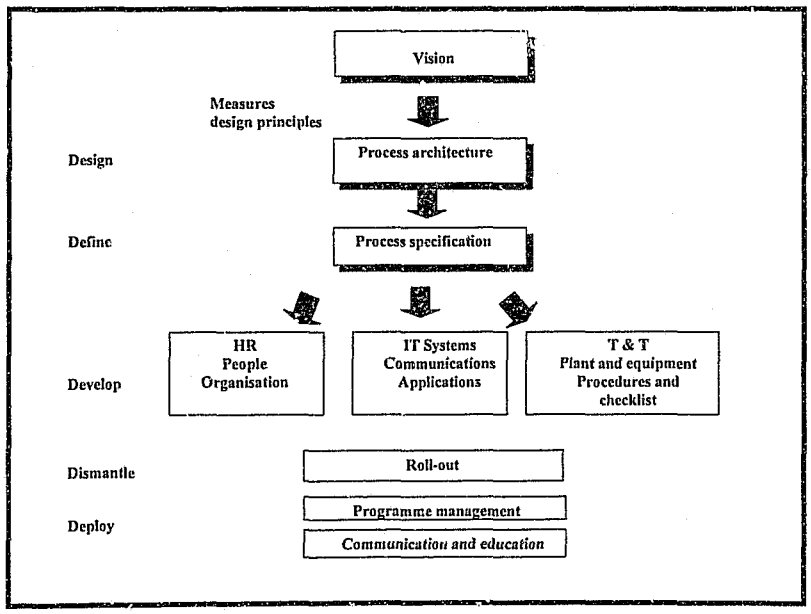


Figure 16: Transformation Approach Overview
Source: Bainbridge (1996:43)

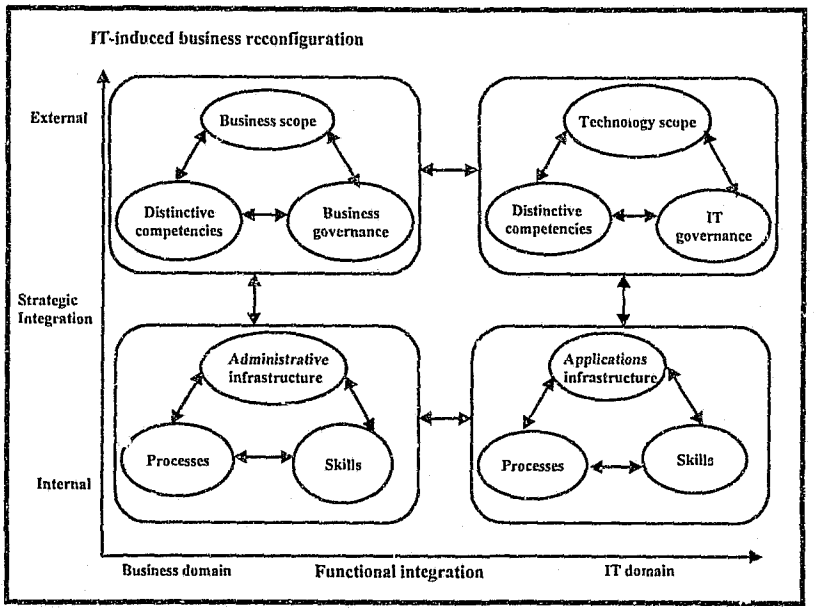


Figure 17: The Strategic Alignment Model
Source: Venkatraman (1991:155)

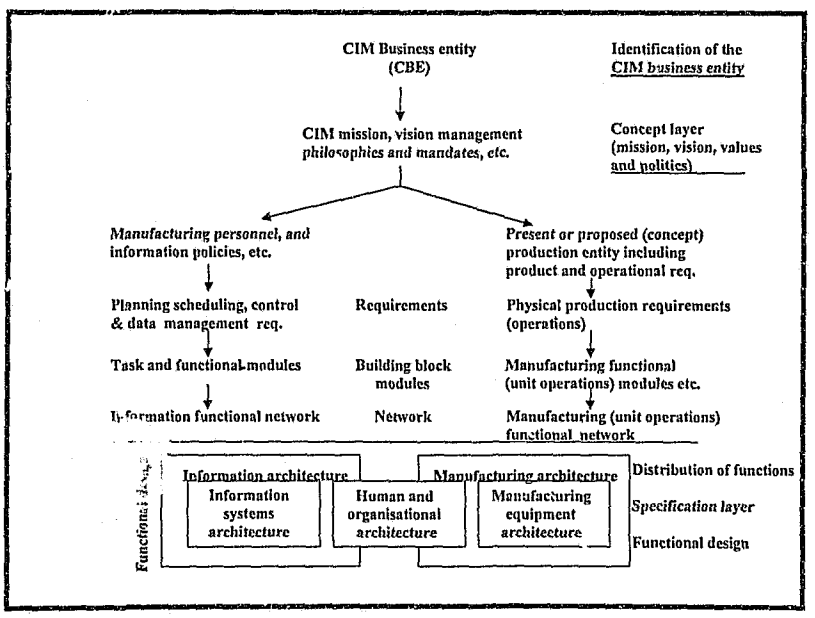


Figure 18: Purdue Enterprise Reference Architecture
Source: Williams (1994:142)

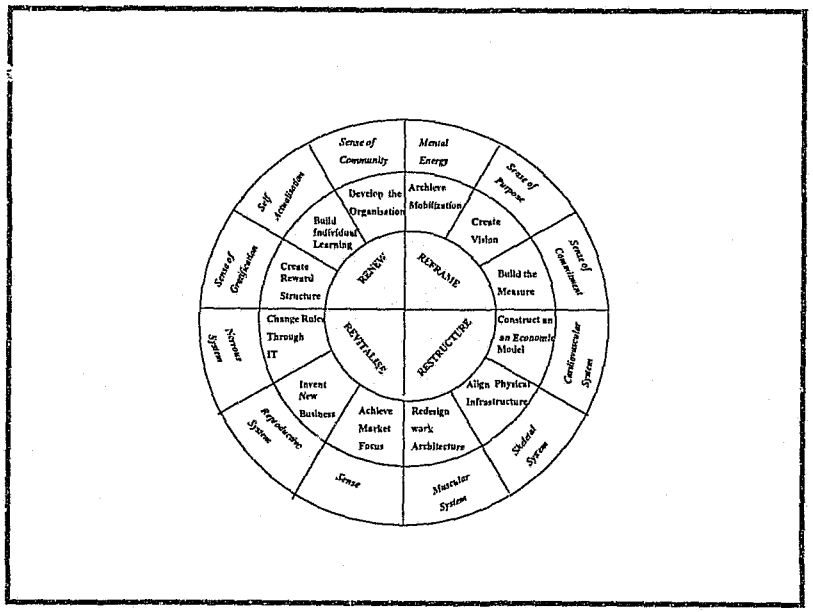


Figure 19: Transforming the Organisation
Source: Gouillart and Kelly (1995:9)

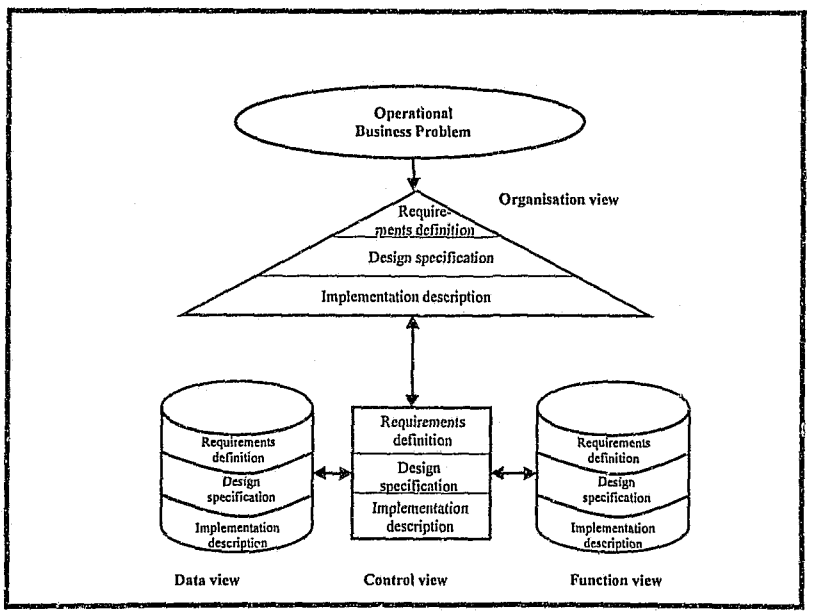


Figure 20: The ARIS Architecture
Source: Scheer (1994:16)

APPENDIX II: IT-ENABLED TRANSFORMATION AND RE-ENGINEERING METHODOLOGIES

Table 9: Re-engineering Methodologies with a Large Number of Phases and Tasks

Davenport (1993:25-154)	Manganelli and Klein (1994:265-281)	Peppard and Rowland (1995:211-226)	McAdam (1996:67-69)
Identifying Processes For Innovation	Preparation	Create The Environment	Identify The Critical Process For Improvement
Enumerate major processes	Recognise need	Build a vision	Define ownership
Determine process boundaries	Develop executive consensus	Gain the support of appropriate level of management	Identify KSFs and measures
Assess strategic relevance of each process	Train team	Formulate a plan and provide necessary training.	Identify critical processes for improvement
Render high-level judgements of the "health" of each process	Plan change	Identify core processes	Exit criteria to proceed to Phase 2: (1) Sponsor(s) identified (2) Sponsor(s) trained (3) Completed customer focus pro forma (4) Agreed customer targets (5) Processes selected for improvement (6) Process owner(s) designated
Qualify the culture and politics of each process	Identification	Appoint programme team/champion	Analyse The Current Process
Identifying Change Levers	Model customers	Communicate vision and goals, the need for the improvement and the plan to get there.	Define ownership
Identify potential technological and human opportunities for process change	Define & measure performance	Analyse, Diagnose And Redesign Processes	Define the viewpoint of the project
Identify potentially constraining technological and human factors	Define entities	Recruit and train teams	Define the process boundaries
Research opportunities in terms of application to specific processes	Model processes	Identify process outcomes and linkages	Define the project purpose
Determine which constraints will be accepted	Identify activities	Analyse existing processes and quantify measures.	Map and validate the as-is process
Developing Process Visions	Extend process model	Diagnose condition	Identify opportunities for improvement
Assess existing business strategy for process directions	Map organisation	Benchmark best practices	Develop a process improvement plan for phase 3
Consult with process customers for performance objectives	Map resources	Redesign processes - systematic or clean sheet, or a bit of both.	Exit criteria: (1) Process improvement team defined and trained (2) Relevant people briefed (3) Project viewpoint defined (4) Process boundaries defined (5) Purpose of the project defined (6) As-is processes mapped and validated (7) Performance issues identified and reviewed

Davenport (1993:25-154)	Manganelli and Klein (1994:265-281)	Peppard and Rowland (1995:211-226)	McAdam (1996:67-69)
			(8) Plan developed for phase 3
Benchmark for process performance targets and examples of innovation	Prioritise processes	Review people requirements of new process design.	Improve The Process
Formulate process performance objectives	Vision	Review technological requirements of new process design.	Define ownership
Develop specific process attributes	Understand process structure	Validate new process design.	Establish benchmarks
Understanding Existing Processes	Understand process flow	Redesign The Organisations Infrastructure	Design and map the new process
Describe the current process flow	Identify value-adding activities	Review the organisations people resource: structure, competences and motivation.	Define roles and responsibilities
Measure the process in terms of the new process objectives	Benchmark performance	Review structure and technological capability.	Perform a validation check
Assess the process in terms of the new process attributes	Determine performance drivers	Formulate new organisational form.	Develop an implementation plan for phase 4
Identify problems with or shortcomings of the process	Estimate opportunity	Define new roles, coach and train employees.	Exit criteria: (1) Benchmarks established (2) New process defined and mapped (3) Roles and responsibilities defined (4) Implementation plan developed for phase 4 (5) Process reviewed by sponsor(s)
Assess current information technology and organisation	Envision the Ideal (external)	Provide outplacement and inplacement services as required.	Implement The Improved Process
Designing And Prototyping The New Process	Envision the Ideal (Internal)	Build new technological infrastructure and applications.	Define ownership
Brainstorm design alternatives	Integrate visions	Pilot And Rollout	Pilot study (if appropriate)
Assess feasibility, risk, and benefit of design alternatives and select the preferred process design	Define sub-visions	Select pilot process	Implement the improved process
Prototype the new process design	Solution: Technical Design	Build team for a pilot process	Exit Criteria (1) Pilot study completed if appropriate (2) Training and communications completed (3) Process implemented (4) Predicted results achieved (5) Method for regular review and improvement established (6) Lesson learned documented for phases 1-4 (7) Overall project benefits listed and quantified (8) Project sponsor(s) objectives satisfied

Davenport (1993:25-154)	Manganelli and Klein (1994:265-281)	Peppard and Rowland (1995:211-226)	
Develop a migration strategy	Model entity relationships	Engage selected customers and suppliers of process	
Implement new organisational structures and systems	Re-examine process linkages	Launch pilot, monitor and support	
	Instrument and informate	Review pilot and feedback learning to other process teams	
	Consolidate interfaces and information	Prioritise roll-out and begin phased implementation across organisation	
	Re-define alternatives		
	Relocate and Retime Controls		
	Modularize		
	Specify deployment		
	Apply technology		
	Plan implementation		
	Solution: Social Design		
	Empower customer contact personnel		
	Identify job characteristic clusters		
	Define jobs/teams		
	Define Skills and Staffing Needs		
	Specify management structure		
	Redraw organizational boundaries		
	Specify job changes		
	Design career paths		
	Define transitional Organization		
	Design change management program		
	Design incentives		
	Plan implementation		
	Transformation		
	Complete business system design		
	Perform technical design		
	Develop Test and Rollout Plans		
	Evaluate personnel		
	Construct system		
	Train staff		
	Pilot new process		
	Refine and transition		
	Continuous improvement		

Table 10: Re-engineering Methodologies with Fewer Phases and Tasks

Talwar (1994:52)	Keeble (1995:234-244)	Andrews and Stalick (1994:91–149)
Initiation	Initiate Reengineering Programme	Frame The Project
Raising awareness understanding and interest	Initiate programme	Create The Vision, Values And Goals

Talwar (1994:52)	Keeble (1995:234-244)	Andrews and Stalick (1994:91–149)
Defining strategic scope, scale and direction	Establish strategic direction	Re-design The Business Operation
Planning the change programme	Scope Programme	Conduct Proof Of Concept
Implementation	Research market	Plan The Implementation
Analysis of current operations	Benchmark	Obtain Implementation Approval
Business redesign	Examine current organisation	Implement The Redesign
Integration and testing	Scope programme	Transition To A Continuous Improvement State
Exploitation	Re-design Processes, Systems And Organisational Structure	
Managing the re-engineered business	Process re-design	
Exploiting the re-engineered architecture	Organisational structure redesign	
Continuing the improvement process	Process testing	
	Implement Culture Change Programme	
	Enhance internal communications	
	Encourage team working	
	Sustain Commitment	
	Maintain visibility	
	Implement early wins	
	Integrate Processes And Organisation	
	Roll-Out	
	Implement	
	Monitor	

Table 11: Further Re-engineering Methodologies Summarised only to Task Level

Morris and Brandon (1993:14-20)	Coulson-Thomas (1994:98) COBRA	Fitzgerald and Murphy (1994:167)	Gartner Group: Magee, Frick, Kirk, Kleinberg, and Andren (1997:6-7)
Determine Goals And New Market Position	Establishing The Approach And Goal Setting	Select Process To Be Re-engineered	Build Infrastructure And Set High Level Goals
Establish A New Business Environment	Opportunity Seeking	Establish Process Team	Visioning
Map The Current Business	Process Analysis	Understand The Current Process	Build And Assess Current Core Process Models
Redesign: Using The Map As A Model	Process Redesign	Develop A Vision Of The Improved Process	Select And Analyse Process For BPR
Build The Foundation	Implementation Of Change	Identify The Actions Needed To Move To The New Process	Engineer New Business Process
Implement And Operate	Performance Monitoring	Negotiate/Execute A Plan To Accomplish These Actions	Build Transition Plan
The New Environment			Implement New Process
			Optimise New Process

Table 12: Methodologies Explicitly Approached from a Transformation Perspective

Tichy and Sherman (1995:331-374)	Gouillart & Kelly (1995:6-14)	Cash, Eccles, Nohria and Nolan (1994:414)
Awakening	Reframing	Idea Generation
Create a Feeling of Urgency	Achieve Mobilisation	Idea Refinement And Development
Deal with Resistance	Create the Vision	Value Analysis
Fighting Resistance	Build a measurement system	Transformation And Organisation Change
Envisioning	Restructuring	
Preparation for the Vision	Construct an economic model	
The Nature of the Visioning Process	Align the physical infrastucture	
Creating Your Vision	Redesign the work architecture	
Rearchitecting	Revitalisation	
Assess Your Organisation on Boundarylessness	Achieve market focus	
Social Architecture at the Top	Invent new businesses	
Companywide Involvement in the Revolution	Change the rules through information technology	
Launching a Work-Out Effort	Renewal	
Human Resource Systems to Support Your Vision	Create a reward structure	
Continuous Revolution	Build individual learning	
	Develop the organisation	

APPENDIX III: QUESTIONNAIRES

Structured Questionnaire

This survey is to establish perceived contribution of IT-enabled business transformation architecture and taxonomy towards the success of business transformation. Having listened to the Spoornet case study, please answer the following questions.

Name:	
Organisation:	
Position in Organisation:	
Telephone numbers:	

Please mark appropriate block with a cross.

Background:

1. Have you been involved in an IT-enabled business transformation?

Yes	No

2. How large is your organisation (number of employees)?

Less than 1000	Less than 5000	Less than 10 000	Greater than 10 000

3. Is there a problem with IT-enabled business transformation?

Yes	No

Overall:

4. In which architecture do most problems exist?

SA	PGA	MA	PA	ITA	HRA	PRA

5. To what degree do you believe the IT-Enabled Business Transformation Architecture contributes to ensuring all aspects are addressed?

Nothing	A little	A lot	Greatly

6. To what degree do you believe the IT-Enabled Business Transformation Taxonomy contributes to maintaining congruency between strategy, measures, process, technology, human and physical resources and the programme architecture?

Nothing	A little	A lot	Greatly

7. To what degree do you believe the IT-Enabled Business Transformation Taxonomy contributes to clarifying the degree of transformation to be undertaken?

Nothing	A little	A lot	Greatly

8. To what degree do you believe the IT-Enabled Business Transformation Taxonomy assists in plotting a trajectory to achieve business transformation?

Nothing	A little	A lot	Greatly

9. To what extent do you believe the IT-Enabled Business Transformation Architecture and Taxonomy contributes to successful transformation?

Nothing	A little	A lot	Greatly

IT-Enabled Business Transformation Architecture

10. Please indicate the most critical element in each architecture (Just write in the number).

Architecture	Elements		Critical Element
a. Strategic Architecture	1. Mobilisation 2. Vision 3. Objectives 4. Scenarios	5. Scope & Benchmarking 6. Strategies. 7. Duration. 8. Business Rules & norms.	
b. Programme Architecture	1. Sponsor/Champion 2. Steering Committee 3. Project or Programmes Manager 4. Process Owners 5. Reengineering Teams	6. Change Partners 7. Process & System Integrators 8. Implementation Teams 9. Release Framework	
c. Measurement Architecture	1. Balanced Score Card 2. Target Gains 3. Key Performance Indicator Trees.	4. Activity Based Costing & Service Level Assessments. 5. Process Accounting	
d. Process Architecture	1. Scale & scope. 2. Focus 3. Selection 4. Understand Current 5. Mechanistic to Organic	6. IT impact 7. Principles & Attributes 8. New Process 9. Bioreengineeering 10. Tools	
e. IT Architecture	1. Technology Requirements 2. Key Enabling Technology 3. Processing	4. Databases 5. Networks 6. Systems Integration	
f. HR Architecture	1. Organisation & skills 2. Jobs & structures 3. Measurement & Reward Systems 4. Values & Beliefs	5. Training & Education 6. Communication 7. Labour Relations	
g. Physical Resource Architecture	1. New Product Development 2. Operational Systems 3. Capacity Management	4. Inventory Management 5. Manufacturing Process Types	

Taxonomy of IT-Enabled Business Transformation Architectures

11. To what extent is the architecture aligned with the degrees of IT-enabled business transformation?

a. Strategic	Badly	Fair	Good	Excellent
b. Programme	Badly	Fair	Good	Excellent
c. Measurement	Badly	Fair	Good	Excellent
d. Process	Badly	Fair	Good	Excellent
e. IT	Badly	Fair	Good	Excellent
f. HR	Badly	Fair	Good	Excellent
g. Physical	Badly	Fair	Good	Excellent

Comments

_____

_____

_____

_____

Semi-Structured Interview Schedule

Name:
Organisation:
Position in Organisation:
Telephone numbers:
Company Profile: Comment on organisation size, structure, culture etc.:
Time taken to explain the frameworks:
Does your organisation have problems with IT-enabled business transformation?
Why do you believe these problems exist (or not)?
In which architecture do most problems exist?
Does the IT-enabled business transformation architecture cover all aspects?
Does the principal taxonomy of IT-enabled business transformation address the key elements of each architecture?
Are the architectures in the taxonomy aligned with degrees of transformation?
Does the taxonomy assist you in defining what degree of transformation you are trying to perform?
Does the taxonomy assist you in plotting a trajectory to achieve a transformation?
Does the taxonomy assist you in maintaining congruency between strategy, process, technology, human and physical resources?
Are the frameworks useful to you? And your organisation? Comments and implications:
Do you have any refinements/additions to the frameworks?
Have you seen a better framework than this?
Any further comments:

APPENDIX IV: QUESTIONNAIRE TRANSCRIPTIONS

Structured Questionnaire

Survey to establish perceived contribution of IT-enabled business transformation architecture and taxonomy towards the success of business transformation. Having listened to the Spoornet case study, please answer the following questions.

Name:	Felicity Grube
Organisation:	Alexander Forbes
Position in Organisation:	Senior Director
Telephone numbers:	011 269-1022

Please mark appropriate block with a cross.

Background:

1. Have you been involved in an IT-enabled business transformation?

Yes **X**	No

2. How large is your organisation (number of employees)?

Less than 1000	Less than 5000 **X**	Less than 10 000	Greater than 10 000

3. Is there a problem with IT-enabled business transformation?

Yes **X**	No

Overall:

4. In which architecture do most problems exist?

SA	PGA	MA	PA	ITA	HRA **X**	PRA

5. To what degree do you believe the IT-enabled business transformation architecture contributes to ensuring all aspects are addressed?

Nothing	A little	A lot	Greatly **X**

6. To what degree do you believe the IT-enabled business transformation taxonomy contributes to maintaining congruency between strategy, measures, process, technology, human and physical resources and the programme architecture?

Nothing	A little	A lot **X**	Greatly

7. To what degree do you believe the IT-enabled business transformation taxonomy contributes to clarifying the degree of transformation to be undertaken?

Nothing	A little	A lot **X**	Greatly

8. To what degree do you believe the IT-enabled business transformation taxonomy assists in plotting a trajectory to achieve business transformation?

Nothing	A little	A lot **X**	Greatly

9. To what extent do you believe the IT-enabled business transformation architecture and taxonomy contributes to successful transformation?

Nothing	A little	A lot **X**	Greatly

IT-Enabled Business Transformation Architecture

10. Please indicate the most critical element in each architecture (Just write in the number).

Architecture	Elements		Critical Element
a. Strategic Architecture	1. Mobilisation 2. Vision 3. Objectives 4. Scenarios	5. Scope & Benchmarking 6. Strategies. 7. Duration. 8. Business Rules & norms.	1
b. Programme Architecture	1. Sponsor/Champion 2. Steering Committee 3. Project orProgrammes Manager 4. Process Owners 5. Reengineering Teams	6. Change Partners 7. Process & System Integrators 8. Implementation Teams 9. Release Framework	3
c. Measurement Architecture	1. Balanced Score Card 2. Target Gains 3. Key Performance Indicator Trees.	4. Activity Based Costing & Service Level Assessments. 5. Process Accounting	1
d. Process Architecture	1. Scale & scope. 2. Focus 3. Selection 4. Understand Current 5. Mechanistic to Organic	6. IT Impact 7. Principles & Attributes 8. New Process 9. Biore-engineeering 10. Tools	4
e. IT Architecture	1. Technology Requirements 2. Key Enabling Technology 3. Processing	4. Databases 5. Networks 6. Systems Integration	2
f. HR Architecture	1. Organisation & skills 2. Jobs & structures 3. Measurement & Reward Systems. 4. Values & Beliefs	5. Training & Education. 6. Communication 7. Labour Relations	5
g. Physical Resource Architecture	1. New Product Development 2. Operational Systems 3. Capacity Management	4. Inventory Management 5. Manufacturing Process Types.	5

Taxonomy of IT-Enabled Business Transformation Architectures

11. To what extent is the architecture aligned with the degrees of IT-enabled business transformation?

a. Strategic	Badly	Fair	Good X	Excellent
b. Programme	Badly	Fair	Good X	Excellent
c. Measurement	Badly	Fair	Good X	Excellent
d. Process	Badly	Fair	Good X	Excellent
e. IT	Badly	Fair	Good	Excellent X
f. HR	Badly	Fair	Good X	Excellent
g. Physical	Badly	Fair X	Good	Excellent

Comments

Transcription of one interview.

Name: Dr Chris Jardine
Organisation: Spoornet
Position in Organisation: General Manager, Process and Systems
Telephone numbers: 011 774-4600
Company Profile: Comment on organisation size, structure, culture etc.: Railway. 48 000 people. Throughout South Africa and operates in Southern Africa up to Zaire. Turnover R9bn per annum. Process orientated. Democratic, but becoming autocratic in areas of execution.
Time taken to explain the frameworks: 15 min, but detail was discussed throughout interview.
Does your organisation have problems with IT-Enabled Business Transformation?: No, not in conceptualisation or appreciation, but definitely yes in execution and implementation.
Why do you believe these problems exist (or not)? Part of the problem is that the principles must be bedded down. The principles are not practised, there is no real process ownership. Our skilled resources are hamstrung. The problems are with the fundamentals.
In which architecture do most problems exist? In IT and HR. IT skills and HR as it pertains to change management and communication. There is also no process ownership which is a measurement problem. There is no accountability.
Does the IT-Enabled Business Transformation Architecture cover all aspects? Yes. The aspects are all systemic, that is people, process and technology.
Does the Principal Taxonomy of IT-Enabled Business Transformation address the key elements of each architecture? All except the programme architecture. The key element in the programme architecture is the steering entity.
Are the architectures in the taxonomy aligned with the degrees of transformation? They are largely true. There may be others. Organisations may play in different quadrants, I do not think they are mutually exclusive.
Does the taxonomy assist you in defining what degree of transformation you are trying to perform? Generally yes. There is perhaps a level of detail missing.
Does the taxonomy assist you in plotting a trajectory to achieve a transformation? Conceptually yes. In detail no I do not think so. The rules are a bit like the stock exchange, buy low and sell high, but in detail you have to play the game one move at a time.
Does the taxonomy assist you in maintaining congruency between strategy, programme, process, technology, human and physical resources? If the contents are all correct yes. There are a lot of variables to think about, but generally it looks OK.
Are the frameworks useful to you? And your organisation? Comments and implications: Yes. At Spoornet, however, we are good at strategy. We need to drop down a level to the execution.
Do you have any refinements/additions to the frameworks? As I said there

are a lot of variables. I will think about it and come back to you if anything comes to mind.
Have you seen a better framework than this? No, I have not seen one looking at the problem quite like this before. I have seen different, simpler ones.
Any further comments: No, thanks, I will think about it and come back to you.

APPENDIX V: COMPUTER ANALYSIS OF EVIDENCE

SEMI-STRUCTURED INTERVIEW

Respondent	Problem	Complexity	Tasking	Execution	Two Levels	Iliteracy	ITLeadership	Skills	Alignment	LeadershipII	Culture	Political	Involved	<100 Time	Problem Arch. SA	PGA	M	PA	IT	HRA	PRA	Coverage	Alignment	Degree	Trajectory	Consensus	Useful	Refinements	Better	Key Element SA	PGA	MA	PA	ITA	HRA	PRA
One	1	1		1					1				1	1	15	0	1	0	0	1	0	0	1	0	1	0	1	1	0	1	2	2	1	5	2	4	5
Two	1									1	1	1	1	1	60	0	0	0	1	0	1	0	1	1	1	1	1	1	0	1	2	3	1	5	2	4	5
Three	1								1				1	1	15	1	0	0	0	0	0	0	1	1	1	0	1	1	1	1	2	3	1	5	2	4	5
Four	1							1					1	0	15	0	0	1	0	0	1	0	1	1	1	1	1	1	0	1	2	3	1	9	6	4	3
Five	1		1				1						1	1	20	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	2	3	1	5	2	4	5
Six	1				1								1	1	20	0	0	0	1	0	0	0	1	0	0	1	1	1	0	1	2	3	1	5	2	4	X
Seven	1			1			1						1	1	15	0	0	0	0	1	0	0	0	1	1	1	1	1	0	1	4	3	1	5	2	4	5
Eight	1	1				1							1	1	15	0	0	0	0	0	1	0	1	1	1	1	1	1	0	1	2	3	1	5	2	4	5
Nine	1		1										1	1	15	0	0	0	0	1	1	0	0	1	1	1	1	1	0	1	2	3	1	X	2	4	5
Ten	1	1											1	1	40	0	0	0	0	0	1	0	0	1	1	0	1	1	1	1	2	3	1	5	2	0	5
Count	10	3	2	2	1	1	2	2	1	1	1	1	10	9	230	1	1	1	2	4	6	1	7	8	9	7	10	10	2	10	2	3	1	5	2	4	5
Percent	100	18	12	12	6	6	12	12	6	6	6	6	100	1	23	6	6	6	13	25	38	6	70	80	90	70	100	100	20	100			MODE				

Correlations

	SA	PGA	MA	PA	ITA	HRA	PRA
Coverage &	0.218	0.22	0.22	0.33	-0.36	-0.09	0.22
Alignment &	0.167	-0.67	0.17	-0.38	-0.1	0.612	0.17
Degree &	0.111	0.11	0.11	-0.67	0.272	0.408	0.11
Trajectory&	-0.51	-0.51	0.22	0.33	0.089	0.356	0.22

STRUCTURED QUESTIONNAIRE

	Problem	Involved	Size				Coverage				Congruency				Degree				Trajectory				Useful			
Grube	1	1		2						4			3				3				3				3	
Bambo	1	1				4				4			3				3				3				3	
Mazwi	1	1	1				2				2				3				3				3			
Nel	1	1	1							4				4				4	3				3			
Van Niekerk	1	0				4			3				3				3		2				3			
Botes	0	1				4			3					4			3			3			3			
Perbhoo	1	1				4				4		2					3			2			3			
Bignaut	1	0				4		2				2				2				2				2		
Count	7	6	2	1	0	5	0	2	2	4	0	3	3	2	0	1	6	1	0	3	5	0	0	1	7	0
Percent	88	75	25	13	0	63	0	25	25	50	0	38	38	25	0	13	75	13	0	38	63	0	0	13	88	0

	SA	PRA	MA	PA	ITA	HRA	PRA
Grube	3	3	3	3	4	3	2
Bambo	3	2	2	2	3	2	3
Mazwi	3	2	3	3	3	2	2
Nel	3	3	2	3	3	2	2
Van Niekerk	3	3	3	3	3	2	3
Botes	3	3	2	3	2	3	2
Perbhoo	4	3	2	3	3	2	2
Bignaut	2	2	2	3	2	3	2
Count	0	1	6	1	0	3	5	0	0	5	3	0	0	1	7	0	1	1	5	1	0	5	3	0	0	6	2	0
Percent	0	13	75	13	0	38	63	0	0	38	63	0	0	13	88	0	13	13	63	13	0	63	38	0	0	75	25	0

	Key Element per Arch							Problem Arch						
	SA	PGA	MA	PA	ITA	HRA	PRA	SA	PG	MA	PA	ITA	HR	PRA
Grube	1	3	1	4	2	5	5	1						
Bambo	2	1	4	7	3	1	4				4			
Mazwi	2	1	2	2	1	1	2	1						
Nel	2	4	4	3	3	3	3						6	
Van Niekerk	5	7	4	6	1	6	3	1						
Botes	2	8	1	4	5	1	5							7
Perbhoo	2	1	1	3	1	1	1						6	
Bignaut	2	1	1	3	3	2	3						6	
Count	2	1	1	3	1	1	3	3	0	0	1	0	3	1
Percent			MODE					38	0	0	12	0	38	12

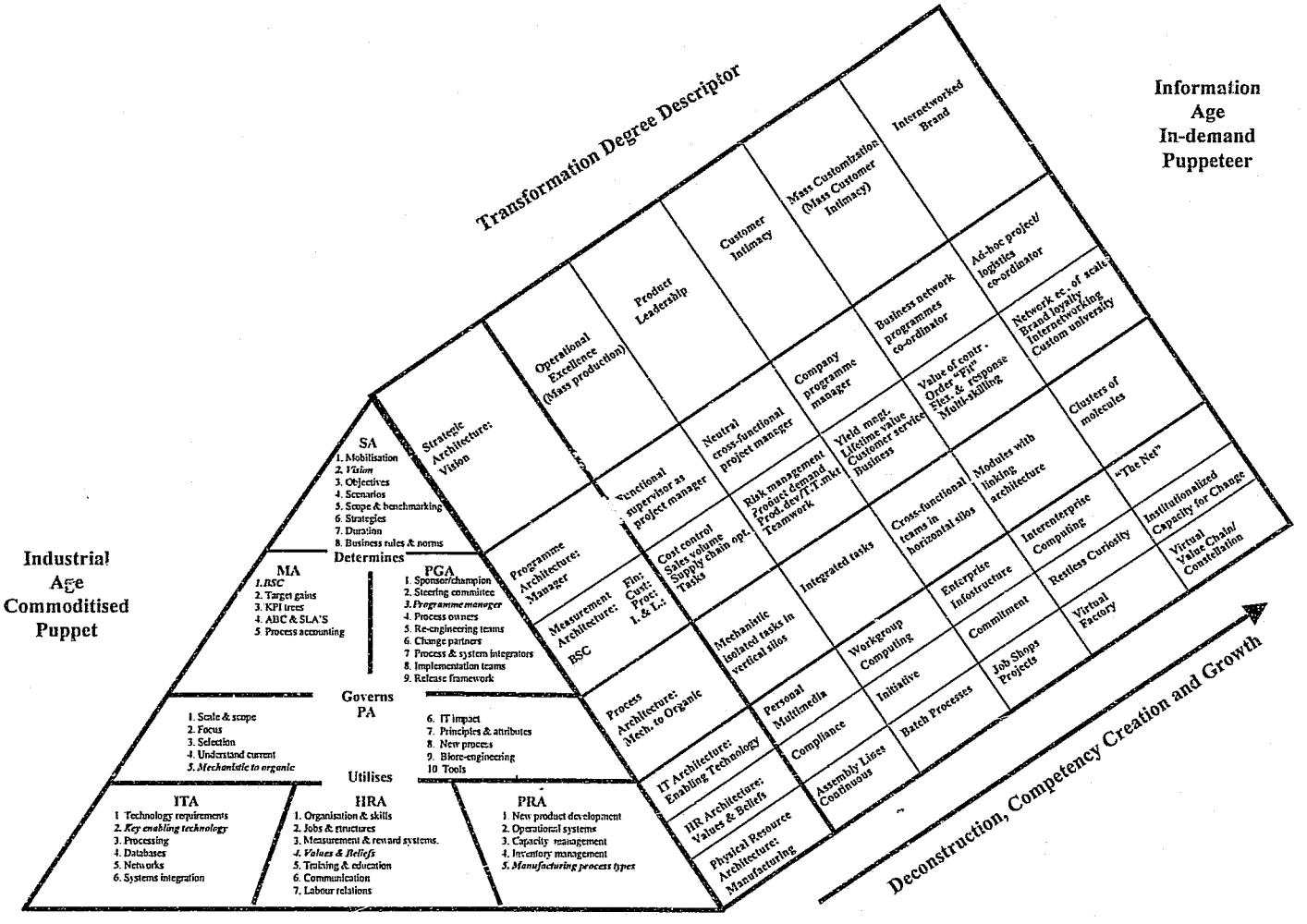
Correlations

Involved & Coverage	0.522	Size & Coverage	0
Involved & Congruency	0.277	Size & Congruency	0.121
Involved & Degree	0.577	Size & Degree	0.567
Involved & Trajectory	0.745	Size & Trajectory	0.586
Involved & Useful	0.655	Size & Useful	0.286

Uniform Distributions

Coverage	0	25	25	50
Congruency	0	38	38	25
Degree	0	13	75	13
Trajectory	0	38	63	0
Useful	0	13	88	0
Average	0	25	58	18

APPENDIX VI: FINAL IT-ENABLED BUSINESS TRANSFORMATION FRAMEWORK



IT-Enabled Business Transformation Architecture

APPENDIX VII: CASE STUDY: SPOORNET PREDICTABLE SERVICE IT-ENABLED BUSINESS TRANSFORMATION PROGRAMME

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1. CASE STUDY RESEARCH OVERVIEW

1.1 Definition

Yin (1994:13) defines a case study as an empirical inquiry that:

> *"Investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident."*

He states that the case study enquiry has to cope with the technically distinctive situation in which there are many more variables of interest than data points. It therefore relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and benefits from the prior development of theoretical propositions to guide data collection and analysis (Yin 1994:13). This case study fulfils all the aforementioned criteria.

1.2 Rationale for Case Study Research

Benbasat, Goldstein and Mead (1987:369) advise that case study research is particularly appropriate for certain types of problems, those in which research and theory are at their earlier, formative stages, and sticky, practice-based problems where the experiences of the actors are important and the context of action is critical. They further assert that the case study strategy is appropriate when:

1. The phenomenon of interest must be studied in its natural setting.
2. The study focuses on contemporary events.
3. Control or manipulation of subjects or events is not necessary.
4. The phenomenon of interest is not supported by a strong theoretical base.

Once again this case study fulfils these criteria.

Yin (1994:44) asserts that a single case study is justifiable where the case represents a critical test of existing theory, where the case is a rare or unique event, or where the case serves a revelatory purpose. This case study was used to assess a proposed framework, the instance is unique (but not many of the generalisations) and it serves a revelatory purpose.

1.3 Collection and Convergence of Multiple Sources of Evidence

Evidence was collected from the following four sources:

1. Archival Records.
2. Documentation.
3. Interviews.
4. Participant-Observations.

A fifth source of evidence, physical artifacts, was indirectly built into the cultural features and technical operations of the case study. All this evidence was converged into a single study. This is depicted in figure 1.

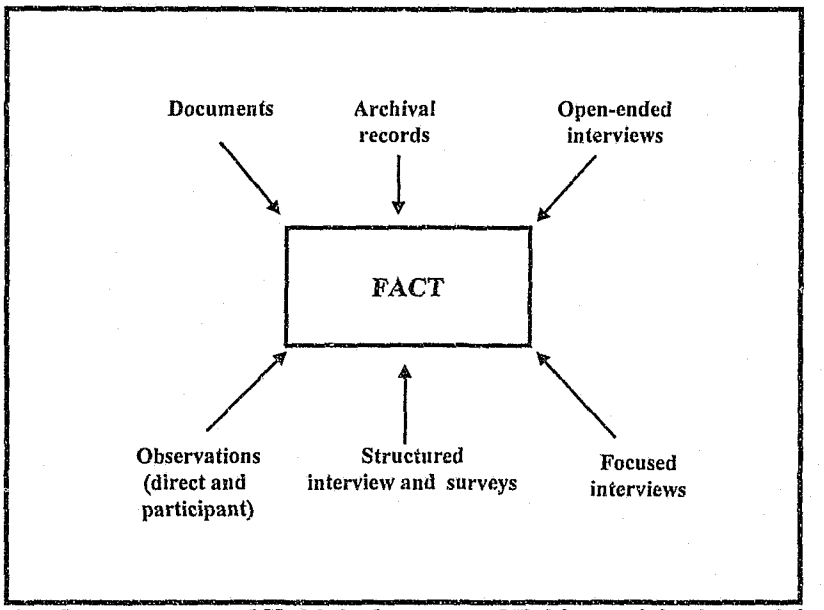


Figure 1: Convergence of Multiple Sources of Evidence (single study)
Source: Yin (1994:93)

The references at the end of the case study are categorised as above for convenience.

1.4 Case Study Structure

The case study was written in the IT-enabled business transformation architecture format. Under each heading the focus was on the characteristics of the degrees of transformation addressed. This was done so the applicability and validity of the theoretical IT-enabled business transformation architecture and taxonomy could be assessed.

2 INTRODUCTION

2.1 Transformation

In 1980 Alvin Toffler (1980:26) made the following prophetic statement:

> *"Humanity faces a quantum leap forward. It faces the deepest social upheaval and creative restructuring of all time. Without clearly recognising it, we are engaged in building a remarkable new civilisation from the ground up. This is the meaning of the third wave".*

Eighteen years later this observation is proving to be far from an exaggeration (Spinello 1997:ix). The theoretical frameworks proposed in the research report and used as a pattern for this study are essentially an attempt to contribute towards a smooth transition from the second to the third wave (agricultural 1750-1850, industrial 1960-2000 and information wave)(Hope & Hope 1997:2). Since inventing the modern business bureaucracy a hundred and fifty years ago (Hammer & Champy 1993:13) railroads have remained at the forefront of organisational design and related technology adoption. This paper presents a case study of an IT-enabled business transformation project based on the actual experiences of sponsors, champions, project managers and process users in the South African railway network, Spoornet. The purpose of the case study is to provide an opportunity to assess the framework's contribution towards solving the vexing and confounding dilemmas facing change agents as businesses advance into the information age.

2.2 Company Background

Transnet had its origins in the Cape Colony Railway established in 1873, the Netherlands South African Railway Company established in 1887, and the Orange Free State Railway. In 1902 the Netherlands South African Railway Company was dissolved and the railways of the boer republics reconstituted under civilian control as the Central South African Railways (CSAR). In 1909, to reduce conflict, the CSAR, Cape Government Railways, Natal Government Railways and harbour infrastructures were united into the South African Railways and Harbours (SAR&H). SAR&H had the status of "common carrier", meaning it was obliged to transport any goods offering, and to charge no more than the market could bear. The Motor Carrier Transport Act of 1930 created a monopoly, by restricting companies from transporting goods more than a radius of 50km from their premises. In 1934 SAR&H took over Union Airways which became South African Airways (SAA). By 1981 SAR&H included air, road, petroleum pipelines and intermodal container services and had changed its name to South African Transport Services (SATS) to reflect this. In 1988, on the recommendations of the de Villiers report, the Minister of Transport was given five years to deregulate the transport market and commercialise SATS. On 1 April 1990 SATS ceased to exist and Transnet, a diversified, tax-paying transport services company, wholly owned by the South African Government, was formed to compete more effectively in a deregulated free market (Mercer Management Consulting 1995:5–13). Transnet

has five divisions: Spoornet (rail), Autonet (road), Portnet (ports), Petronet (pipelines) and South African Airways (air). In 1991 the Transnet Chairman, Marius de Waal, had the following to say (Transnet Annual Report 1991:2):

> *"After 80 years as a state-controlled organisation, Transnet had to establish itself as a company, function according to private sector norms, strive for profit and return on capital, prepare a profit and loss account in accordance with the Companies Act, and effect auditing by auditors in public practice".*

2.3 Staffing

From a peak in 1982 of about 248 000 people Transnet had a staff of 140 000 people when it was formed in 1990 (Mercer Management Consulting 1995:10) and by 1997 only 110 358 (Transnet Annual Report 1997:79). This reduction was necessary because more than fifty percent of costs were staff related. Prior to 1990 the workforce was white, male and Afrikaans dominated, largely influenced by the National Party's (NP) policy of using the railways as a national employer to support their political aims. This demographic distortion is addressed by the "Turn Strategy" (Transnet Annual Report, 1994:70):

> *"A strategy to steer Transnet towards the goal of becoming an equal opportunity company has now been in operation for a little more than three years. It is known as the "Turn Strategy" because it addresses racial disparity on a much wider front than the classical affirmative action and intends to shift the whole culture within Transnet".*

By 1997 twenty-four percent of management, forty-seven percent of professional staff, thirty-one percent of administrative staff and forty-six percent of technical staff were black (Transnet Annual Report, 1997:59). In 1994 the African National Congress (ANC) was elected into power and, on 16 September 1996, Mr Saki Macozoma was appointed to succeed Dr Anton Moolman as managing director. If the reduction in numbers and change in demographic ratios are combined it can be seen that Transnet is a very different company today to what it was a decade ago.

The rest of this research report will discuss the transformation of Spoornet, the rail and largest division of Transnet.

3. STRATEGIC ARCHITECTURE

3.1 Mobilisation

It was with this heritage that the fledgling company, Spoornet, entered the free market system in 1990 and began assessing its situation. It recognised that in 1957, the railways' estimated share of the South African freight market was sixty-one percent by 1981 it had fallen to thirty-seven percent (Mercer Management Consulting 1995:5–13) and by 1996 it held only sixteen percent of the high risk general freight market. (Spoornet Business Plan 1996:6). Spoornet derives approximately forty-eight percent of its revenue from coal and ore, including thirty percent from its two export "machines" COALlink (Ermelo – Richards Bay for coal) and OREX (Sishen – Saldanha for iron ore). Coal and Ore account for about half of Spoornet's traffic, but use less than ten percent of Spoornet's resources. Spoornet cannot, however, rely on this traffic indefinitely, since it is very price sensitive, and depends on the competitiveness of South African products in the world market. The rest of Spoornet's assets serving general merchandise are under-utilised. More than ninety percent of the network is utilised at less than half its practical capacity (21 000 route kilometres). The 140 000 wagon fleet is still under-utilised. At the same time, the railways' total volume is declining relative to the South African economy (Mercer Management Consulting 1996a:10–15). In the short run Spoornet is primarily a fixed-cost business and requires large volumes to reduce its unit costs.

Recognising that transport and logistics comprise twenty to twenty five percent of the final cost of manufactured goods of which rail service is a small portion, Spoornet decided to position itself as a source of multi-modal door-to-door transport and overall logistics management. Spoornet acknowledged, however, that before it could be considered as a serious contender in this market, it must demonstrate competence in managing its own rail traffic predictably. Numerous surveys, including one done by Research International in 1995 (Mercer Management Consulting 1996b:addendum), indicated that predictability and reliability were the number one requirement of Spoornet customers.

With its formation in 1990, Spoornet established its own Information Systems (IS) function with the mandate to create an information culture in Spoornet. In 1992 Professor N Venkatraman of the then Massachusetts Institute of Technology (MIT) assisted Spoornet in strategically positioning IS in Spoornet and Transnet. Venkatraman and Henderson's Strategic Alignment Model (SAM) (Venkatraman, 1991:155) and Japan's Ministry of International Trade and Industry (MITI) (Davis & Davidson 1991:149) models were extensively used in this exercise. This strategic orientation positioned IS to play a crucial rôle in the Spoornet information technology (IT) enabled transformation.

In February 1994 Herman Evert, an ex-Delloitte Haskins and Sells senior consultant, then chief information officer (CIO), and Hennie Muller, assistant general manager, process development (PD), visited the Swedish and various North American railways to assess world-wide best practice and find a railroad

strategically aligned with Spoornet. The Swedish Railway, SJ Gods, was found to be the best fit and in April 1994 a core team of six was sent over to assess their processes and systems in detail. In July 1994 the predictable service core team consisting of a group of 10 managers from IS, PD and Human Resources (HR) was formed under the leadership of Hennie Muller. The following month a select group of marketing, rail operations and wagon service managers, together with union representatives, were sent over to experience the SJ Gods' way of managing a railway (Predictable Service Core Team 1994a:2).

3.2 Vision

The predictable service programme was launched with the objective of transforming Spoornet's general freight operations from an inefficient and ineffective service based on a "push" philosophy to an efficient and effective service based on a "pull" philosophy (Predictable Service Core Team 1995a:5-10).

In a presentation given at an International Railway Conference in Australia in 1997, Braam le Roux, Spoornet's chief executive officer (CEO), described the difference between the "pull" and "push" philosophy. He asserted that the classic, 100 year old approach to rail freight resembles a frenetic game of "pass-the-parcel". The "push" model works like the sorting of mail in the post offices. Every letter arrives with a postal code and based on this, the letter is pushed from sorting station to sorting station until it reaches the final mail box. There is no promised arrival time. This system works well until there is an abnormal demand, then stations become clogged. The "pull" model works like the airline passenger system, based on the time of his meeting abroad, a passenger reserves several connecting flights to arrive on time (le Roux 1997a:1-13).

This operational focus is, however, only seen as a pre-requisite to providing more value-added services in customer intimate relationships as Spoornet advances towards providing logistical solutions globally. This transformation trajection is depicted in figure 1.

In 1995 Spoornet top management defined its vision and later its mission, as depicted in table 1.

Table 1: Spoornet Vision and Mission

Vision	Mission
Spoornet is the leader in providing profitable freight logistic solutions. In living the vision we will be conscious of and contribute to the ideals of South Africa.	To transform Spoornet into a market-driven organisation within the social realities of South Africa. The transformation can be classified at two levels, viz. Business transformation and culture transformation.

Source: Transnet Draft Corporate Plan (1997a:29).

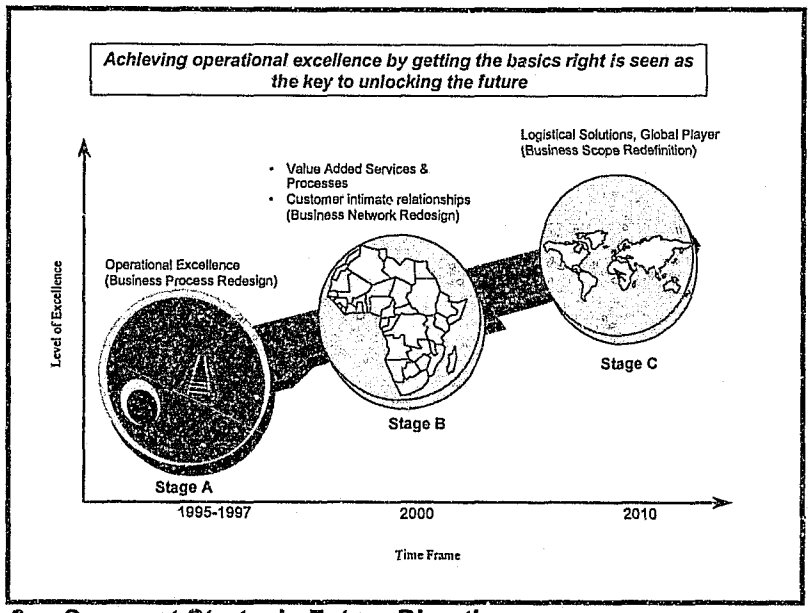


Figure 2: Spoornet Strategic Future Direction
Source: Predictable Service Core Team (1996:8).

3.3 Objectives

The key business objectives (illustration only) and predictable service objectives defined at various forums thereafter are depicted in table 2.

Table 2: Spoornet Key Business and Predictable Service Objectives

Key Business Objectives	Key Predictable Service Objectives
Create attitude of a real market- orientated company Acquire new competencies to equip Spoornet to render total freight logistic solutions Sustainable financial position Ensure employee skilling Entrench business ethics Market segmentation Define products/services Predictable service Use of information technology as a key enabler of excellence Meet customer expectations	The predictable service initiative aims to transform the way Spoornet does business and to enhance the economic performance of conventional (non- conveyor belt) rail activities. • Spoornet human resources must be mobilised and motivated to increase the attractiveness of rail. • Financial performance, measured in terms of return on asset managed, must be sustainable for all Spoornet business activities in the future. Higher revenue through greater market share in conventional rail activities. Lower costs through better work organisation. Lower asset base through reduction of redundant assets (for example unutilised goods . yards).

Key Business Objectives	Key Predictable Service Objectives
Transform business culture through participative management style	• Improved service, enhanced economics, and freed-up assets must allow for, and support, growth at Spoornet.

Source: Transnet Draft Corporate Plan (1997a:29); Mercer Management Consulting (1996b:1).

3.4 Scenarios

3.4.1 End-to-end Process Perspective

In 1993, whilst addressing a select group of information systems professionals and change agents in management Braam le Roux asserted (le Roux 1993:1):

> *"We need to be like Naas Botha, no matter where the ball goes he just happens to be in the right place. So when a customer realises he needs wagons and looks out of the window, there must just happen to be wagons rolling into his yard".*

This statement succinctly encapsulates what he wanted Spoornet to achieve operationally. In order to achieve the efficiency objectives it was decided operational planning must be centralised. This would break the nine little independent regional railways paradigm, each optimising their own locomotives, drivers, wagons, maintenance and other assets, with little regard for a holistic end-to-end process perspective.

3.4.2 Client Intimate Relationships

In the 1980s Leo Petkoon, now Chief Operating Officer (COO) was already preaching (Petkoon 1990:1):

> *"We cannot let someone get between us and our customers, we will simply become another choice and be forced into a low cost producer situatior.".*

In 1995 the Spoornet Management Board (SMB) began to clarify what needed to transpire on the commercial side. Salesmen needed to get into "intimate" relationships with their customers so they could forecast next year's, quarter's and week's business more accurately and start providing more value-added services. They would have to risk their commission on what they did not know. The four market segments were extended to eighteen, and posts for two hundred and fifty salesmen created to serve the top three thousand customers. Fixed tariffs, based on what the market could bear, needed to be replaced with market-related pricing. Operations had to commit to providing a service to the salesman for a fixed cost, and to being penalised for not fulfilling this contract. This became known as the "Two Stream" Spoornet concept, one with an **operational** focus, and the other with a **market** focus.

3.4.3 Logistics

To get into logistics Spoornet needed to become mode independent, and in 1993 changed the focus from wagons to consignments. As a start for getting into logistics a tool, Global Logistics Management (GLM), that allowed the plotting of a logistics plan across companies and transport modes, was purchased. Once the plan is set up, the actual progress is then monitored automatically from the diverse operational systems, and deviations from plan are highlighted for action.

3.4.4 Scope and Benchmarking

In 1994 the Mercer Consulting Group completed a benchmarking project based on 1993 performance of Spoornet versus other international railways. On the two export machines, coal and iron ore, Spoornet appears to be world class. However, in general freight traffic, although Spoornet's wagon maintenance cost is one third of Burlington Northern's (the benchmark railway), Spoornet's wagon productivity is less than one fifth of Burlington Northern's and each track-km produces only one-fourth the nett tonne-kilometres of Burlington Northern (Mercer Management Consulting, 1996a:11–15). This made it patently clear that Spoornet needed to increase its volumes to reduce its unit costs on installed capacity. The scope of the benchmark was transportation, traction energy, locomotive repair and servicing, wagon maintenance, infrastructure and administration, that is, all processes. All these processes needed to be transformed.

3.6 Strategies

Spoornet's history of being a common carrier had left it with a legacy of an under utilised installed capacity and inefficient practices. Now deregulation was eroding the market, and the lifting of sanctions increasing global competition. Spoornet needed to reduce costs, improve service, elevate IT as a strategic resource and reengineer the entire business with an IT lever simultaneously. In parallel it needed to develop a logistics competence, by slowly building a network of logistics alliances across the extended value chain. At the same time the aforementioned turn strategy and restructuring at the Transnet level continued to receive attention.

3.7 Duration

In early 1995, Bob Schultz, recently retired Vice President, Rail Operations for Union Pacific Railroad was invited to scrutinise and advise on Spoornet's change programme. The core team predicted five years for the change. Bob Schultz's words were (Schultz 1995:1):

> *"Don't be disappointed if you achieve very little this year, it took Union Pacific 12 years to achieve a less ambitious programme than this in the 70's, and we only finally got the operating staff to use the computer when we took away the wagon cards".*

3.8 Business Rules and Norms

The core team set the following challenge. Transformation will be accomplished when Spoornet staff can answer "yes" to the following six questions on fundamental business rules and norms:

- Do I sell what Spoornet can deliver?
- Are my promises to Spoornet's customers executable?
- Do I communicate my promises to the customer to everyone?
- Do I live the promises?
- Am I dealing with the cause of unpredictability?
- Am I planning ahead?

(Mercer Management Consulting 1996b:17)

4. PROGRAMME ARCHITECTURE

4.1 Sponsor Champion

Although the COO is chairman of the steering committee, the programme is orchestrated by the CEO, Braam le Roux. The reason for this is that although the programme was initially focused on operations, in reality it extends across the entire organisation, affecting everyone including customers.

4.2 Steering Committee

The initial steering committee included virtually all functional heads plus a representative from each union. Within a year most of the unions had withdrawn owing to other commitments and a lack of clarity as to what the eventual impact of the programme would be on their members. The initial programme structure is depicted in figure 2.

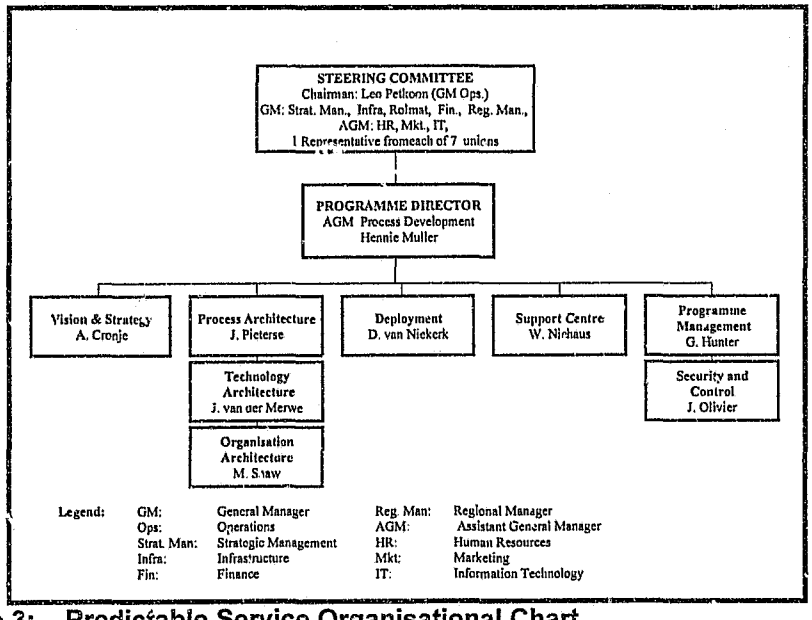


Figure 3: Predictable Service Organisational Chart
Source: Predictable Service Core Team (1995a:10).

4.3 Project or Programme/s Manager

Hennie Muller, assistant general manager, process development, was appointed programme director. As head of process development he was responsible for the entire integrated Spoornet process. This made him ideally positioned to neutrally re-orientate functions to processes. In 1997 process development was incorporated into information systems, and the new rôle named process and systems. The programme manager has to ensure alignment of the complete business architecture across all projects. This process is depicted in figure 3.

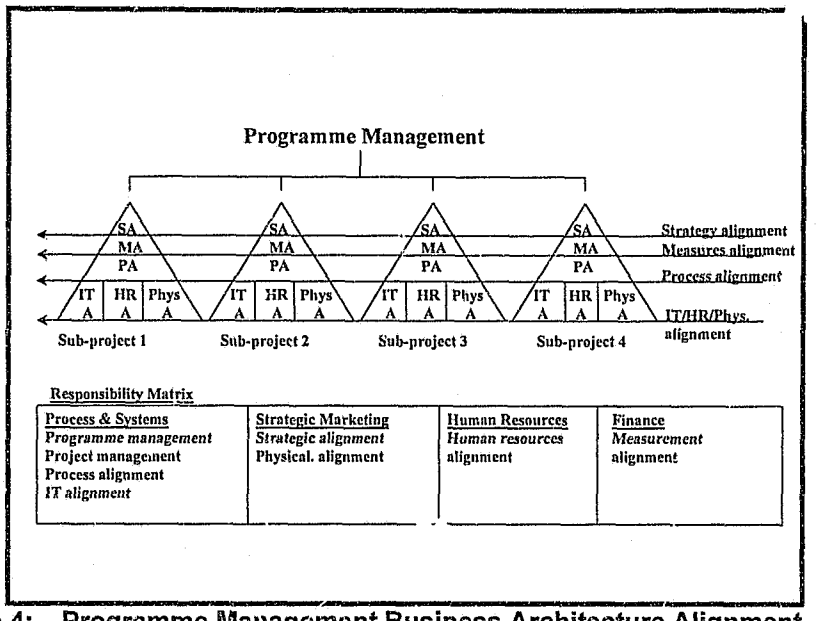


Figure 4: Programme Management Business Architecture Alignment Responsibility

Source: Predictable Service Core Team (1998b:4).

4.4 Process Owners

Although line managers were appointed process owners, none took ownership or provided any leadership the first year. In early 1995, after an extensive "head-hunting" exercise for the "best industrial engineer in the country" an assistant general manager, operations, was appointed to champion the overall process. Unfortunately he did not align himself with many of the tenets of the predictable service programme, distanced himself from the core team and clashed on many fundamentals. Having virtually no support in the company except from the CEO, COO and CIO the core team now had active opposition. This had a demoralising effect on a team already struggling with unrealistic expectations and a certain amount of internal conflict. Within the year he had resigned and was replaced by Willem Kuys. Under Willem Kuys' leadership operations started to take ownership in 1996.

4.5 Re-engineering Teams

The core team turned the end-to-end process into a work breakdown structure. Each deliverable was resourced with a business area design (BAD) team consisting of a project leader, business analysts (process designers), a human resource specialist, and staff from all functions central to the re-engineered processes. IT developers were included when appropriate, depending on the amount of prototyping required. The size of the team depended on the size of the deliverable (Predictable Service Core Team 1996:1-8).

4.6 Change Partners

Predictable service has made the customer's ability to commit to a time appointment when a wagon will be made available, key in order to schedule next week's trip plans. However, because of the inherent inertia in a large organisation like Spoornet, the core team decided it should wait until at least a fixed national schedule, a reservation system, and works orders had been developed before approaching customers. So, although customers were an integral part of the process, they were never formally approached to participate in the design.

4.7 Process and System Integrators

Prior to the establishment of Spoornet information systems in 1990 virtually all legacy systems were built on request to Datavia (SATS internal IT) and so were stand- alone and functionally oriented. There was a lot of redundancy and very little integrity for any management information. A prime example of this was the fact that rail operations, wagon maintenance, asset management, income accounting and expenditure all had differently designed wagon tables in their separate databases. Now all processes and supporting systems needed to be integrated to attain management information with integrity across the process. To ensure this alignment across the various BAD teams the core team identified the need to establish a full time process, and systems integration rôle. After the normal unit and systems testing an integrated test of the process and system was added to the traditional system development life cycle (SDLC).

4.8 Implementation Teams

Most members of the predictable service core team were involved in various other system developments during 1993 and 1994. During this period many complaints were received from the 36 newly appointed area managers that they were being bombarded by an array of unsynchronised system deployments necessitating numerous rounds of training. The core team realised that system deployments should be co-ordinated two or three times per annum, per audience. Deon van Niekerk was given the rôle of deployment manager and formed a group of release implementation teams drawn from natural leaders in the areas. This reduced the number of people who had to be trained centrally, and improved local ownership.

4.9 Release Framework for Flexible and Modular Development

In order to synchronise the system development life-cycles so that all system testing would end on the same date, "time-boxing" was introduced. This facilitated the consolidation of the projects into one integrated test, training and roll-out. The aforementioned *modus operandi* also meant that the time integrated testing would start was fixed, but the scope of and resources for the individual projects were flexible. The environment demanded that a lot of prototyping be done in order to define specifications iteratively, therefore design, construction and system testing were allowed to overlap. This concept is depicted in figure 4.

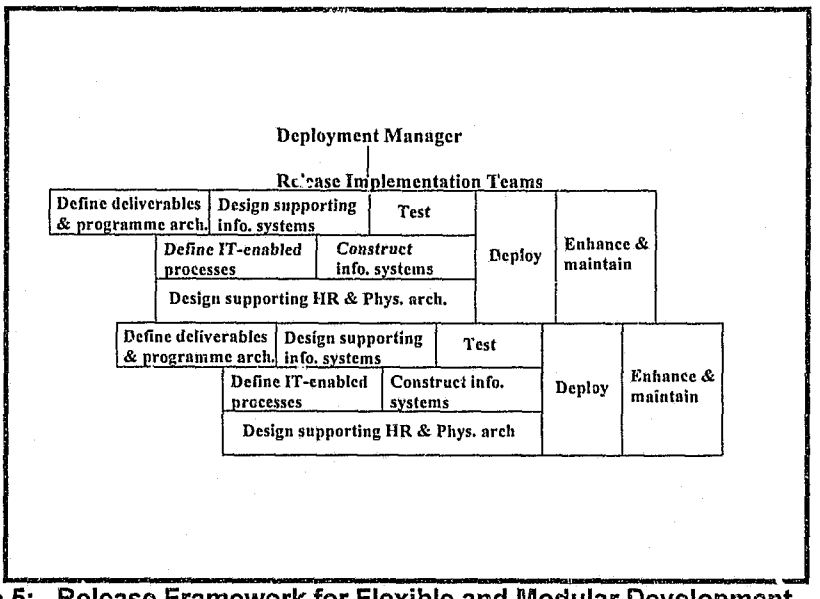


Figure 5: Release Framework for Flexible and Modular Development
Source: Predictable Service Core Team (1998b:5).

The core team spent October 1994 using brown paper and yellow stickers to develop a work breakdown structure. In their enthusiasm the core team identified 160 work packages, linked to the new process, that would have to be addressed for the transformation to be completely successful. At the first steering committee meeting held on 22 February 1995 they proposed that 44 of them be addressed immediately (Predictable Service Core Team 1995a:10-16). Two months later it became obvious that buy-in to the new concepts could not be gained so quickly. There was not a critical mass of people in the business who could assist with thinking through the detail to derive system specifications. There was also not enough experienced, mature IT skills to deliver the systems quickly. The risk of failure was far too high and so the focus was reduced to five high leverage points, which would give the business time to digest the nature of the change. Thirty-three deliverables have been deployed in five releases to date and the programme is still ongoing. The deliverables of the releases are depicted in table 3.

Table 3: Predictable Service Release Programme

Release 1. July 1995	Release 2.5. April 1997	Release 3.5 April 1998
National train schedule	Balance service to determine train slots	Service codes
Reservations	Communicate train slots that should run	
Works orders	Consolidate empties and consignments on trains per region	
Event reporting	Locomotive allocation	
Monitoring key performance indicators	Match trains and locomotives	

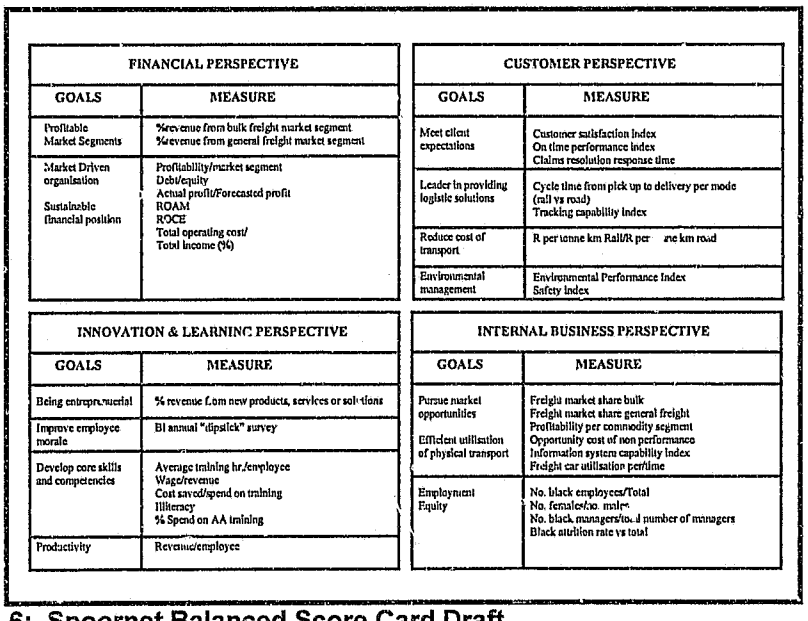
Release 2. Aug 1996	Release 3. July 1997	
Expected time of arrival of ships	Enhanced incident reporting	
Empty wagon distribution (process redesigned for rel.4)	Freight protection facility	
Monitor trains and manage deviations	*En route* reservations	
Next week's business	Inter-line reservations	
Reservations refinements	Next week's business enhancements	
Ring-fenced fleets	Expected time of arrival *en route* and expected time at destination	
Re-reservations	Trace and report train delays (amended time of arrival *en route* and amended time at destination plus reasons)	
Stage consignments	Consignment status enquiry	
Plan train movement	Order processing enhancements	
Customer management	Permits	
Incident reporting	Claims	

Source: Predictable Service Core Team (1998b:10).

5 MEASUREMENT ARCHITECTURE

5.1 Balanced Score Card

In 1994, when the predictable service programme was mobilised Spoornet had not yet adopted Kaplan & Norton's (1992:71–79) Balanced Score Card (BSC) concept. The BSC was, however, adopted by Spoornet in 1997 when the predictable service programme had already been running for three years. A draft version of Spoornet's BSC, which is still in development is depicted in figure 5.



FINANCIAL PERSPECTIVE	
GOALS	MEASURE
Profitable Market Segments	%revenue from bulk freight market segment %revenue from general freight market segment
Market Driven organisation Sustainable financial position	Profitability/market segment Debt/equity Actual profit/Forecasted profit ROAM ROCE Total operating cost/ Total Income (%)

CUSTOMER PERSPECTIVE	
GOALS	MEASURE
Meet client expectations	Customer satisfaction Index On time performance index Claims resolution response time
Leader in providing logistic solutions	Cycle time from pick up to delivery per mode (rail vs road) Tracking capability index
Reduce cost of transport	R per tonne km Rail/R per [illegible]ne km road
Environmental management	Environmental Performance Index Safety Index

INNOVATION & LEARNING PERSPECTIVE	
GOALS	MEASURE
Being entrepreneurial	% revenue from new products, services or solutions
Improve employee morale	BI annual "dipstick" survey
Develop core skills and competencies	Average training hr/employee Wage/revenue Cost saved/spend on training Illiteracy % Spend on AA training
Productivity	Revenue/employee

INTERNAL BUSINESS PERSPECTIVE	
GOALS	MEASURE
Pursue market opportunities Efficient utilisation of physical transport	Freight market share bulk Freight market share general freight Profitability per commodity segment Opportunity cost of non performance Information system capability index Freight car utilisation per/time
Employment Equity	No. black employees/Total No. females/no. males No. black managers/no. of number of managers Black attrition rate vs total

Figure 6: Spoornet Balanced Score Card Draft
Source: Transnet Draft Corporate Plan (1997a:30).

Currently Spoornet is in the process of automating the BSC. It is being placed onto an executive information system (EIS) with drill down facilities into existing operational systems for automatic updates of key performance indicators (KPIs).

5.2 Target Gains

On 7 September 1995 Braam le Roux challenged the company to attain ninety percent on time delivery by the end of 1996 and linked a percentage of all Spoornet's performance bonuses to this. Considering the predictability of delivery on time within 90 minutes was less than ten percent in 1995, this represented a greater than fifty percent improvement in the effectiveness of the process. With this improved service a concerted marketing drive to attain a greater share of high valued traffic is in progress. To improve efficiency, yards and other assets are to be rationalised.

5.3 Key Performance Indicator Trees

Having realised "what gets measured, gets done" and been challenged to attain ninety percent on time delivery, the core team realised that every key activity in the end-to-end process would have to be measured. In February 1996 the first waterfall of KPI's was introduced. Initially the "waterfall" had only five tiers: released, reserved, making the right train, departing on time and arriving on time. This has subsequently grown to nineteen tiers per twenty-nine areas. The June 1998 KPI totals are depicted in table 4.

Table 4: Spoornet Predictable Service Key Performance Indicators

Consign Confirm	Consign with wagon orders	Consign with res.	Release consign	Total wagons release	Consign arrived at final dest.	Consign Collect on time	Consign depart on planned train	Consign depart on time	Consign arrived on planned train
42 113	31 700	34 140	38 312	248 368	27 534	21 310	20 820	14 141	14 437
Consign Arrived at planned time	Consign placed at planned time	% Res.	% Collected on time (T2) 3hr	% Depart on correct train	% Depart on time. 15 min sched. 1	% Arrived on correct train	% Arrived on time. 15 min sched. 1	% Placed on Time (T3) 3hr	
6 036	9 599	89.11	77.4	75.62	51.36	52.43	21.92	34.86	

Source: Predictable Service Core Team (1998a:1).

5.4 Activity Based Costing and Service Level Agreements

In 1996, Gerlof van Rooyen, a chartered accountant project managing Spoornet's costing project joyfully announced that finance was finally able to cost a train, based on unit costs, with charges allocated to cost centres. It was hoped this would assist Spoornet in identifying non value-adding activities and to weed out inefficiencies from the process. The resolution level, unfortunately, made it impractical to keep the information up to date and it failed to highlight systemic inefficiencies from a holistic perspective. Doing "the wrong things better" was not going to help Spoornet. A small application was eventually developed using higher level "rules of thumb" on which operations could evaluate their performance. Activity based costing was shelved temporarily.

It is the intention that operations commit to a level of service with an agreement to sales, upon which in the event of failure, penalties will be paid. Upon requesting a service, sales will be furnished a service code, which must be captured into next week's business forecast. Operations will use this to schedule trip time-tables route-plans. The service code was implemented in April 1998 and once the process is mature the service level agreement will be enforced.

5.5 Process Accounting

During one late-night alignment session earlier this year, Louis Cronje, the senior analyst on the BSC implementation grumbled (Cronje 1998:1)

> *"We'll never be process orientated while our accounting system is functionally orientated. Our income statement should be process orientated".*

He has since included it as a last stage of the BSC project so that process performance per key performance area (KPA) will be linked to strategic objectives.

6 PROCESS ARCHITECTURE

6.1 Scale and Scope of Process Re-engineering

Braam le Roux first expressed the sentiment that information systems should not be fed with historic information as to where trains, wagons and consignments had been, but used pro-actively. At one of his occasional informal evening dialogues with the predictable service champions, Herman Evert described the global logistics management (GLM) system and enquired if he should purchase it. Braam le Roux replied that he could not understand why Herman had not already done so (Predictable Service Core Team 1995b:2). This tool has the potential to re-engineer the industry.

6.2 Focus

In February 1994 when Herman Evert and Hennie Muller returned from investigating the North American and Swedish railways there was some discussion around whether Spoornet should be dynamically demand-driven and manage yield like the airline carriers. They were particularly impressed with Santé Fe's Railroad whose daily schedules and trains were dynamically demand-driven. It was felt, however, that this would be far too great a leap for Spoornet whose first priority was efficiency and reliability. The core team soon realised that a fixed schedule was also unrealistic and a compromise of a weekly planning window was reached with the implementation of next week's business in release two.

6.3 Selection

In the June 1994 assessment of the Swedish Railway, Bravo System, the core team stated that the bare essentials Spoornet needed for a giant leap closer to predictable service was: a fixed schedule, reservations, works' orders, monitoring and an intensive change management effort (Predictable Service Core Team 1994:26). They intuitively knew that this was most central to achieving their business strategy. After another six months of intense analysis they came up with one hundred and sixty work packages that needed attention and tried to start with forty-four in January 1995. By April 1995 they were back to the original five. These were the highest leverage points to achieve the business strategy.

6.4 Understand Current

The project team who developed an order fulfilment system for Spoornet in 1993 had documented the basic business process at a high level in "Powerpoint". This served as a basic understanding of the current process, but the tool was very limited and no methodology prescribing procedures and standards had been used. In July 1994 the core team decided to adopt the integrated definition language (IDEF) methodology so that process models developed by different teams would be consistent and integrate. All BAD teams were advised to first develop a basic understanding of the current process so that the magnitude of the change was understood.

6.5 Mechanistic to Organic

Spoornet railway operations had always been mechanistic, with a rule for every eventuality. Operations worked basically like an assembly line, but planning was done in isolation, bottom-up from yard to area to region and then tohead office. Rolling stock and infrastructure did their maintenance-planning in isolation according to their own efficiency goals. In October 1996 the operation of the nine regions was centralised and operations, rolling stock and infrastructure merged into one cross-functional team doing planning together. GLM will extend this planning across companies' and transport modes with EDI and/or Internet standards providing a linking architecture. Previously nobody was responsible for the end-to-end process, now the despatching client co-ordinator monitors and is responsible for the consignment until it is delivered. Execution is still mechanistic, strictly according to works orders, but the sales staff are empowered with only a sales target driving them. This highlights the difference in the two streams of Spoornet.

6.6 IT Impact

Spoornet manages approximately 2000 consignments per day (could be complete train) and 140 000 wagons moving across 21 300 km of track on 3000 different train sets to 5 500 possible sidings (Myburgh 1998:1). The core team designed the process with these IT capabilities in mind. Without computer support NWB, reservations, a changing national schedule and works orders, that is, the complete core process, would not be feasible. The computer allows customer co-ordinators to track consignments' progress from origin to destination. The automated BSC will give management knowledge of the business process and work-flow will entrench it.

6.7 Principles and Attributes

The core team derived the following eight principles governing process (Predictable Service Core Team 1996:30):

- Seven day planning window
- Synchronised service planning
- Centralised wagon distribution planning
- Decentralised service execution according to plan
- Through scheduling
- Fixed national schedule
- Reservations – mechanism for pro-active commitment of resources
- What gets measured gets done.

6.8 New Process

The first high level process was developed by six members of the core team visiting the Swedish Railway, SJ Gods, in Stockholm in April 1994. Using this as a basis, the first complete high-level value chain was developed by the core team at a workshop held at Bakubung in July 1994. Legacy applications were mapped to

it and gaps and shortcomings identified. This served as the initial applications' development portfolio and as an input to the development of the work breakdown structure. This process was documented in IDEF. The process was tested for reliability with a larger, more diverse group in August and presented to the S ornet management board and unions in September. It was not well received all and Braam le Roux accused the core team of offending many senior managers and the unions. In January 1997 the commercial process was added. The high level process is depicted in figure 5.

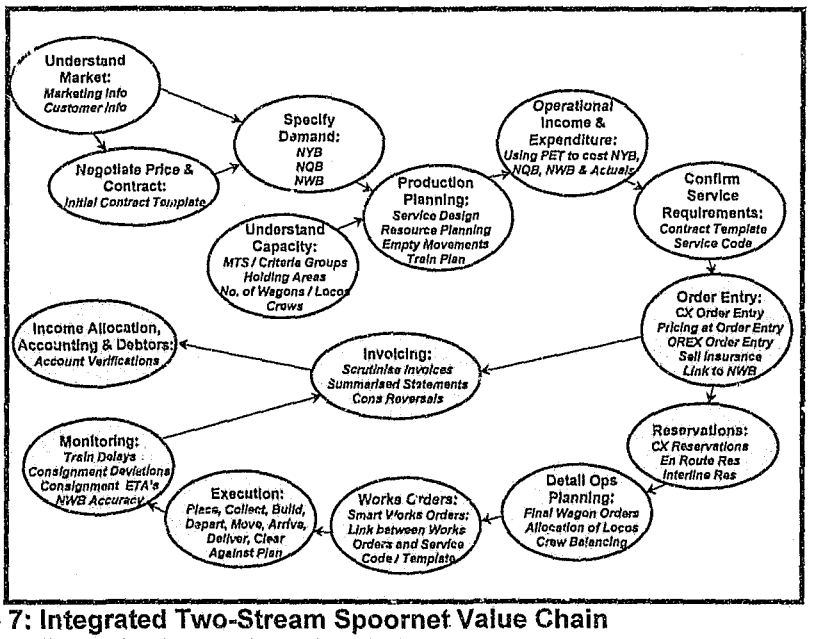


Figure 7: Integrated Two-Stream Spoornet Value Chain
Source: Predictable Service Core Team (1998b:5).

6.9 Biore-engineering

Ian Bird, the Chief Executive of COALlink (Ermelo – Saldanha), demanded in November 1997 (Bird 1997:1):

> *"We've been using the balanced score card for a year now, but it is paper-based, I need it integrated with the operational systems and in an EIS system so I can look at different perspectives to find the cause and effect relationships".*

The first phase of this project is complete and when Ian Bird finds cause and effect relationships he will no doubt build in learning loops.

6.10 Tools and Methodologies

In 1995 the core team assessed the Knowledge Based Systems (KBSI) and Ptech tools on which to model its processes using IDEF. The core team chose Ptech because it was found to be more flexible and to date it has served its purpose.

The Gartner Group has subsequently rated both these tools as niche players with a low ability to execute (Magee et al 1997:5). Spoornet's maintenance management, accounting and HR systems are on SAP and in these environments the architecture of integrated information systems (ARIS) methodology is used. The need for one methodology has since become an, as yet, unresolved issue. A customised rapid application development (RAD) methodology and the Bachman tool to document Data Flow Diagrams (DFD) and Entity Relationship Diagrams (ERD) are used in the relational environments and the Rational Rose methodology in the object-orientated environments.

7 IT ARCHITECTURE

7.1 Technology Requirements

Sigvard Christiansen, Head of Strategic Planning, SJ Gods, was keen to sell Spoornet the SJ Gods "Bravo" system and get into an alliance with Spoornet. The price quoted was a R100m plus consulting fees. The system was mainframe based, with a relational database, 3270 emulation, written in PL1 "spaghetti" code and undocumented. It had a wagon, not consignment focus, and SJ Gods did not manage its own infrastructure, locomotives or auxiliary equipment or use works' orders. There were, nevertheless, advantages to getting into an alliance instead of trying to re-invent the wheel alone. The core team grappled with the issue for two months, considering various scenarios from buying pieces to re-writing together on a distributed platform. On 30 June 1994 the core team recommended that Spoornet develop their own system, modularly, preferably with an object orientation on a distributed client server platform (Predictable Service Core Team 1994:16).

7.2 Key Enabling Technology

As part of its drive to create an information culture Spoornet adopted Microsoft Office as a standard in 1992 and installed a local area network (LAN) at each of its thirty-seven area offices in 1993. An electronic data interchange (EDI) gateway was established in 1992. To support distributed client server technology Spoornet began migrating from the System Network Architecture (SNA) protocol to the more open Transmission Control Protocol/Internet Protocol (TCP/IP) for its network. E-mail was introduced in 1994. With the explosion of the Internet in 1995 Transnet established an in-house service provider. Although these developments did not initially directly enable predictable service, they were fundamental in creating an enterprise infostructure to turn information into knowledge and facilitating inter-enterprise computing which is key for logistics.

7.3 Application Supporting Technologies

In 1992 Spoornet adopted the policy "buy where you are the same and build where you want to be unique". This is why the maintenance, human resources and accounting systems are on SAP R/2 and R/3 platforms. With the decision not to buy the Bravo system, but develop in-house Herman Evert (CIO) knew Spoornet would have to do RAD. A search for a fourth generation language tool was done and Sapiens chosen (Evert 1998:1). The service management, incident reporting and freight protection systems were developed on this tool. reservations and the schedule remained in Cobol because of their complexity.

In 1997, to turn all this operational information into knowledge (and hopefully wisdom), the new CIO, Dr. Chris Jardine, launched the establishment of an electronic workplace (EW). The EW consists of a web-based EIS using a multi-dimensional database, a web-based filing system, E-mail and Intranet, Extranet

and Internet workflow capabilities. Access to Spoornet's data warehouse will be made available for data mining where appropriate.

7.4 Database Supporting Technologies

Entering the 1990s Spoornet was dominated by IBM DB2 relational databases. In order to reduce redundancy a policy of "data are captured once" only was instituted. To ensure all databases are logically integrated a knowledge co-ordination function was established. Although Spoornet would have liked to progress to an object orientated, client server environment with distributed processing and data, it did not want to do this for all mission critical systems until it could build up the skill base and prove the technology. The container movement management system was selected for this trial. It was developed using IDEO on a distributed Sybase platform and although it was implemented nationally in 1996 it is still not completely stable. A service execution view application developed for the central planning office was written with an object orientation in C++ on a Unix Oracle platform.

Early in 1995 the core team identified that four core databases: wagons, stakeholders, commodities and locations, should be developed as objects. It, however, proved too difficult to mix legacy relational systems with object orientation and the data bases were normalised in a relational manner.

7.5 Network Supporting Technologies

Having established an in-house Internet service provider made it easy for Spoornet to establish its own Intranet early in 1996. Predictable service established its own web site and this was used extensively for national communication and programme management of release 2. For some time Transtel (Transnet's network provider) had been replacing stolen copper cables with fibre optic cables between main centres, which meant predictable service did not have to worry about bandwidth between these centres as network traffic increased. Transtel had also been investing in very small aperture terminals (VSATs) (very small satellite-earth stations) for communication into Africa. In release 4, predictable service will be extended into neighbouring African states largely using this network. The disparate systems communicate via middleware.

7.6 Systems Integration

The linking of the legacy computer applications and the identification of gaps and shortcomings was the first attempt at systems integration. The attempt at the establishment of four objects was an attempt to integrate data. Subsequently a complete mapping of processes to applications to databases has been done (Hlongwane 1998:1). The adoption of EDI Edifact standards, TCP/IP and other Internet standards is an attempt to maintain data integrity across the external business network.

8 HR ARCHITECTURE

8.1 Organisation and Skills

In October 1996 the closure of all nine of the regional managers' offices was announced. The "April 30" project was announced and all posts, from assistant manager upwards, were aligned with the "Two Stream Spoornet" and Predictable Service process. All the regional manager operational planning functions were centralised in the Central Planning Ofice (CPO) and Joint Operations Office (JOO) with execution still decentralised. Authority and a high level of skills are now central with a low level of empowerment. At the same time, in the commercial environment, the existing six market segments were increased to eighteen and the sales force tripled. This put high skills at the boundary of the organisation and empowerment close to the point of customer contact.

8.2 Management Measurement and Reward Systems

Since 7 September 1995, when Braam le Roux first challenged the company to deliver ninety percent of consignments on time, operational staff's performance has been primarily based on this. Sales are measured on sales targets (yield is built into the targets). Percentage annual increases and bonuses are linked to how successful staff is at meeting these targets. In order to reach their targets, sales staff have to request capacity from operating, without a firm commitment from the customer at times, and operating have to commit to providing the service, exposing both to a certain degree of risk. Sales may sub-contract to put end-to-end deals together that test their co-ordination abilities.

8.3 Jobs and Structures

All jobs and structures are linked to the process. The CPO was created out of a desire to optimise Spoornet's assets nationally because the nine regions were de-optimising them. The CPO also had an end-to-end (customer to customer) focus, whereas the regions had a functional focus. The CPO is also bringing together a process council consisting of wagon fleet managers, locomotive fleet managers, driver managers and rolling stock and infrastructure maintenance-management all focussed on delivering on schedule. The customer co-ordinator has been made the end-to-end process owner. The process performers in the yards have been gelled into a process team by a count down procedure. When logistic networks are built and portions sub-contracted process owners will have to concern themselves with the process centred business network.

8.4 Values and Beliefs

All placement and promotion in Spoornet is done in terms of competency or potential competency. Candidates for all jobs are assessed in terms of their knowledge, skills and attitude. Attitude is largely a manifestation of values and beliefs. In sales and the CPO the overriding value and belief that is sought is a commitment to the business success. This is different from initiative for opportunity which can be narrow-minded and harm the greater company. In the

decentralised execution of the schedule, obedience and diligence (compliance) are sought. A certain degree of restless curiosity is also desirable in sales that may result in new opportunities. The highlights of recommended culture changes are depicted in table 5.

Table 5: Highlights of Recommended Culture Changes

Theme	Old Behaviour	New Behaviour
Attitude	Work according to clock	Work according to plan, until client is satisfied
Organisation	Functional smoke-stacks	Multi-functional, process work teams
Quality/excellence	Speaking quality	Living quality
Enablement	Restricted and controlled	Competent and allowed
Communication	Secretive	Open / Sharing
Relationships	Undermining	Supportive / Mentoring
Task orientation	Defined by a beginning and an end	Continuous improvement / Openness to change

Source: Mercer Management Consulting (1996b:16).

8.5 Training and Education

Besides the normal task-oriented training developed and delivered per release by the HR members of the BAD teams, two other significant interventions contributed to changing the behaviour of Spoornet staff

.

First, in 1994 Herman Evert and a few other senior managers identified four things:

- the larger majority of Spoornet staff had only been exposed to narrow, functionally-oriented tasks,
- there was not alignment in management regarding the Spoornet challenge,
- there were very few "big picture" thinkers in Spoornet, and
- a lot of new people had entered Spoornet.

They recognised that this would have to be remedied if the transformation was to be a success. In 1995 they initiated the Spoornet induction programme for everyone, down to middle management. This was a split, two-week course held full-time off-site at the Aloe Ridge Hotel. It took one through the whole spectrum of railway management and the new business challenge and included an interactive groupware railway game.

Second, as part of their social programme, Transnet provided a significant budget for education. Everyone had to have a two-year development plan. A specially tailored, Master of Business Leadership course was developed with UNISA and a B Admin course with Wits Technikon, which is run in-house at Esselen Park. This is a long-term investment, but it is positioning Spoornet to move beyond predictable service and become a global logistics player in the information age where everyone can act independently because they have a holistic view.

A computer-based on-line interactive national learning system has been proposed several times since 1993, but because some of the other more basic issues are not yet resolved it has not reached a high enough priority to be implemented..

8.6 Communication

Each release has a communication plan consisting of wall pictures, calendars and videos. At one stage a screen-saver and a small computer game were developed. As mentioned before the Intranet is used extensively as are telephone conferences. A matrix of who must receive an overview, the rationale, the detail and background is drawn up. At the end of the design phase of each release a "walk-through" of all the business rules, processes, designs and prototypes is given over two weeks to the whole of Spoornet's top management. This is their last chance to make an alteration. A permanent "walk-through" facility is being developed as part of the ongoing communication and education programme. To date, little of this has been shown to customers, suppliers and other stakeholders, but the intention is to do so. A "smart coach" is being developed in which all Spoornet business partners can experience the latest logistical tools, techniques and ideas (Evert 1998:1).

In July 1994 in a back office of Umjantshi House, the core team developed the first credo: "Consistently Delivering the Promise". Since then several more have been produced, notably:

- Plan the Work, and Work the Plan
- Pro-actively committing resources
- We only execute smart plans

(Predictable Service Core Team 1996:8)

8.7 Labour Relations

In March 1996 the Transnet National Education Training and Development (ETD) Forum produced a Transnet transformation framework proposal discussion document. The key sentence in the document states (Transnet National ETD Forum 1996:2):

> *"It will be argued here that possibilities of Transforming the company lie in embedding new business processes within new and appropriate people relations (social relations) in one integrated initiative so that as the business transforms, new industrial relations which are supportive to the business mature, resulting in reduced conflict, efficiency, predictability, sustained growth and development".*

One of their representatives, Martin Sebakwane, argued that the predictable service programme had not gone anywhere near far enough in participative, democratric involvement of all workers up front in this change process. At the Transnet 1997 top 1000 forum the managing director, Saki Macozoma, announced that joint transformation committees would be for m the

beginning of 1998 all predictable service initiatives are discussed jointly with the unions, and are subject to the approval of the Spoornet joint transformation committee.

9 PHYSICAL RESOURCE ARCHITECTURE

9.1 New Product Development

Spoornet sells time and place utility. Over time Spoornet has tailored 38 different categories of wagons and three sizes of containers to suit customers' requirements for wood, bulk fluids, cement, coal and manufactured products to name a few. Traditionally the service has been from rail-head to rail-head. predictable service is to get this portion efficient and effective. Customers, however, want a comprehensive door-to-door service and if Spoornet does not provide this Spoornet's customers will find an intermediary to relieve them of this logistical burden. During discussions on the "Two Stream Spoornet" concept the policy was adopted that salesmen may therefore negotiate end-to-end deals and sub-contract the non-rail portions which may include packaging, warehousing, road and ship. The freight protection facility is an example of an extended service put together in an alliance with a broker and a network of insurers.

9.2 Operational Systems

Spoornet has an installed capacity of lines, wagons and locomotives built up over the years. This means Spoornet has capacity in stock before it is demanded and provided for use. This is important when availability is a key pre-condition of sale. In the short run this installed capacity makes Spoornet primarily a fixed cost business (everything is variable in the long run) with fuel, electricity and maintenance variations being relatively negligible. In order to tailor the sale of this capacity the wagon types and auxiliary services are assembled to order, together with other sub-contracted items. What predictable service changed is that Spoornet will also commit to performing to order, according to schedule. GLM gives Spoornet the ability to do this beyond the rail-head and throughout the value chain.

9.3 Capacity Management

Prior to predictable service Spoornet had a level capacity management strategy. The problem was that, at great cost, it installed and maintained enough capacity to cover peak demands. The introduction of zero-based planning for next year's, next quarter's and next week's business, a weekly flexible schedule and reservations with central end-to-end planning of all resources, has given Spoornet the ability to vary the use of a smaller capacity to meet changes in demand (Myburgh 1998:1). Where sales cannot get a commitment from a customer they must take the risk of penalties and estimate demand or lose sales. As Braam le Roux stated at the release 3 walk-through (le Roux 1997b:1):

> *"This is the same as the ice cream boy on Durban beach. He estimates sales and if his ice cream runs out he loses sales, if he has left over he must throw them away".*

Where demand exceeds capacity sales now sub-contract to cope with customers' requirements.

9.4 Inventory Management

Spoornet does not have inventory in the traditional manufacturing environment sense of raw materials and parts, semi-finished products and finished products. When Spoornet's wagons are empty, however, they could be regarded as inventory for the production line. Prior to predictable service, areas unofficially kept a buffer stock of empty wagons and ordered based on a pre-determined re-order level. NWB introduced the concept of ordering wagons based on demand. Areas no longer have a buffer inventory of wagons to match demand, but a virtual inventory managed by the CPO. The predictable service concept of a CPO is building competence for managing Spoornet's assets nationally like a virtual warehouse, distributing stock to areas according to demand. Given this core competence GLM is simply extending it to managing customers' inventory throughout the value chain.

9.5 Manufacturing Process Types

Spoornet's two ore lines, OREX and COALlink are analogous to continuous assembly lines for mass production. General freight operates more like job shops, with a wide variety of products demanded in small quantities. The closer Spoornet moves to mass customisation the more every order will become a "one off" project. Here the CPO is building up a competence of a virtual factory by co-ordinating the activities of drivers, locomotives, wagons, infrastructure maintenance, wagon and locomotive maintenance to deliver a service Just-in-Time (JIT) from rail-head to rail-head. The next logical step is to extend this competence to managing a constantly changing, extended value chain virtually, using open Internet standards and evolve it into a virtual factory.

10 IMPLEMENTATION

The following are extracts from a semi-structured interview held with staff at the Isando area office on 10 July 1998. It highlights some of the ongoing challenges of the programme.

10.1 Process Owner

Gawie Mans, the customer co-ordinator at Isando, maintains (Mans 1998:1):

> *"How can I be positive when a thing does not work? I have no control over the end-to-end process, but I am responsible for it".*

10.2 Next Week's Business

Ben Umslongo, the area manager, Isando, asserts (Umslongo 1998:1):

> *"On average ninety percent of customers forecast wagon requirements are actually used. However, only approximately thirty-four can furnish the correct destination, which is necessary to build next week's trip plans".*

10.3 Reservations

Linda Lensley, the person processing orders states (Lensley 1998:1):

> *"Most wagon orders we capture, confirm, release and reserve simultaneously, approximately one hour before the wagons are pulled from the siding. We do this because customers rarely, if ever, give us the exact time of release, correct number of wagons, commodities, masses and destinations prior to this. We can only do a correct reservation on a train if the information we receive is correct".*

10.4 Blockouts

Ben Umslongo contends (Umslongo 1998:1):

> *"Blockouts are still one of our biggest headaches. This happens when a customer receives a block load of 80 wagons and his siding can only handle 10. Alternatively he receives cumulatively too many consignments too handle from different origins simultaneously. We are thinking of moving to the "ring the bell" system to resolve this".*

11 CONCLUSION

Given the constraints of space and time, as much realism as possible has been built into the case study, whilst sticking to the business architecture framework. The prime focus is the tangible methodological issues whilst simultaneously building in some of the salient intangible issues of transformation in a large corporate environment. Much of the finicky, absolutely railway specific detail that cannot be generalised into common lessons has been omitted, but the axiom that "the devil is in the detail" once again proved true on this programme. The discipline of project management and concomitant implementation frustrations is also specifically excluded from the scope of this paper as this warrants a substantial research report of its own.

REFERENCES

Archival Records

Mercer Management Consulting, 1995. Railways in South Africa: History and Strategic Evolution. pp. 1-17.

Mercer Management Consulting, 1996a. Elements of Railway Management. Spoornet Industry Programme. pp. 1-9.

Mercer Management Consulting, 1996b. Achieving Predictable Service. Spoornet Industry Programme. pp. 1-18.

Mercer Management Consulting, 1996c. Benchmarking Spoornet's Performance. Spoornet Industry Programme. pp. 1-37.

Rainmaker Management Consultants, 1997. Spoornet Strategic Diversity Programme, Knowledge Pack. pp. 1-13.

Transnet, 1991. Annual Report. *Transnet.* pp. 1-81.

Transnet, 1994. Annual Report. *Transnet.* pp. 1-119.

Transnet, 1997b. Annual Report. *Transnet.* pp. 1-104.

Transnet 1997a. Transnet Draft Corporate Plan, 1998/99. *Transnet.* pp. 1-44.

Transnet National ETD Forum, 1996. Transnet Transformation Framework Proposal. *Transnet.* pp. 1-8.

Books and Journals

Benbasat, I., Goldstein, DK, & Mead, M. 1987. The Case Research Strategy in Studies of Information Systems. *MIS Quarterly*, Sept. pp. 369-386.

Davis, S. and Davidson, B. 1991. *2020 Vision.* New York: Simon and Schuster.

Hamel, G. and Prahalad, C.K. 1994. *Competing for the Future.* Boston: Harvard Business School Press.

Hammer, M. and Champy, J. 1993. *Reengineering the Corporation. A manifesto for Business Revolution.* London: Nichlolas Brealey Publishing.

Hope, J. & Hope, T. 1997. *Competing in the Third Wave. The Ten Key Management Issues of the Information Age.* Boston: Harvard Business School Press.

Kaplan, RS. and Norton, DP. 1992. The Balanced Score Card, Measures that drive Performance. *Harvard Business Review*, Jan/Feb. pp. 71-79.

Magee, F., Frick, V., Kirk,T., Kleinberg, K. and Andren, E. 1997. Managing Distributed Computing (MDC). Strategic Analysis Report. Creating IT Processes: Organising Work Across Distributed Computing Boundaries. Gartner Group, Inc. pp. 1-5.

Scott Morton, MS. 1991. The Corporation of the 1990s. *Information Technology and Organisational Transformation.* Oxford: Oxford University Press.

Spinello, RA. 1997. *Case Studies in Information and Computer Ethics.* New Jersey: Prentice Hall.

Toffler, A. 1980. *The Third Wave.* New York: William Morrow and Company.

Venkatraman, N. 1991. IT-Induced Business Reconfiguration. In Scott Morton, M.S. ed. *The Corporation of the 1990's. Information Technology and Organisational Transformation.* Oxford: Oxford University Press.

Yin, RK. 1994. *Case Study Research, Design and Methods.* California:

Sage Publications.

Documentation

le Roux, AS. 1997a. Delivering Uncertainty. CEO, Spoornet. pp. 1-13.

Predictable Service Core Team, 1994a. Workshop Notes. Predictable Service Working Papers. pp. 1-5.

Predictable Service Core Team, 1994b. An Assessment of the Swedish Railroad Information System, Bravo. Predictable Service Working Papers. pp. 1-28.

Predictable Service Core Team, 1995a. Steering Committee Minutes/attachments, Predictable Service Working Papers. pp. 1-27.

Predictable Service Core Team, 1995b. Meeting Notes. Predictable Service Working Papers. pp. 1-3.

Predictable Service Core Team, 1996. Walkthrough Presentation. Predictable Service Working Papers. pp. 1-120.

Predictable Service Core Team, 1998a. Key Performance Indicators. http://intra.spoornet.co.za/Predictable Service. p. 1.

Predictable Service Core Team, 1998b. Spoornet Joint Transformation Committee Training Material *Predictable Service Working Papers.* pp. 1-12.

Spoornet Business Plan, 1996. pp. 1-25.

Interviews

Evert, H. 1998. Semi-structured Interview Notes. General Manager, Strategic Marketing, Spoornet. p. 1.

Hlongwane, D. 1998. Semi-structured Interview Notes. Manager, Process & Systems, Spoornet. p. 1.

Lensley, L. 1998. Semi-structured Interview Notes. Chief Admin Official, Isando, Spoornet. p. 1.

Mans, G. 1998. Semi-structured Interview Notes. Client Co-ordinator, Isando, Spoornet. p. 1.

Myburgh, J. 1998. Semi-structured Interview Notes. Manager, Process and Systems, Spoornet. p.1.

Umslongo, B. 1998. Semi-Structured Interview Notes. Area Manager, Isando, Spoornet. p.1.

Participant-Observations.

Bird, I. 1997. Address to COALlink Management Board. Executive Manager, COALlink. p. 1.

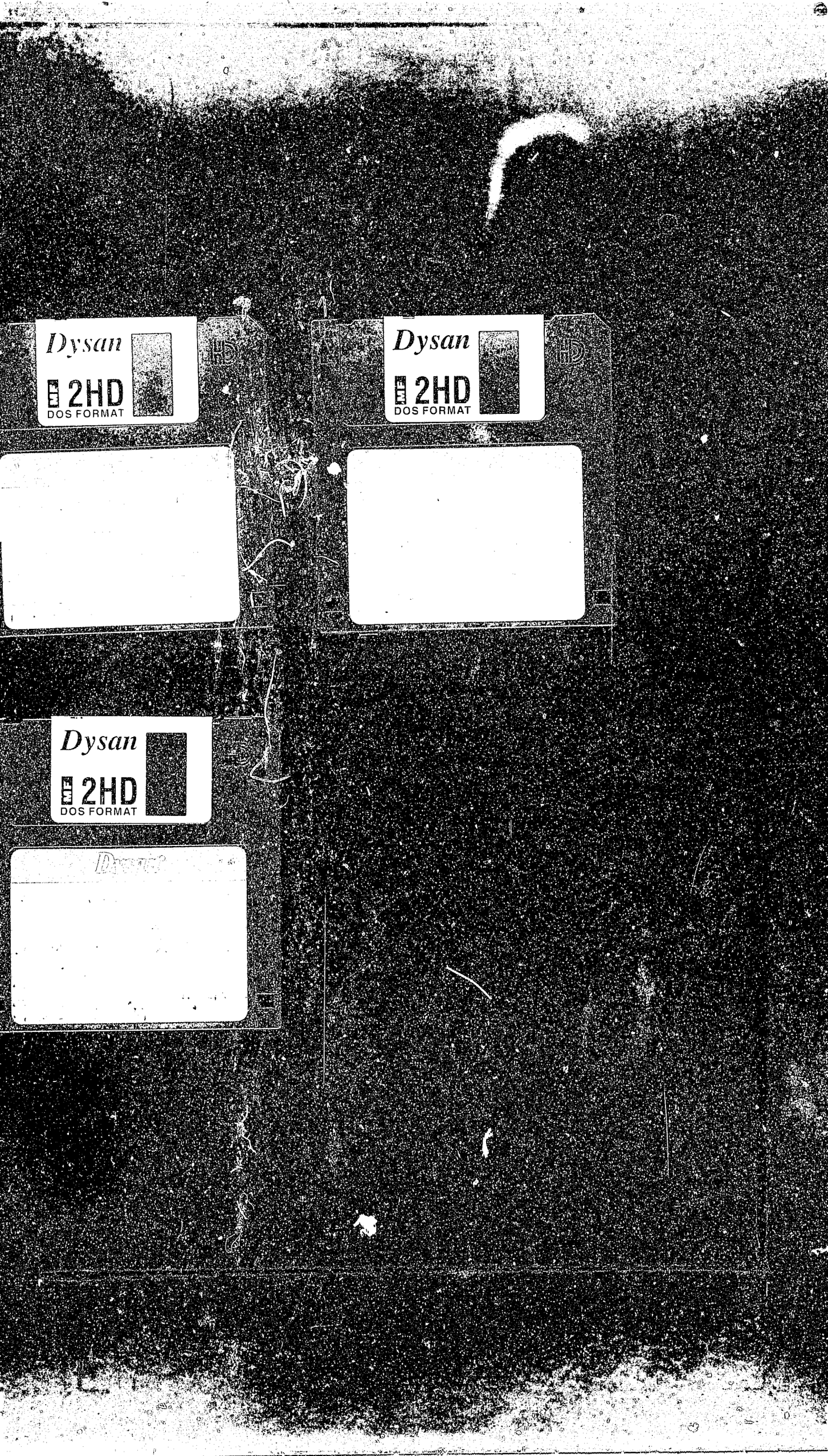
Cronje, L. 1998. Address to Balanced Score Card Core Team. Senior Manager, Key Controls, Transnet. p. 1.

le Roux, AS. 1993. Address to Gemini Steering Group, July. CEO, Spoornet. p. 1.

le Roux, AS. 1997b. Address to Predictable Service Walkthrough Meeting, June. CEO, Spoornet. p. 1.

Petkoon, L. 1990. Address on EDI to Senior Management. August. General Manager, Rail & Terminal Services, Spoornet. p. 1.

Schultz, R. 1995. Address to Predictable Service Core Team. Past COO of Union Pacific Railroad, USA. p. 1.


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2HD
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Dysan
2HD
DOS FORMAT
Dysan
2HD
DOS FORMAT

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